A Just Transition to Sustainability in a Climate Change Hot Spot: The Hunter Valley, Australia

Geoffrey Russell Evans
Bachelor Applied Science
Master Applied Science

Thesis submitted for the degree of
Doctor of Philosophy (Human Geography)
September 2009

School of Environmental and Life Sciences
University of Newcastle, New South Wales, Australia

Signed Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the *Copyright Act 1968*.

I hereby certify that the work embodied in this Thesis is the result of original research, the greater part of which was completed subsequent to admission to candidature for the degree.

Signed: ....

Date: ....

Abstract

This thesis uses a transdisciplinary, sustainability-science approach to investigate the potential for the Hunter Valley region of New South Wales, Australia to make a transition to sustainability. The Hunter Valley, one of Australia's historic food, wine and grain breadbaskets, is now home to over 50 open cut and underground black coal mines and is one of the world's major coalmining and exporting regions. It is Australia's largest black coal electricity generating region where six coal-fired power stations generate 40% of Australia's electricity supply. The carbon intensity of the Hunter Valley's economy makes the region Australia's largest direct and indirect contributor to global carbon dioxide emissions. The region is a climate change hot spot that embodies the challenges and opportunities confronting Australia if it is to move towards a clean, renewable energy future and ecologically and socially-sustainable economy. The study examines the Hunter Valley as a complex adaptive socio-ecological system nested in an extended panarchy (Gunderson and Holling, 2002) that includes global energy systems and the ecosphere. The research examines the linked ecological and social health impacts of different scenarios for the Hunter Valley, comparing its current status – given the name *Carbon Valley* (Ray, 2005a) – with an alternative socio-ecological regime described by local residents as a *Future Beyond Coal* (CAN, 2006). This *Future Beyond Coal* is a regional manifestation of what Heinberg (2004) calls, at a global scale, a *Post-carbon Society.* Transdisciplinary sustainability-science is used to examine complex processes in which Hunter Valley residents are dealing with linked ecosystem-human health distress, while developing capacity for anticipating and forging change towards sustainability. They are also boosting the resilience of desirable states while challenging the perverse resilience of coal dependency. The thesis examines the potential for a 'Just Transition' to sustainability, a social and economic restructuring process which aspires to move the region's socio-ecological relationships rapidly towards sustainability through protecting the wellbeing of vulnerable workers, communities and ecosystems. It investigates hegemonic relationships within coal communities, and the role popular education and social learning are playing in building a social movement for sustainability, a movement that links local, regional and global attractors and disturbances in order to change the basin of attraction from the current non-sustainable coal-dependent society to one that is ecologically sustainable and socially just.

Contents

Figures

Tables

List of shortened forms

ACF	Australian Conservation Foundation
ACTU	Australian Council of Trade Unions
AIGN	Australian Industry Greenhouse Network
ALP	Australian Labor Party
AMWU	Australian Manufacturing Workers Union
ASEN	Australian Students Environment Network
AWU	Australian Workers Union
BAU	business-as-usual
BLF	Builders Labourers Federation
CAN	Climate Action Newcastle
CANA	Climate Action Network Australia
CAP	Catchment Action Plan
CARMA	Carbon Monitoring for Action
CAS	Complex adaptive system
CCAG	Caroona Coal Action Group
CCC	Community Consultative Committees
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CEI	Clean Energy Initiative
CFMEU	Construction Forestry Mining and Energy Union
CFMEU M&E	Construction Forestry Mining and Energy Union Mining and Energy Division
CLC	Canadian Labour Congress
CMA	Catchment Management Authority
CofFEE	Centre of Full Employment and Equity, University of Newcastle
CoI	Commission of Inquiry
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalency
CPRS	Carbon Pollution Reduction Scheme
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DECC	NSW Department of Environment and Climate Change
DLWC	NSW Department of Land and Water Conservation
DPI	NSW Department of Primary Industries
DSRD	NSW Department of State and Regional Development
DUAP	NSW Department of Urban Affairs and Planning
EFI	Eco-footprint Index
EITE	Energy Intensive Trade Exposed (industries)
ESD	ecologically sustainable development
EWG	Energy Working Group
FoE	Friends of the Earth
GDP	Gross Domestic Product
gha	global hectares
GHG	greenhouse gas
GPI	Genuine Progress Indicator

Gt	Billion tonnes
GW	gigawatt
GWh	gigawatt hours
HEHI	holistic ecosystem health indicator
HEL	Hunter Environment Lobby
HIV/AIDS	human immunodeficiency virus/acquired immune deficiency syndrome
HROC	Hunter Regional Organisation of Councils
ICEM	International Federation of Chemical Energy Mine and General Workers' Unions
IEA	International Energy Agency
IFE	Institute for Energy
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ITUC	International Trade Union Confederation
IUCN	International Union for the Conservation of Nature
LGSA	Local Government and Shires Association
MAP	Movement Action Plan
MLC	Member of the Legislative Council
MP	Member of Parliament
MPI	Mineral Policy Institute
Million tonnes	Mt
NEMMCO	National Electricity Market Management Company
NCC	Newcastle City Council
NFFE	National Framework for Energy Efficiency
NGO	non-government organisation
NSESD	(Australia's) National Strategy for Ecologically Sustainable Development
NSW	New South Wales
OCGT	open-cycle gas turbines
OECD	Organisation for Economic Cooperation and Development
PAR	Participatory action research
ppmv	parts per million of CO_2e by volume
PV	photo-voltaic
REN 21	Renewable Energy Network for the 21st Century
RET	Renewable Energy Target
SCCC	Southern Cross Climate Coalition
SD	sustainable development
SES	socio-ecological system
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
WCED	World Commission for Environment and Development
WHO	World Health Organization
WWF	World Wildlife Fund

Glossary

Clean energy	'Jobs, businesses and investments that produce, transmit and store clean, renewable power from solar, wind, low-impact hydro, hydrogen fuel cells, marine and tidal, geothermal and small-scale biopower energy sources', the definition used by the Washington DC-based Pew Center in the USA (Pew Charitable Trusts, 2009: 12).
Ecosystem	A complete community of living organisms and the non-living materials of their surroundings. Thus, its components include plants, animals, and microorganisms; soil, rocks, and minerals; as well as surrounding water sources and the local atmosphere (Science Clarified, 2006).
Ecological footprint	A measure of human demand on the Earth's ecosystems. It compares human demand with planet Earth's ecological capacity to regenerate. It represents the amount of biologically productive land and sea area needed to regenerate the resources a human population consumes and to absorb and render harmless the corresponding waste. Using this assessment, it is possible to estimate how much of the Earth (or how many planet Earths) it would take to support humanity if everybody lived a given lifestyle.
Ecology	A multidisciplinary science that studies the interactions between living organisms and their biotic and abiotic environments. The environment of an organism includes physical properties that make up the sum of local abiotic factors such as climate and geology, and biotic ecosystem which includes other organisms (including humans) that share its habitat.
Green jobs	Secure, well-paid, quality jobs which are clean, healthy and stress-free and which have a direct, positive impact on the environment (Canadian Labour Congress, 2000: 1).
Long-wall	A form of underground coalmining where a long wall (typically about 250–400 m long) of coal is mined in a single slice (typically 1–2 m thick). The long-wall panel (the block of coal that is being mined) is typically 3–4 km long and 250–400 m wide.
Open cut	A mining technology that involves removing the topsoil and top layers of rock to reveal coal seams near the surface, and then removing the coal while creating a large open pit.
Social movements	Collective actions in which the populace is alerted, educated, and mobilised, sometimes over years and decades, to challenge the powerholders and the whole society to redress social problems or grievances and restore critical social values (Moyer *et al.*, 2001: 2).

Preface and acknowledgements

After six years it is a great relief to finish the writing of this thesis, even if the campaigns it describes shall continue for the foreseeable future. One of the great challenges of this thesis has been finding the point to draw a line under it as the climate change, ecosystem health and social justice issues I write about are so dynamic, and new directions are constantly unfolding. This has particularly been the case in 2008–09 in the lead up to the international climate change agreements being negotiated at the United Nations Climate Change Conference in Copenhagen; as the Australian Government made some major policy announcements; and the Obama Administration set new directions in the US after the long years of the Bush Administration. Political change is occurring as a global financial crisis unfolds, and the warnings of climate scientists tell us that potentially catastrophic climate chaos looms ever more likely.

The convergence of so many issues and changes to policy possibilities is both a wake-up call that humanity needs to urgently act together and a cause for excitement about an historic moment and potential for real change to happen.

My feeling of optimism is tinged with fear that an historic opportunity will be missed. I hope this thesis makes a small contribution to moving things forward towards genuine sustainability, at least in the place where I live, and have come to love – the Hunter Valley of Australia.

I learnt, as a student, some solid foundations for environmental and social justice activism: passion, ethics, care and science. Though environmental activism I learnt about grassroots organising and campaigning, about educating the public and confronting corporate power and government expediency. The *Radical Ecology Conference*, held in Melbourne in Easter 1975, was where I first saw the breadth of the Australian environment movement, and the possibility that bold visions matched with grassroots action for an egalitarian society can achieve a just and sustainable future.

Many years and many campaigns later I moved, with my partner Deborah Hartman and (then) baby Jack, to the small gold and copper mining town of Tennant Creek in the heart of the desert country of Australia’s Northern Territory. It was perhaps here, more than any other place, that I was directly confronted by the linked human and ecological dimensions of distress of the land and the health of people. My first job in Tennant Creek was helping (as a volunteer with Jane Simpson and John Havnen) to document the appalling living conditions of the Indigenous people living in the camps in and around Tennant Creek. This was the beginning of many years learning from the Warumungu, Alyawarr, Wambaya, Warlmanpa and Warlpiri people of the Tennant Creek and Barkly region. Sadly, many of my teachers and friends have ‘finished up’ at far too early an age. However, the Dawsons, Franks, Grants, Stokes, Nelsons, Corbetts, Murphys and Fosters – to name just a few – have been good and dear friends to my family and have taught us about the power of the link between people and country. We still cherish these connections.

Some years later, as convenor of the Arid Lands Environment Centre in Alice Springs, I was again involved in linked ecological-human health and social justice issues when central Australia was designated as the proposed site for disposal of Australia's stockpile of radioactive waste. Once again, as at Maralinga and Jabiluka, Indigenous people were designated to carry the burden of society's most hazardous industry and its waste. This fight continues today, with four sites close to Indigenous communities in the Northern Territory – including at Muckaty, north of Tennant Creek – being designated radioactive waste dumps. Strong community resistance continues.

When my family moved to Newcastle from Alice Springs 10 years ago, I again found myself working on mining issues with local people fighting to protect the beautiful Hunter Valley from being destroyed by vast open-cut coalmines. People like Wendy Bowman, Gail Collins, Julia Imrie, Christine, Phelps Bev Smiles, Mavis and Tony Tersteeg, Peter Flynn and Tim Duddy were just a few among the thousands of families affected by coalmines and coal-fired power stations who staunchly resisted the impact of the Hunter Valley's carbon economy on their lives and wellbeing – and from whom I have learnt.

The restoration of ecological and social health is through the courage and generosity of many people who invariably act for no vested interest other than a wish to live in a healthy place and a healthy community, providing local expertise, advice, encouragement, contacts, hospitality, food and shelter, and love to the world.

I never expected to be a PhD candidate, and perhaps there are some who will say, 'He never should have been one!' However, I must thank Professor Glenn Albrecht, then of the University of Newcastle (now Murdoch University) for encouraging me to 'have a go', and for believing that I could do it. Glenn has been a great friend and mentor. He has also recognised that students, even mature-aged students with a family such as myself – and especially ones who are not on a scholarship – need an income, and he has assisted me with paid work as a lecturer, tutor, and course developer in courses related to my thesis. Glenn's academic support as a supervisor has also been extraordinary. I have been very fortunate in having such an inspirational and supportive supervisor, a true 'critical friend'. His rigorous critique of my work and advice on readings and theories has been invaluable and allowed me to structure my argument around key propositions in what I hope is a useful and interesting transdisciplinary study.

I must thank Professor Phil O'Neill (now of University of Western Sydney) who helped get me started on the thesis, and the other lecturers, staff, and fellow students and researchers at the School of Environment Life Sciences at University of Newcastle, who also contributed a supportive and academically challenging environment.

I have been inspired by the new generation of activists becoming involved in environment and social justice issues, in Rising Tide, Friends of the Earth, the Australian

Students Environment Network (ASEN), Newcastle University Students' Association (NUSA) and elsewhere. I'm encouraged by the many excellent workplace and community activists and officials within various trade unions, including both the Construction Forestry Mining Energy Union (the CFMEU) in the Hunter Valley and the Australian Manufacturing Workers Union (the AMWU) who helped me grapple with the issues involved in making a transition to a Green economy while protecting the livelihoods of vulnerable workers and communities; that is, a Just Transition.

Thanks to Peter Lewis, resident cartoonist at the *Newcastle Herald,* for generously providing cartoons that so well depict Hunter Valley life and issues. Thanks also to Jill Albrecht, Liam Phelan, Mark Maclean and Christine Bruderlin who have provided great skill with comments as critical friends, proofreaders and designers, and also encouragement and friendship.

Most important has been the love and support of my fabulous family – wife Deborah and sons Jack and Vincent – who have been so encouraging and generous about the disruptions to time together as I have beavered away on this project over six years. As an impoverished student, the belt-tightening of relying on casual and part-time work has been tough on all of us at times, but has encouraged us to cook a lot at home and get an excellent vegie garden happening!

Writing the thesis has been a luxury that I have been able to enjoy and greatly appreciate. I hope it is of some value to the millions of people around the world who risk their wellbeing – for some their very lives – to protect the planet and create a safe, secure and environmentally friendly livelihood, and who hopefully still can find some time to contemplate the dignity of humans, the beauty of nature and all the wonderful living things on it.

Introduction

This study is about how the Hunter Valley in New South Wales, a region that has been described as a food bowl and breadbasket[1] of Australia "with an international reputation for fine wine and finer cuisine" (Mason, 2007) can avoid becoming a basket case[2] – a place suffering from linked and irreparable social and ecological distress syndromes.

The study is a transdisciplinary examination of the Hunter Valley from a complex adaptive systems perspective. The research examines the dialectics and potential for transition to sustainability and the role of opposing social and ecological forces to drive alternative scenarios. One potential scenario is ongoing coal dependency that is pushes the region's linked social and ecological systems towards ecosystem and social collapse and chaos in the quest for short-term economic gain. The alternative scenario investigated is a just transition to sustainability that aims to restore ecological and social health, and justice *to* and *in* the environment (Low & Gleeson, 1997) as the over-riding principles guiding the region's future development trajectory.

The research investigates how a region that is the largest exporter of coal to the global economy can develop a "moral economy" that is based on the "right relationships" between humans, and between humans and nature, guided by principles of "goodness, fairness and justice" (Brown & Garver, 2009: 3). In a moral economy relationships between humans and nature in both particular localities and across the planet as a whole acknowledge that humans live within the planet's ecological limits and that practices in one place affect the health of people and places in others. The purpose of a moral economy is to protect the "integrity, resilience, and beauty of the commonwealth of life for future generations" (Brown & Garver, 2009: 21).

Brown and Garver (2009) propose that a moral economy would be based on awareness of "the beauty and majesty of the cosmos and recognition of humanity's appropriate place in it" (2009: 21). It would be an economy for protecting "the whole earth" that is informed by history but tailored to the future. The foundations for achieving a moral economy are democratic, transparent, accountable and effective local and global governance institutions and regimes, in which individual and collective political commitments to transformation and action to achieve sustainability are ignited by social movements that change hearts, minds, policy and practices (Brown and Garver, 2009).

All humans aspire to live in a healthy, safe and just world, but our potential for doing so is at risk because the health of the biosphere that we depend on is under severe

[1] A 'breadbasket' is defined as "a region serving as a principal source of agriculture and grain supply" (Answers.com (2009) www.answers.com/topic/breadbasket: Accessed: 2/7/2009). As recently as July 2009, Australia's national broadcaster, the Australian Broadcasting Commission, described the Hunter and Liverpool Plains region as a food bowl and breadbasket of the nation (ABC, 2009b), while Senator Brett Mason described the region as a breadbasket "with an international reputation for fine wine and finer cuisine"(Mason, 2007).

[2] A 'basket case' is defined as "One that is in a completely hopeless or useless condition" Answers.com, (2009) http://www.answers.com/topic/basket-case Accessed: 2/7/2009).

anthropogenic stress. Approximately 60% of the ecosystem services that support life on Earth, such as fresh water and fisheries, are being degraded or used unsustainably (Millennium Ecosystem Assessment 2005). The loss of healthy ecosystems and biodiversity diminishes the potential of humans and other species to find the food, water, clean air and other essentials of life. As biodiversity shrinks, the balance of nature is disrupted and the physical, psychological and social health of humans is threatened (Costanza *et al.*, 1992; McMichael, 1993; Rapport *et al.*, 1998; Corvalen *et al.*, 2005; Connor *et al*, 2004).

Climate change has emerged as a major threat to the linked health of ecosystems and humans, and some places and people are particularly vulnerable because of their high exposure to global warming's impacts (IPCC, 2007b). In contrast, some people are benefiting (at least in the short term) from the anthropogenic drivers of climate change, through direct economic and political benefits gained from the fossil fuel economy, including the coal economy which contributes roughly 20 percent of global greenhouse gases (Pew Center on Global Climate Change, 2008). Australia is a significant contributor to climate change through reliance on coal-fired power generation, and as the world's largest exporter of coal to the global economy. The Hunter Valley is arguably Australia's most significant climate change hot spot.[3] The region is Australia's largest direct and indirect contributor to climate change.

There are six coal-fired power stations located in the Hunter Valley, which between them generate about 40% of Australia's electricity supply. The Hunter Valley is also the site of some of Australia's most carbon-intensive industries, including two large aluminium smelters, which utilise a third of the coal-fired electricity generated in the region (NSW DPI, 2008; Saddler *et al.,* 2004; Diesendorf, 2007). However, the Hunter Valley's greatest contribution to global climate change is its coal export industry. The port of Newcastle, at the mouth of the Hunter River, is the world's largest coal export port currently exporting 100 million tonnes (Mt) of coal annually, with plans and investment underway to more than double exports over the next decade.

The Hunter Valley economy is not just jeopardising ecosystem health and sustainability at the regional scale, but, with each tonne of Hunter Valley coal burnt annually (locally and globally) contributing around 2.4 tonnes of carbon dioxide (or its equivalent[4]) to the global atmosphere (Australian Department of Climate Change, 2008: 12), the region's economy is jeopardising ecological and human health at the global scale, and therefore no longer has the qualities of a moral economy. The Hunter Valley has been labelled

---

3 A 'hot-spot' is defined as 1. A place where there is a lot of exciting activity or variety: e.g. cultural and biodiversity hot spots 2. an area where there is fighting or political unrest: e.g. a political hot spot. 3. a small area of abnormally high temperature or radioactivity, e.g. urban areas, coal-fired power stations, Chernobyl (Collins Dictionary, 2006).

4 Carbon dioxide equivalency (CO_2e) is a quantity that describes, for a given mixture and amount of greenhouse gas, the amount of CO_2 that would have the same global warming potential (GWP), when measured over a specified timescale (generally, 100 years).

Carbon Valley by the region's major newspaper, the *Newcastle Herald*, which identified the region as:

> A greenhouse capital … in one of the world's biggest per-head producers of global warming gases (Ray, 2005a: 1).

Many millions of the world's poorest and most vulnerable people on Earth are already suffering from ecosystem collapse and climate change, and lack the adaptive capacity and resources to cope with loss of ecosystem services, natural disasters, food and water insecurity, conflict or economic dislocation due to climate change. Many of the most vulnerable people live in the vulnerable mega-deltas in Asia and Africa, the Arctic, small islands, and Africa generally (IPCC, 2007b; United Nations, 2008).

These linked crises pose an ethical, political and sustainability challenge for humanity and for governments, corporations and communities throughout the world. These challenges are particularly relevant to Australia and the Hunter Valley, as a nation and a region with a growing coal export economy that contributes directly to the global climate change problem.

Many of the impacts from climate change may not yet be apparent to all but it is the nature of complex adaptive systems that incremental changes can build up – often imperceptibly – and then cascade across domains to cause collapse of ecological and social systems. Many such rapid, unpredictable and uncontrollable collapses have occurred in ecosystems and human societies over time, and as this thesis is being written, leading climate scientists have warned that the world faces a growing risk of abrupt and irreversible climate shifts (Richardson, 2009). Under these circumstances it is likely that the ecosphere, and human communities living as part of it, will transform in fundamental ways in the near future, and while the trajectory of human responses to the climate change threat is not known, hopefully it will be towards sustainability rather than towards ecological and societal collapse and chaos.

This thesis investigates the potential of the Hunter Valley to make a transition to sustainability as part of local and global climate change mitigation strategies. It investigates two linked dimensions of this transition – a shift from coal-fired power generation to clean, renewable energy systems in the region, and a rapid phasing out of the region's coal export industry.

Fossil fuel use and climate change are linked issues at the centre of the quest for a sustainable future for humanity and all species. In 2005, the amount of carbon being emitted by human activities (our "Carbon Footprint") accounted for 45% of humanity's demands on the Earth's biologically productive land and sea (our "Ecological Footprint") (WWF, 2008a), with fossil fuel use, particularly coal, being the largest single contributor to humanity's Carbon Footprint and contribution to climate change (IPCC, 2007a, 2007b; WWF, 2008a).

Australia's per capita greenhouse gas emissions are among the highest in the world; according to Raupach (2007) Australia's per capita emissions in 2004 were 4.5 times the global average, just below the value for the USA. In 2006, Australia's per capita emissions were 28.1 tonnes carbon dioxide equivalent (CO_2e), nearly twice the Organisation for Economic Cooperation and Development (OECD) average (Australian Government Department of Climate Change, 2008; Garnaut, 2008).

Climate change is identified as a human rights issue by significant non-government organisations, such as Oxfam (Raworth, 2008), Greenpeace (Ananthapadmanabhan *et al.*, 2007), Friends of the Earth International (FOEI, 2006) and India's Centre for Science and Environment (Agarwal and Narain, 1991; CSE, 2008). The Oxfam report *Climate Wrongs and Human Rights: Putting People at the Heart of Climate Change Policy* (Raworth, 2008) highlighted that the wellbeing of the global human community and its environment are interconnected and that climate change is an emergent human rights issue that demands new responsibilities from people and governments of all countries. The report states:

> When the Universal Declaration of Human Rights was drawn up in 1948, its authors could not have imagined the complex global interconnectedness that climate change would lead to today. But now it is clear that the devastating international impacts of greenhouse-gas emissions give countries undeniable international responsibility for the human-rights consequences of their policies (Raworth, 2008).

At the *Climate Change: Global Risks, Challenges, and Decisions* conference, held in Copenhagen, Denmark, in March 2009, scientists, economists and energy policy experts issued six key messages that serve as renewed and urgent reminders that CO_2 emissions must peak and then decline in the next six to 10 years to avoid abrupt or irreversible climatic shifts (Richardson *et al.*, 2009). The scientists issued a call to action for the global community, and particularly governments, leading up to the December 2009 United Nations Climate Change Conference, which will negotiate and adopt the international climate-change protocol that will replace the Kyoto Protocol, and guide global action over the next decade. The messages are reproduced in Table 1 below as they set a global context for this thesis.

Table 1: Six key messages calling for urgent action on climate change

(From Richardson *et al.,* 2009: 6)

Key Message 1: *Climatic trends* Recent observations show that greenhouse gas emissions and many aspects of the climate are changing near the upper boundary of the IPCC range of projections. Many key climate indicators are already moving beyond the patterns of natural variability within which contemporary society and economy have developed and thrived. These indicators include global mean surface temperature, sea-level rise, global ocean temperature, Arctic sea ice extent, ocean acidification, and extreme climatic events. With unabated emissions, many trends in climate will likely accelerate, leading to an increasing risk of abrupt or irreversible climatic shifts.
Key Message 2: *Social and environmental disruption* The research community provides much information to support discussions on “dangerous climate change”. Recent observations show that societies and ecosystems are highly vulnerable to even modest levels of climate change, with poor nations and communities, ecosystem services and biodiversity particularly at risk. Temperature rises above 2°C will be difficult for contemporary societies to cope with, and are likely to cause major societal and environmental disruptions through the rest of the century and beyond.
Key Message 3: *Long-term strategy: global targets and timetables* Rapid, sustained, and effective mitigation based on coordinated global and regional action is required to avoid “dangerous climate change” regardless of how it is defined. Weaker targets for 2020 increase the risk of serious impacts, including the crossing of tipping points, and make the task of meeting 2050 targets more difficult and costly. Setting a credible long-term price for carbon and the adoption of policies that promote energy efficiency and low-carbon technologies are central to effective mitigation.
Key Message 4: *Equity dimensions* Climate change is having, and will have, strongly differential effects on people within and between countries and regions, on this generation and future generations, and on human societies and the natural world. An effective, well-funded adaptation safety net is required for those people least capable of coping with climate change impacts, and equitable mitigation strategies are needed to protect the poor and most vulnerable. Tackling climate change should be seen as integral to the broader goals of enhancing socioeconomic development and equity throughout the world.
Key Message 5: *Inaction is inexcusable* Society already has many tools and approaches – economic, technological, behavioural, and managerial – to deal effectively with the climate-change challenge. These tools reflect both mitigation and adaptation options, but if they are not vigorously and widely implemented the societal transformation required to decarbonise economies will not be achieved, and the challenge of adapting to the unavoidable climate change will be enormous, potentially overwhelming the capacity of many societies. On the other hand, a wide range of benefits will flow from a concerted effort to achieve effective and rapid adaptation and mitigation. These include job growth in the sustainable energy sector; reductions in the health, social, economic and environmental costs of climate change; and the repair of ecosystems and revitalisation of ecosystem services.
Key Message 6: *Meeting the challenge* If the societal transformation required to meet the climate-change challenge is to be achieved, then a number of significant constraints must be overcome and critical opportunities seized. These include reducing inertia in social and economic systems; building on a growing public desire for governments to act on climate change; reducing activities that increase greenhouse gas emissions and reduce resilience (e.g. perverse subsidies); and enabling the shift from ineffective governance and weak institutions to innovative leadership in government, the private sector and civil society. Linking climate change with broader sustainable consumption and production concerns, human rights issues and democratic values is crucial for shifting societies towards more sustainable development pathways.

Another report examining the impacts of climate change on the United States (Karl *et al*, 2009) reaffirms the risks from unanticipated impacts of climate change – such as major alterations in oceans, massive dislocations of species or pest outbreaks, and major shifts in wealth, technology, or societal priorities – and how this would affect humanity's ability to respond. These challenges will only become harder as carbon dioxide concentration increases.

The international environmental organisation Friends of the Earth recognises the human rights dimensions of climate change and argues for (Friends of the Earth International, 2006a):

> The right for all peoples to have access to sufficient energy within ecological limits from appropriate sustainable sources for a dignified life.

Humans have a moral or ethical responsibility to mitigate climate change in an equitable way, and to assist vulnerable communities to cope with inevitable climate change impacts. However, humans also have an ethical responsibility to nature as a whole and to other species on the planet, which also have an intrinsic right to survive irrespective of whether they may, or may not be, useful to humans (Taylor, 1981; Regan and Singer, 1976; Devall and Sessions, 1985; Callicott, 1985; Shiva, 2005).

Sustainability

The concept of sustainability, the capacity to endure, as an integrative organising principle for human societies emerged in public discourse in the 1980s, particularly after the release of the World Commission on Environment and Development report *Our Common Future* (WCED, 1987). The report refers to the capacity of ecosystems and human societies to persist and to provide the goods and services needed for life into the foreseeable future. Achieving sustainability is an ethical and social justice issue, as well as an environmental issue. The potential of life for billions of humans, and millions of other species, is in jeopardy as people living in the world's wealthiest societies – which have historically used a disproportionate share of the world's resources – continue to expand their consumption way beyond the Earth's carrying capacity. Indeed, the *Living Planet Report 2008* indicates that humanity is now consuming resources at a rate that by 2030 will require two planet Earths, and that people on a per capita basis in the USA, United Arab Emirates and Australia are consuming about four planet Earths to sustain their lifestyles (WWF, 2008a).

This thesis uses ecosystem health as an indicator of sustainability. Ecosystem health is a transdisciplinary concept that bridges the natural, social, and health sciences. A healthy ecosystem is a social-ecological unit that maintains its integrity, vigour, resilience, and its characteristic composition, organisation, and function over time, while remaining economically viable and sustaining human communities (Costanza 1992, Haskell *et al*, 1992; Rapport 1998). In an unhealthy ecosystem, functions that provide essential services for life become impaired and ecosystem distress syndromes become apparent (Rapport *et al*, 1998). These distress syndromes include loss of productivity, loss of species diversity and changes to biotic structure, pest and disease prevalence, and loss of soil fertility. In many cases, ecosystem distress syndrome is linked to increased disease incidence and physical, psychological and social wellbeing in humans and other species, and thus the sustainability of the social and ecological systems they inhabit (Rapport, Costanza and McMichael, 1998; McMichael, 1993; Corvalen *et al,* 2005; Albrecht, 2005).

Social ecologist Murray Bookchin (1980) argued that sustainability is possible only if human-nature relationships could be brought back into alignment and balance. He proposed that (Bookchin, 1989:171):

> [Human] interest centres around the establishment of a harmonious balance with nature. Our viability as a species depends on our future relationship with the natural world.

Furthermore, as Bookchin also noted, nearly all ecological problems have their roots in social problems, and thus there is an urgent need for human societies to "search out the relationship of society to nature" (Bookchin, 1989: 24) and simultaneously address social and ecological components of non-sustainability. Bookchin described the urgent challenge of humans creating an "ecological society" through "bringing society back into the ecological picture" (Bookchin, 1989: 24) and investigating "how social evolution can be situated in natural evolution" (Bookchin, 1989: 38).

Bookchin's social ecological propositions, and the calls by non-government organisations such as Oxfam that climate change is a human rights issue, are powerful motivations for this thesis which investigates how a particular region of the world – the Hunter Valley - can make a transition to sustainability in such a way that ethical and ecologically-grounded human-human relationships and human-nature relationships can be created at local, regional, national and global scales.[5]

Beyond tinkering

According to Bookchin, achieving an "ecological society" requires more than just "tinkering with existing institutions, social relations, technologies and values [but] rather [requires] changing them" (Bookchin 1980: 77). Many other commentators on the global ecological and sustainability challenges have also supported this view, but in their own distinctive approaches (Schumacher, 1973; Commoner, 1975; Daly and Cobb, 1989; Merchant, 1992; Brown *et al.,* 1992; Meadows *et al.*, 1992; Beder, 1996; Doherty and Geus, 1996; Costanza *et al.,* 2001; Dobson, 2003; Eckersley, 2004; Elliott, 2004; Dryzek, 2005; Shiva, 2005; Clapp and Dauvergne, 2005; Lovelock, 2006; Raskin *et al.,* 2006).

Institutional change needs to redress the failures of governments and markets to change non-sustainable patterns of growth, production and consumption. Such change needs to

---

[5] For the purposes of this thesis, local refers to neighbourhood, township or city scale of social organisation (for example, Muswellbrook or Newcastle) within the larger regional spatial scale. Regional scale generally refers to a bioregional spatial scale (such as the Hunter Valley). National, continental or global scales are also referred to throughout the thesis.

be a process that empowers communities with the capacity to mobilise and exercise countervailing power to those social forces that maintain non-sustainable states that are proving perversely resilient, and thus obstinately keeping human societies in a pathological state that is harmful to the health of people and the planet.

This thesis investigates the pathological state of the Hunter Valley socio-ecological system that is locked into fossil fuel dependency. It investigates how the perverse resilience (Ráez-Luna, 2008) of the Hunter Valley's current status as a climate-change hot spot can be replaced by the genuine resilience of an ecological society in a healthy ecosystem, in which thousands of new "Green jobs" can be created that replace jobs lost in industries that contribute to non-sustainability. Perverse resilience occurs where pathological social relationships that are oppressive and exploitative of humans and ecosystems are rendered resistant to change by political support, including economic subsidies.

Green jobs have been defined in various ways. The Green Jobs Initiative of the United Nations Environment Program (UNEP), the International Labor Organization (ILO) and the International Trade Union Confederation (ITUC) defined Green jobs as:

> Positions in agriculture, manufacturing, R&D, administrative, and service activities aimed at alleviating the myriad environmental threats faced by humanity. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity, reduce energy consumption, decarbonizes the economy, and minimize or altogether avoid the generation of all forms of waste and pollution. A successful strategy to green the economy involves environmental and social full-cost pricing of energy and materials inputs, in order to discourage unsustainable patterns of production and consumption. A green economy is an economy that values both nature and people and creates decent and adequately paid jobs (UNEP, 2008: 7).

Van Jones, the founder of the US organisation *Green For All* which has campaigned strongly for Green job creation in low-income communities, emphasises its potential to tackle both poverty and climate change simultaneously. From March to September 2009 Jones was a special adviser to US President Barack Obama on Green jobs. Jones defines a Green job as:

> Family-supporting, career-track job that directly contributes to preserving or enhancing environmental quality. Like traditional blue-collar jobs, green-collar jobs range from low-skill, entry-level positions to high-skill, higher-paid jobs and include opportunities for advancement in both skills and wages. Think of them as the 2.0 version of old-fashioned blue-collar jobs, upgraded to respect the Earth and meet the environmental challenges of today (Jones, 2008: 12).

Like Jones, trade unions emphasise job quality as an essential feature of a Green job, including security, safety and fair pay levels for the work done. The Canadian Labour Congress definition of Green jobs is a useful and succinct definition which captures the concept as it is used in this thesis:

> Secure, quality, fairly paid jobs which are clean, healthy and stress-free and which have a direct, positive impact on the environment (Canadian Labour Congress, 2000: 1).

Clean energy is another concept with multiple and contested definitions. The Minerals Council of Australia (MCA), the peak body of coalminers and the minerals industry in Australia, uses the definition of clean energy proposed by the Cambridge Energy Research Associates (Banville *et al.* 2006), namely:

> A set of new and conventional energy technologies that, alone or in combination, can (1) provide energy with a minimal carbon footprint to help address climate change, and (2) facilitate greater energy security through broader diversity of fuels and technologies -all at prices that are politically acceptable and conducive to economic growth and development (cited in MCA, 2008c: 3)

The industry likes this broad-ranging definition of clean energy because it includes so-called "clean coal" with carbon capture and storage of CO_2 emissions within its ambit (MCA, 2008c).

However, the end-use impacts of a mineral's use cannot be seen in isolation from the impacts of its mining and processing, and recognising the impacts of coalmining on the air, water and landscape of the Hunter Valley, coal cannot be regarded as "clean". Also, unlike renewable energy technologies, carbon capture and storage technologies are unproven and not currently deployed. Therefore, "clean coal" is not accepted as clean energy for the purposes of this thesis, and rather than the MCA's preferred definition this researcher uses the definition of clean energy proposed by the Washington DC-based Pew Centre, which refers to:

> Jobs, businesses and investments that produce, transmit and store clean, renewable power from solar, wind, low-impact hydro, hydrogen fuel cells, marine and tidal, geothermal and small-scale biopower energy sources (Pew Charitable Trusts, 2009: 12).

A convergence of social and ecological crises

At the time of writing this thesis, the world is experiencing a coincidence of major global crises: massive and irreversible species extinction and biodiversity loss; persistent global poverty; extensive violence and war; global financial system collapse; and the threat of runaway climate change. These actual problems and threats, together and separately, indicate the non-sustainability and potential collapse of the dominant social, economic, political and cultural regimes governing human societies and human relationships with nature. Many human societies have collapsed throughout history because of their inability to develop cultures and governance regimes that enabled them to live within available resources and to absorb shocks (Weiss and Bradley, 2001; Diamond, 2005; Costanza *et al.*, 2007; Ponting, 2007).

The capacity of human social systems and the ecological systems in which they are located, known as socio-ecological systems (Berkes and Folke, 1998), to withstand shock is a measure of their resilience (Walker *et al.*, 2004). Hopefully, there will be a positive aspect of the convergence of current crises and humanity will take them as a wake-up call for new learning, values change and the transformation of institutions of governance so that a transition to ecological sustainability and global justice is possible. This thesis will demonstrate that the Hunter Valley is an excellent case study of threats to, and opportunities for, achieving a transition to genuine resilience and sustainability at a regional scale based on analysis of current and emergent drivers and trends.

The Hunter Valley case study is relevant to other regions of the world that are also engaged in non-sustainable economic activities from which a transition needs to be made. In other regions the dominant driver of non-sustainability might also be reliance on fossil fuels, or it might be another non-sustainable industry, perhaps over-fishing, toxic chemical industries, or narcotics production.

There are many regions throughout Australia and globally that host industries that are potentially sustainable, such as agriculture, tourism or manufacture but are currently vulnerable due to ecological collapse or economic restructuring. Mapping a potential pathway to sustainability, grounded in maintaining the health of environmental assets and protecting the wellbeing of displaced workers and at risk communities is essential if human communities are to overcome linked ecological and social crises.

Chapter 1

Transitions to sustainability

The Hunter Valley[6] region is located on Australia's east coast, 150 km north of Australia's largest city, Sydney, and extends 200 km inland from the coast. In 2007 the Hunter Valley had a population of 624,296 persons, approximately 9% of the state of New South Wales's total of 6.5 million. The region comprises 11 local government areas, the largest being the coastal cities of Newcastle (population 150,357) and Lake Macquarie (population 193,092); the Lower Hunter cities of Maitland (population 66,530), Port Stephens (population 64,698) and Cessnock (population 48,985); and the Upper Hunter towns of Singleton (population 23,258) and Muswellbrook (population 16,039) (HVRF, 2008a).

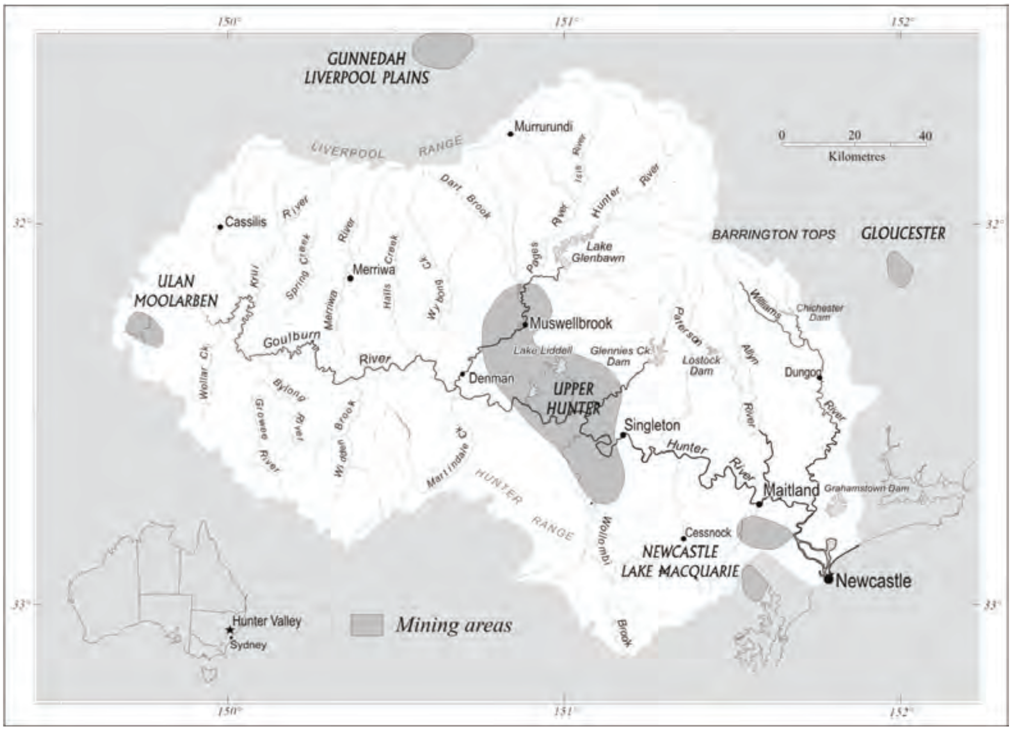


Figure 1: The Hunter River catchment and mining areas
The Hunter Valley includes the Hunter River catchment and the adjacent Lake Macquarie and Great Lakes catchments (see footnote). The region's major current coalmining area is concentrated around the towns of Singleton and Muswellbrook but also includes the Gloucester/Great Lakes, Newcastle/Lake Macquarie, Ulan/Moolarben and Gunnedah/Liverpool Plains coalfields (Rey-Lescure, 2009a).

The region has more than 35 currently operating coalmines, and more than 20 others are in planning and approval phases of development (NSW DPI, 2008). The Hunter Valley's

[6] The term Hunter Valley is used in this thesis to describe a region that is often referred to simply as "the Hunter". The term Hunter Valley is preferred because it provides a more ecological description of the region and acknowledges that the majority of the region is comprised of the catchment of the Hunter River. The adjacent Lake Macquarie and Great Lakes catchments are also regarded as part of the Hunter Valley for the purposes of this thesis. Some coal mines and coal-fired power stations discussed in this thesis are located in the Lake Macquarie and Great Lakes catchments.

coalfields and power stations are located in both the lower and upper Hunter River catchment, particularly around Lake Macquarie in the Lower Hunter and around the towns of Muswellbrook and Singleton in the Upper Hunter.

Over the last 30 years the region's fossil fuel energy resource and the electric power generated from it have become fully integrated into national, and now globalised, energy and mineral commodity markets: coal, steel and aluminium. This shift in the dominant drivers of the Hunter Valley's socio-ecological evolution from regional to global has seen the scale of individual mines and the region's mining-affected landscape expand enormously. Newer mines are designed to supply global export markets (for example Bengalla, Mt Arthur, Moolarben, and Mangoola) and extend for many square kilometres above and below ground using open-cut and long-wall techniques, both of which have significant impacts on landscapes, vegetation, aquifers and rivers individually and cumulatively (NSW DUAP, 1997; Booth *et al.*, 1998; NSW DMR, 1999; Holla and Barclay, 2000; ACARP, 2001, 2002; Eco Logical, 2004; NSW Scientific Committee, 2005; Galvin & Associates, 2005; NSW DIPNR, 2005; Total Environment Centre, 2007; NSW DECC, 2007; see also the environmental impact statements of each mine).

Mapping by the University of Newcastle's Ecosystem Health Research Group shows that over 280 km^2 of the Upper Hunter Valley is directly affected by mining operations, with the 19% of the central floor of the Hunter Valley between the towns of Singleton and Muswellbrook being mine-affected (Ray-Lescure, 2009b). A *Synoptic Plan* was prepared by the NSW Department of Minerals in 1999. It presents snapshot plans of the coalfield at the two points in time – 1998 and 2020 – based on current projects, approved mine sequencing, and planned rehabilitation and proposes "opportunities for revegetation across the coalfield in an integrated approach that considers biodiversity, agroforestry for amenity and commercial return, catchment protection, and bioengineering of mined landforms" (NSW DMR, 1999: 1). However, it is evident from interviews with local residents conducted during this research, and from analysis of numerous media articles, submissions to government inquiries and from scientific reports, that there is an enormous gap between the sustainable development promises of industry and governments, and the reality. Indeed, there is growing evidence of linked ecosystem health and human health distress syndrome (Connor *et al,* 2004; Higginbotham *et al,* 2007).

Challenging the ecological hegemony of Big Coal

Linked ecosystem health and human health distress and the emergence of climate change as a social concern have become powerful drivers for a call by many Hunter Valley residents for a shift in the economic base of the region, a challenge to the dominant influence of the coal industry over the region's political culture and development trajectory, and the dominant influence of a value system that legitimises "ecological destruction and the appropriation of environments and common rights by private capital" (Grove, 1990: 17). This value system is described as the "ecological hegemony" of the region's multi-billion coal industry, Big Coal, over the aspirations of many people in the region for an alternative socio-ecological relationship that promotes ecosystem health, human health and social justice – locally and globally.

Appluying the concept of hegemony helps us to investigate and understand the perverse resilience of coal dependency in the Hunter Valley, and Australian and global society more generally. The concept of hegemony was proposed by the Italian political activist and theorist Antonio Gramsci who defined it as:

> Spontaneous consent given by the great masses of the population to the general direction imposed on social life by the dominant fundamental group [i.e. the ruling class] this consent is historically caused by the prestige (and consequent confidence) which the dominant group enjoys because of its position and function in the world of production (Gramsci, 1971: 12).

Gramsci identified three dimensions of hegemony influencing morality, ideology and politics, with both coercive and non-coercive modes (Gramsci, 1971). Examples of these dimensions occurring in practice around the perverse resilience of fossil fuel dependency are discussed, referring, for example to the activities of the coal industry as a very influential lobby group determining government policies and investments at local and global scales with a coercive element reflected in threats of capital strike and energy insecurity. However, the hegemony of coal dependency also asserts itself through the pervasive non-coercive dominion of capitalist economies addicted to growth and power of consumerist cultures with insatiable appetites for commodities that are rendered cheap and accessible through the lack of internalisation of the environmental and social costs of embedded fossil fuel-derived energy.

Ecological hegemony therefore reflects a struggle between various political actors – communities, governments, corporations, NGOs, etc - about what constitutes a healthy relationship between people and nature, and about pathways to ecological sustainability.

Plumwood (2002) argued from an ecological feminist perspective that an "ecological crisis of reason" (2002: 13) has enabled an ecological hegemony that has resulted in dangerous forms of ecological denial and the failure of the dominant value system to situate humanity as ecological beings. She asserts that the hegemony of "rationality" that promotes ecologically destructive practices is dominant and is in conflict with "ecological rationality". She proposed that the hegemonic crisis of reason is not a failure or crisis of nature, but rather reflects the failure of a human culture that is unable to acknowledge its place on earth, and to adapt to the needs of other species and to nature's limits. She noted that the ecological crisis of reasoning manifests as a practical, concrete and material set of linked crises that reflect the disembeddedness of global capitalism from nature, and its mal-adaptation as an economic system to planetary ecological processes.

Cahill (2005) proposes that hegemonic relationships exist as an outcome of social relations of production and reproduction, and are instrumental in identity formation of individuals and communities. He argues that:

> For a set of social relations to be considered hegemonic … the following broad conditions apply: the existence of a class, or an alliance of class forces, which are the prime beneficiaries of, and are committed to maintaining and extending, a particular set of social relations; the absence of significant organised opposition to such social relations; and the development of subjectivities, within the subordinate classes to such social relationships, consistent with the legitimation and naturalisation of such relationships (Cahill, 2005: 1).

Myers (2005) identifies that challenging prevailing ecological hegemony is linked to the capacity of affected communities to imagine "a just and sustainable human habitation of that world" inspired by activists and writers whose work "recognises and respects non-human nature and its constituents as a reality that precedes [our] own world" (Myers, 2005: 18) . This counter-hegemonic imagination "provides an ecological site of resistance to the hegemony of values that privilege white people, oppresses the poor and people of colour, and destroys the natural world (Myers, 2005: 19).

Williams (1977) notes that a particular set of hegemonic relationships may be dominant but they are "never either total or exclusive. At any time forms of alternative or directly oppositional politics and culture exist as significant elements in the society" (1977: 113). Social movements and institutions compete for political, cultural and ecological hegemony, with strategies for establishing or maintaining dominance including critiquing, ridiculing, transforming, suppressing or incorporating the alternative worldviews of their protagonists.

The Australian coal industry, for example, spends millions of dollars on proactive public relations strategies to convince governments, investors, trade unions and communities in which it operates that it is an essential element of the national economy, and has credible solutions to global energy and climate change challenges. According to the industry's peak representative and lobbying organisation, the (ACA), these strategies have been highly successful with state and federal governments: driving the establishment of the Low Emissions Coal Council, the Carbon Storage Taskforce, the Queensland and NSW Clean Coal Councils, and the Global Carbon Capture and Storage Institute (discussed later in this thesis). Strategies include supplying information to opinion makers, including the media; the development of an interactive website to explain coal and climate change and low emissions technologies; meetings with political leaders and key public servants; attending and speaking at conferences on energy issues; making submissions to parliamentary inquiries; writing letters and providing briefings; commissioning and distributing economic modelling on the potential impact of the Australian Government's proposed Carbon Pollution Reduction Strategy (CPRS) on mining jobs and investment (Perl, 2009).

However, hegemonic domination is dynamic and "has continually to be renewed, recreated, defended, and modified. It is also continually resisted, limited, altered, challenged by pressures not all of its own" (Williams, 1977: 112), and thus the political struggle around political, cultural and ecological hegemony is part of a transformative process in the Hunter Valley, and globally. The dominant culture is vulnerable as emerging disturbances in the socio-ecological system make the ecosphere, and ecosystems within it, protagonists in the struggle around hegemony, catalysing the emergence of new social forces, ideas and actions that challenge the hegemonic dominance of ecologically-destructive socio-economic relations, while simultaneously creating the impetus for new socio-ecological values, visions and practices to emerge.

An alternative regional vision

The local residents' group Climate Action Newcastle (CAN) is one of hundreds of locally based climate action groups that have formed around Australia since 2005 that together make up the organised grassroots climate movement (ClimateMovement.org.au, 2008). The CAN vision for the Hunter Valley is a *Future Beyond Coal*, "a clean energy and low-carbon future for the Hunter" (Climate Action Newcastle, 2006). In 2006, hundreds of Hunter Valley residents announced their vision in a human sign depicting the words "Beyond Coal" on Newcastle's Nobbys Beach on International Climate Action Day, November 2006 (Figure 2).

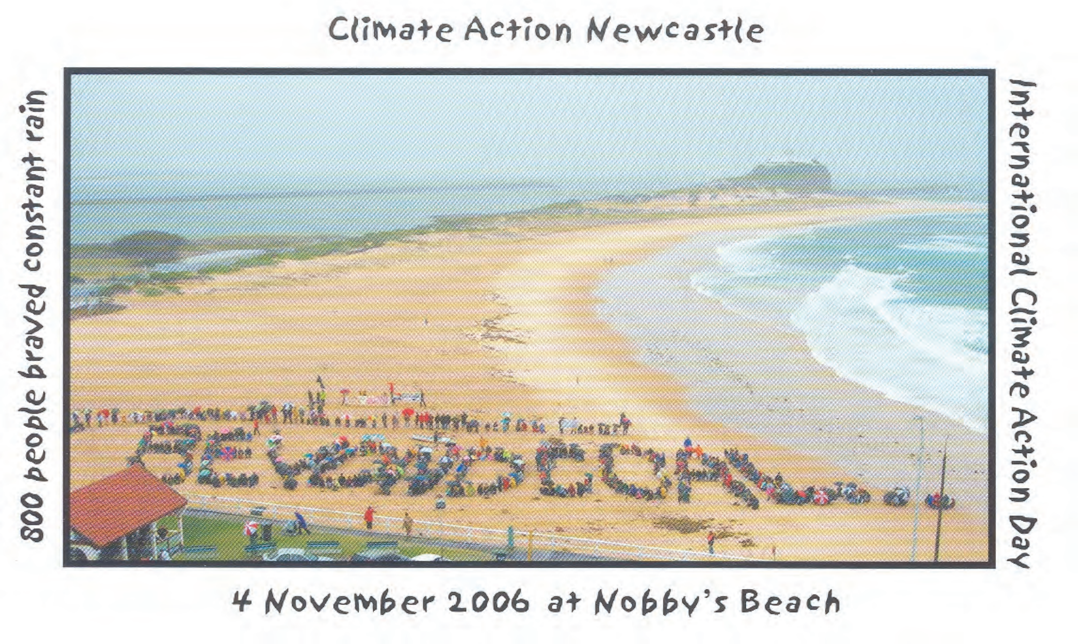


Figure 2: Postcard from Newcastle: International Day of Action on Climate Change

A human sign depicting Hunter community aspirations for a regional economy "Beyond Coal" (Climate Action Newcastle, 2006)

CAN's vision of a *Future Beyond Coal* fits with Heinberg's vision of a global *Post-carbon Society*, which he describes as a society based on renewable energy sources, reduced per capita resource usage in wealthy countries, a refocusing of economies from global back to local production and markets, and dramatically improved environmental conditions and social equity (Heinberg, 2004).

The desirability of the *Future Beyond Coal* scenario is a hotly debated and politically contested issue within the Hunter Valley, across Australia, and globally. While many environmental advocates and local residents have called for the Hunter Valley's coal-fired power stations to be phased out by 2020 (Teske *et al.*, 2008; Pearse, 2009), the national government of Australia, the state government of New South Wales (NSW), industry corporations and some trade unions have challenged the need for and desirability of Hunter Valley's *Future Beyond Coal* scenario (Australian Labor Party, 2007a, 2007b; Rudd, 2008a; NSW Minerals Council, 2007; CFMEU M& E, 2007a; 2007d; Australian Coal Association, 2008a, 2008c). Alliances of the industry, unions and some environmental organisations have been formed calling for massive investment in "clean coal" and carbon capture and storage technologies to "solve" the problem of coal-fired power stations' greenhouse gas emissions, rather than phasing out coal dependency (CFMEU M& E, 2007c; Minerals Council of Australia, 2008b; Australian Coal Association *et al.*, 2008a).

However, Climate Action Newcastle's *Future Beyond Coal* vision is inevitable sooner or later, as coal resources are finite. University of Newcastle researcher Steven Mohr (2009) estimates that the remaining recoverable coal resource in NSW is probably in the region of 16–21 billion tonnes (Gt) and that cumulative production to 2009 has been around 3.7 Gt. Mohr estimates that NSW will reach the point in time when the maximum rate of coal extraction is reached and then enters terminal decline, "Peak Coal", around 2060–70. As most of the NSW coal resource is located in the Hunter Valley and surrounding regions Peak Coal will therefore be a factor in the region after 2060–70.

However, it is most unlikely that business as usual involving ongoing dependence on coal will occur up to and beyond Peak Coal as global energy systems based on coal will become more expensive relative to alternative technologies as carbon prices are internalised. It has been suggested that the cost of Australia's cheap coal-fired electricity would more than double if the toll on human health and the volume of greenhouse gas emissions were taken into account (Biegler, 2009). Furthermore, as climate-change impacts grow, rapid political change at a global level might accelerate, and if technological solutions such as carbon capture and storage fail to materialise, it is likely that coal-based energy systems will lose their social license to operate.

Therefore, it is quite likely that there will be an energy shift from coal to alternatives well before Hunter Valley resources are exhausted, and so the community vision of a *Future Beyond Coal* is a prudent call for adaptive management that anticipates a *Post-carbon Society* within the next 30–50 years and prepares the Hunter Valley for transition into such a future.

1.1 Aims of the study

The aim of this research is to investigate, from a transdisciplinary perspective, the potential of communities confronting a critical sustainability challenge to negotiate a transition to sustainability in which the transition process achieves justice both for humans and the environment. The thesis addresses the question:

> How might it be possible to make a rapid transition to sustainability in the Hunter Valley from its current status as a climate change hot spot to an alternative *Future Beyond Coal*, in such a way that the wellbeing of vulnerable workers, communities, and the ecosystems they live in, are protected during the change process?

Within this over-arching question are subsidiary questions:

- What are some of the shared and contested values about sustainability in the Hunter Valley?
- What threat does the current economic trajectory of the Hunter Valley, and in particular the region's coal dependency, pose to sustainability?
- How do complexity, resilience and panarchy theories help explain current threats to sustainability in the Hunter Valley and the potential for a shift towards sustainability or non-sustainability?
- What principles and practices might guide a Just Transition to sustainability that protect the wellbeing and livelihoods of vulnerable human communities and ecosystems?
- What role might popular education and social learning play in building a social movement for a *Future Beyond Coal* in the Hunter Valley that is sufficiently strong that it might become an attractor powerful enough to create an alternative sustainable and socially equitable basin of attraction for the Hunter Valley?
- To what extent are activities occurring in the Hunter Valley reflecting that a Just Transition from its current *Carbon Valley* status to an alternative *Future Beyond Coal* is actually happening, and what are its prospects?

1.2 A transdisciplinary sustainability science approach

A transdisciplinary approach to research asks that the researcher(s) transcend the boundaries of any single discipline or field of knowledge in order to draw linkages between different ways of thinking and different fields of knowledge, in order "to more fully understand the complexity inherent in human existence in the natural world" (Albrecht *et al*., 2001: 32).

The evolution and transformation of socio-ecological systems are complex processes that cannot be studied from the point of view of any one isolated discipline. This research attempts to consider the subject of social-ecological relationships influencing the potential transition of the Hunter Valley from multiple perspectives informed by the insights of different fields of research and analysis, including ecology, geography, political economy and social change theory.

Complexity and adaptive change theories help explain how social and biophysical systems co-evolve over space and time, and how patterns emerge within complex socio-ecological systems as they respond to disturbances and changes in their internal and external environments.

A transdisciplinary approach to socio-ecological system transformation can provide an holistic picture that appropriately reflects the complexity of the complex processes involved, and avoids simplistic and isolated solutions (Albrecht *et al*., 1998; Kay, 1999, Albrecht and Higginbotham, 2001a, Higginbotham *et al*., 2001, Holling, 2001).

This research is also informed by other transdisciplinary domains, particularly the field of sustainability science (Kates *et al.,* 2001; Clark and Dickson, 2003; Lowe, 2005, 2009; Max-Neef, 2005, Komiyama and Takeuchi, 2006; Rapport, 2007; Perrings, 2007; Kajikawa, 2008); and ecosystem health (Haskell *et al*., 1992, Costanza *et al*., 1992; Rapport *et al*., 1998; Rapport and Whitford, 1999, Horowitz and Rapport, 2000, Rapport *et al*., 2003).

Lowe (2005) describes the role of sustainability science as an essential framework for considering how the challenges of achieving sustainability in a world where both ecological and human societal health are in jeopardy, as having:

> Emerged from attempts to understand the interactions between human activities and natural systems. It spans the full range of scales from the local to the global, recognising that land use is affected by the changing global climate and is also affecting change to the global climate, so interactions in both directions need to be considered (Lowe, 2005: 239)

Specifically, this research looks at the local impacts of coalmining in the Hunter Valley as part of a larger global socio-ecological system, and how local land uses of coalmining and coal-fired power generation are contributing to global climate change, as well as destruction of local ecosystem health. The research investigates how this non-sustainable local and regional situation can be changed and the system realigned with principles and practices that can support ecological and social sustainability, and how change at the regional scale is influenced by change at global scales. The thesis also examines how changes at a regional scale can influence global systems.

Rapport (2007: 77) asserts that sustainability science is:

> Not a "science" by any usual definition – that is, it is not yet a set of principles by which knowledge of sustainability may be systematically built. Rather, it consists of a plethora of ideas and perspectives, sometimes conflicting, by which one might hope to achieve a viable future for humankind. All approaches recognise, in one way or another that "our common future" depends critically upon preserving the life-giving functions of the Earth's ecosystems, landscapes, and biosphere.

Komiyama and Takeuchi (2006) proposed that sustainability science aims to deepen understanding of the linkages between the "global system" (the planetary base for human survival), the “social system” (the political, economic, industrial, and other human-devised structures that provide the societal basis of human existence), and the “human system” (the sum total of all factors impacting the health of humans) (Rapport, 2007, 77, referring to Komiyama and Takeuchi, 2006). A diagrammatic representation of these cross-domain linkages, and relevant issues and sustainability goals linked to them, is shown below (Figure 3).

Figure 3: Sustainability science linking three systems

Sustainability science integrates insights from the study of global ecological, human social and human health systems across multiple scales (From Komiyama and Takeuchi, 2006).

Rapport (2007) identifies the links between sustainability science and ecosystem health which “includes the human dimension of sustainable livelihoods, human and animal health, and sustainable cultural traditions. All of this is the essence of a symbiotic relation of humans within nature” (Rapport, 2007:82).

Rapport suggests therefore that:

> The goal of sustainability, thus, should be that cultural and ecological systems maintain their full functionality – not only for the benefit of present generations, but also for future generations; not only for the benefit of the human component (that is, the maintenance of ecosystem services), but for the benefit of all species. (Rapport, 2007:82).

Ecosystems and human societies are complex and dynamic systems that co-evolve, and are characterised by uncertainty, surprise and non-linearity in their evolution (Holling, 1986; Berkes & Folke, 1998; Gunderson & Holling, 2002; Olsson *et al.,* 2004). Sustainability science, with its transdisciplinary approach, is a useful framework through which to attempt to understand complex adaptive socio-ecological systems that reflect the multiple facets of these types of systems. Sustainability science accommodates the integrative thinking that helps us understand the complex and dynamic interconnectedness between the ecological and human social structures and functions of linked socio-ecological systems.

Gunderson and Holling's (2002) theory of "panarchy" – that describes how complex adaptive systems are influenced by, and in turn influence, other smaller and larger systems they are connected to – is also useful to explain the transformation processes within and between socio-ecological systems investigated in this thesis. Panarchy theory helps explain how ecological and social disturbances from systems at different levels of the panarchy to which the Hunter Valley is connected will drive change towards or away from sustainability across systems at different regional, continental or global scales.

Other aspects of complexity and resilience theory explain how disturbances from one element of the system can cascade across to affect other domains of socio-ecological systems, and can eventually overwhelm the controlling mechanisms of systems and their capacity for maintaining resilience (Walker *et al*, 2004; Kinzig *et al.,* 2006). Thus apparently stable systems, such as the global fossil-fuel economy that the Hunter Valley is nested in, are vulnerable as linked disturbances from climate change, Peak Oil, Peak Coal and global financial crises approach and cross critical thresholds, and change for better, or worse, can occur very rapidly.

The global financial crisis occurring at the time of writing is an example of cascading collapse within a complex socio-economic system that requires a transdisciplinary approach to fully comprehend. The crisis, which includes a crisis in credit markets, debt markets, derivatives markets, property markets and equity markets, began in the USA, attributed by some as due to "the overconfident commodification of uncertainty" (Lohmann, 2009: 3) and the establishment of a "shadow banking system over the past 30 years to circumvent regulation and to offload risk onto others, relying on derivatives and securitisation" (Hildyard, 2009).

A cascading collapse in confidence in the global financial system and a freezing of investment finance led to a collapse in investment and reduced demand for industrial and consumer goods (such as cars and electronic commodities). The crisis was identified by Australia's Prime Minister, Kevin Rudd, as exemplifying the failure of the neo-liberal anti-regulation agenda and, like climate change, the failure of unconstrained free markets (Rudd, 2009a). The impacts of the collapse in investment finance and commodity demand extended beyond the borders of the USA to the global economy, affecting Japan, China and Korea – nations that import large volumes of raw materials from Australia. The Organisation for Economic Cooperation and Development (OECD) noted that

Australia's dependency on external financing of investments and dependency on the global commodity market (particularly iron ore and coking coal) exposed the vulnerability of the Australian economy (Long, 2009).

Lohmann (2009) noted with concern the tendency to commodify financial risk and the "earth's carbon-cycling capacity", and highlights the dangers of "technical-fix proposals" to both crises. He identified the need for "a fair transition away from fossil fuel dependence" (2009: 57).

The global financial crisis is just one example of the speed and scale of cascading potential of anthropogenic disturbances across the planet. Climate change is another. Crises can be opportunities as well as threats, and the global financial and climate change crises may actually be beneficial if these crises catalyse the emergence of creative responses based on new values, learning and social change that promote sustainable levels of consumption and production, social equity and genuine resilience (Folke *et al.*, 2002; Folke *et al.*, 2005; Glasbergen *et al.*, 2007; Walker and Salt, 2006; Waltner-Toews, 2008)

1.3 Perversity and resilience

There has been a great deal of research done on the links between resilience, vulnerability and capacity of complex socio-ecological systems to respond to threats and move towards or away from sustainability. The Resilience Alliance, a transdisciplinary network of scientists and practitioners collaborating to explore the dynamics of social-ecological systems, fosters this research (Resilience Alliance, 2005).

Resilience is a quality of complex adaptive systems that arises from both human and ecological processes. It is an existing or emergent phenomenon which may be genuine or alternatively it may be illusory. Pathological conditions that cause harm to ecosystem and human health, and which threaten sustainability, may be very resilient and can persist over many years. Conditions that may appear resilient may in fact not be resilient if the props that hold these conditions in place are removed or overwhelmed when the steady rise of cumulative impacts of non-sustainable practices that may not have been perceived reach a critical threshold (Walker *et al.* 2004).

The propping up of vulnerable systems by physical engineering such as dams and irrigations systems, or social engineering such as political patronage and financial subsidies, has been described as "perverse resilience" (Gallopín, 2006; Raez-Luna, 2008).

Perversity is defined as "directed away from what is right or good; obstinately persisting in an error or fault; wrongly self-willed or stubborn; marked by a disposition to oppose and contradict" (Free Online Dictionary, 2009), and the concept is apparent in various institutional contexts.

Long (2008), for example, describes the formation of perverse organisations and corporations, and she identifies five indicators of perversity, including: prioritising individual pleasure over the general good; denial of aspects of reality; engagement of others as accomplices in perverse practices; thriving when a blind eye is turned to harmful social practice; and where abusive behaviour breeds further abusive behaviour in an ongoing cycle. According to Long, perverse organisations (and people) often do not recognise the needs or rights of others, and thrive when instrumental social relations blur boundaries about appropriate behaviour.

Long argues that perverse practices, structures and cultures within organisations influence the emergence of perverse features in broader society, in part due to the growing influence of corporations in contemporary capitalist society. Long further argues that corporations, as major centres of social activity, provide a critical source of identity and values for their members, just as families and religions do, and that these values can then permeate from the organisation into the wider community.

Governance regimes influencing the development of the Hunter Valley and its coal industry demonstrate many features of perverse organisations and cultures, as the reality of climate change and the need for urgent action is denied, boundaries about acceptable risk are blurred, and the necessity for precautionary and anticipatory governance is ignored in favour of benefit to a relatively few mining corporations; governments, trade unions and workers are prioritised over the rights to health of local and global human communities and environments (Pearse, 2009).

Perelman (2003), in discussing what he calls “economic perversity”, suggests that conventional economic analysis justifies self-defeating policies that encourage wanton use of the environment and abuse of the least advantaged workers. He asks the questions “Why do those whose work is most essential, such as farm workers, earn the least? Why are natural resources exploited in ways that do not take account of their scarcity?” He concludes that conventional economic theory is perverse as it offers skewed views of scarcity and resource extraction, and thus presents an unrealistic picture of the true value of people and natural resources that jeopardises both human capacities and nature itself.

Riedy (2007) identified that the Australia’s fossil fuel dependency is propped up by what he describes as “perverse subsidies” amounting to over $10 billion annually. He argues that the subsidies are perverse because they increase greenhouse gas emissions while distorting the market, and have an adverse economic impact while reducing social equity (Riedy, 2007: 10). Riedy suggests that if perverse subsidies were removed then the Australian economy would move rapidly towards a low-carbon future with incentives created for investment in public transport, energy efficiency and renewable energy.

This research investigates policies and practices that engineer a perverse resilience of the Hunter Valley’s coal industry, and examines how social learning and pressure from social movements are challenging these practices in order to shift the Hunter Valley’s socio-ecological system from vulnerability and perverse resilience towards genuine resilience and sustainability.

1.4 Scenarios: *Carbon Valley* and a *Future Beyond Coal*

There are many potential trajectories for socio-ecological transition – and sustainability is just one them. Social and ecological system collapse is another potential trajectory of transition for the Hunter Valley.

In his book, *Don't Think of an Elephant*, George Lakoff (2004) identified that the power of language, metaphors and addressing concepts of critical importance to key stakeholders help 'frame' an issue and enable communities to comprehend and discuss the issue from different perspectives. Lakoff identified how shrewd use of frames helps position particular ideas in favourable terms to citizens. Therefore, to win citizens' support for a transition from coal dependency to sustainability, the issue needs to be framed as an opportunity to improve ecological, social and economic well-being rather than as a scary, threatening and unattainable challenge.

The cartoons below by the *Newcastle Herald*'s resident cartoonist Peter Lewis, (Figures 4 and 5) graphically contrast the ecological sustainability threat and ethical challenge posed by the Hunter Valley's prevailing coal-dependent socio-ecological system, *Carbon Valley*, with the opportunity of a transition to a *Future Beyond* Coal, based on clean, renewable energy.

Figure 4: The sustainability threat and ethical challenge posed by the Hunter Valley's *Carbon Valley* economy

(Courtesy: Lewis, *Newcastle Herald*, 25/7/2009.)

Figure 5: The challenge and opportunity of a shift to a *Future Beyond Coal* based on clean energy

(Courtesy: Lewis, *Newcastle Herald*, 20/2/2009.)

Scenarios of a sustainable future

The *Great Transition* essay (Raskin *et al.*, 2002) presents an analysis of historical transitions, with a focus on three key periods of fundamental transformation. The authors show how these transitions demonstrate a pattern of development through sequences of quasi-stability, rapid chaotic change, and re-stabilisation (consistent with Holling's (1986) model of four phases in the adaptive cycle of complex systems). The analysis goes further to describe how various aspects of past socio-economic transitions have evolved through history. Raskin *et al.* (2002) identified three great periods of transition in human history. These were the transition from the *Stone Age* to what they call *Civilisation* (in a rather Eurocentric value-system). They argue that this transition occurred about 10,000 years ago and took about 9,000 years. It was characterised by the emergence of the city-state, settled agriculture and writing. The second great transition identified by Raskin *et al.* was from *Civilisation* to the *Modern Era*, and occurred about 1,000 years ago. It took almost 1,000 years, and was characterised by the emergence of the nation state, industrial economy and printing. Raskin *et al.* propose that human societies are now entering from the *Modern Era* to a *Planetary Era*. They believe this transition will take about 100 years, and will be characterised by global governance, economic globalisation and the Internet as the dominant form of communication.

Raskin *et al.* (2002) used scenarios as a tool for identifying potential endpoints of transition processes, and are just some of many alternative scenarios about potential trajectories for human societies. However, their transition scenarios are helpful insofar as they highlight that alternative scenarios for humanity are driven by a complex mix of environmental, demographic, economic, cultural, social, technological and governance factors, and reflect how dominance of particular values and socio-ecological relationships have radically different implications for sustainability.

Foresight exercises, such as scenario making, are helpful in that they can (Johnston, 2009a: 4):

8 **Inform policy-making** by showing key social actors how longer-term developments interact with current policy decisions, potentially providing alerts on major future risks and opportunities.

9 **Build networks** by bringing together people from different sectors and institutions to work on their visions and to become better able collectively to understand the challenges and opportunities that they may confront, and the strategies and objectives they (or others) might pursue.

10 **Develop capacity** of communities and social institutions to think about the future in a continuing manner.

11 **Build strategic visions** and create a shared sense of commitment to these visions.

Scenarios are often categorised by whether they are possible, probable or desirable (Johnston, 2009a). Two alternative scenarios for the Hunter Valley are investigated in this thesis, namely *Carbon Valley* and *Future Beyond Coal*. The *Carbon Valley* scenario is a projection of the current situation and therefore is both possible and (maybe) probable, though not necessarily desirable, while the *Future Beyond Coal* scenario builds from emergent trends so is therefore possible. Because its realisation is contested by currently dominant political powerholders the scenario is not necessarily inevitable and may, in fact, be less probable than a continuation of the *Carbon Valley* scenario. However, because the *Future Beyond Coal* scenario embodies a low-carbon future and social justice principles it is desirable (at least to this author).

Great Transitions

It is helpful to map the alternative scenarios discussed in this thesis against the scenarios identified by Raskin *et al.* (2002) in the *Great Transition.* Raskin *et al.* (2002) identify six alternative scenarios for potential transition trajectories in the *Planetary Era* that they argue we currently live in, based on current trends and policies and on alternative values. They describe these scenarios using different archetypal worldviews that might inform them, with the scenarios falling into three broad scenario classes called *Conventional World, Barbarisation* and *Great Transitions.* These scenarios are shown in Figure 6 below.

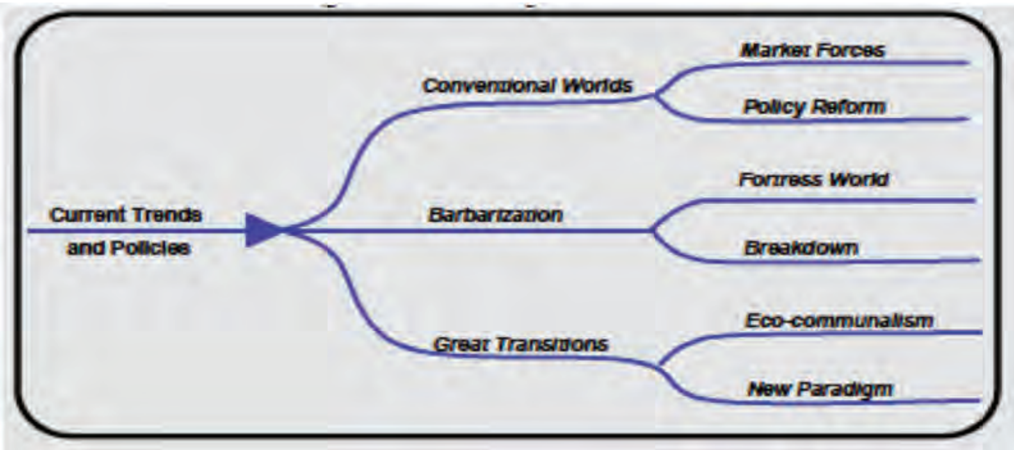


Figure 6: Potential scenarios and streams into the future

(From Raskin, 2006: 3.)

The *Conventional World* scenario assumes that current global socio-ecological systems continue without major surprises or sharp discontinuity, but where one of two alternative policy paradigms prevails, namely *Market Forces* or *Policy Reform*. The second broad scenario, *Barbarisation*, foresees environmental and social catastrophe and embodies two alternative scenarios of *Breakdown,* where conflict and chaos spiral out of control and social institutions (and ecosystems) collapse, or an alternative *Fortress World*, where authoritarian responses lead to a partitioned world in which an elite inhabit more or less healthy environments while the majority are kept out and exist in poverty and socio-economic marginalisation. The third broad scenario, the *Great Transitions*, embodies two different scenarios which have features of sustainability: *Eco-communalism* and an alternative *New Sustainability Paradigm.* In the *Eco-communalism* scenario society is organised primarily at the bioregional scale of social and economic organisation, and commodity production and exchange systems are predominantly localised rather than globalised. The *New Sustainability Paradigm* assumes the ongoing dominance of globalised social and economic networks moderated by a strong institutionalist regime in which global justice and solidarity are entrenched, ensuring "a liberatory, humanistic and ecological transition" (Raskin *et al.*2002: 18).

The defining characteristics of the six scenarios are summarised in Table 2 (below). The table also shows the potential physical and geographical scale of commodity production and exchange that may have a bearing on relationships that the Hunter Valley coal industry might have with the wider world in different scenarios.

The *Future Beyond Coal* scenarios for the Hunter Valley, described earlier, could fit within either the *Eco-communalism* or the *New Sustainability Paradigm* scenarios of the broader *Great Transitions* scenario. Heinberg's *Post-carbon Society* could also fit both, though sits more within the *Eco-communalism* scenario as Peak Oil is likely to constrain global trade and travel and become a powerful driver for a relocalisation of global societies. Gallopín (2002), one of the authors of the *Great Transition*, argues that the *Eco-communalism* scenario might emerge only as a recovery pathway from the *Breakdown* scenario, and though possible, is a less likely societal choice for transformation than the *New Sustainability Paradigm*.

Table 2: Archetypal worldviews and alternative scenarios
(From Raskin *et al.*, 2002: 17.)

Worldview	Advocates	Philosophy and values	Motto	Potential impacts on energy markets, commodity production and exchange
Conventional Worlds				
- Market Rules	Smith	Markets provide a hidden and enlightened hand	Don't worry, be happy	Energy and commodity markets grow according to business-as-usual predictions, with market forces determining supply and demand
- Policy Reform	Keynes, Brundtland	Policy stewardship and institutionalism	Growth and environment protection through technology and management	Energy and commodity markets may grow or shrink (at least for some commodities such as fossil fuels), as regulation and 'environmental market' creation imposes full cost accounting and internalisation of environmental and social costs. Interventionist policies (such as protectionism) may drive a shift from global to local scale
Barbarisation				
- Breakdown	Malthus	Population/resource catastrophe	The end is coming, 'dog eat dog'	Trade in energy and commodities breaks down, with local and global markets collapsing in chaos
- Fortress World	Hobbes	Social chaos; nasty nature of man	Order through strong leaders, border protection	Production and exchange systems break down as capacity to produce and trade decline in a permanent siege and war environment reduces reliable access to resources
Great Transitions				
- Eco-communalism	Bookchin, Schumacher, Sales, Gandhi	Human goodness prevails, relocalisation, bioregionalism	Small is beautiful, Keep it local	Energy and commodity production reduces as scale of production is geared to local rather than global demand, and global markets give way to multiple local markets, with shift towards low-tech/ appropriate technology
-New Sustainability Paradigm	Mill, Biermann, Monbiot	Sustainability as a progressive global social evolution	Human solidarity, new values, the art of living in a global village	Energy and commodity production and resource consumption reduces to fit local and global bio-capacity (guided by adoption of sustainability principles and shift to an industrial ecology). Markets find a balance between local and global scale based on clean energy technology availability and costs

The Hunter Valley scenarios

The *Carbon Valley* and *Future Beyond Coal* scenarios for the Hunter Valley can each be further broken down into two sub-scenarios: *Carbon Valley* into *Dirty Coal*, in which business continues as usual with growth of coalmining and export and ongoing reliance on coal-fired power generation without any constraints on carbon dioxide emissions; and a *Techno-fix Saves the Industry* scenario, in which coalmining and coal-fired power generation continue but emissions are curbed by the introduction of carbon capture and storage (CCS) technologies. The *Future Beyond Coal* scenario could be divided into a *Clean Energy Hub* scenario in which the Hunter Valley continues its historic role as a major energy exporter to Australia's economy but does so by relying on clean renewable energy technologies such as solar thermal, geothermal and wind, or an *Energy Self-sufficiency* scenario in which the Hunter Valley is no longer an energy-exporting region but local energy needs (including for locally-based manufacturing) are generated from renewable energy sources.

Table 3 (below) describe some features of these alternative scenarios, and compares their impacts against various ecological and social criteria.

Table 3: Potential energy scenarios for the Hunter Valley

	Carbon Valley		*Future Beyond Coal*	
	Dirty Coal	*Techno-fix Saves the Industry*	*Clean Energy Hub*	*Energy Self-sufficiency*
Landscape impacts	High	High		Low
Greenhouse gas impacts			Low	Low
Energy exports	High	High	High	Low
Social licence to operate risks	High	High	Low	Low
Health impacts	High	High	Low	Low
Water demand	High	High		Low
Green jobs potential	Low	Low	High	High

The political risks of the *Carbon Valley* scenarios are high because global climate change and mining impacts threaten linked local and global ecosystem and human health, and thus jeopardise the social licence to operate. Water use for coalmining and coal-fired power generation is high, but much less if there was no mining and if renewable energy technologies were used for power generation. Even though the *Techno-fix Saves the Industry* scenario has lower social licence to operate risk than *Dirty Coal* because CCS technology reduces climate-change impacts, the likelihood of CCS technology being commercialised is doubtful and, in any case, the impacts of local mining are still jeopardising regional/local ecosystems and human health. The renewable energy-based economy of the *Clean Energy Hub* and the *Energy Self-sufficiency* scenarios would stimulate

Green jobs while *Dirty Coal* will not do so, and the *Techno-fix Saves the Industry* scenario would produce few, if any jobs. The Green job potential of the two *Future Beyond Coal* scenarios is discussed in more detail in Chapter 8.

The following section compares these scenarios with two other scenarios, the CSIRO's *The Heat is On* energy study and the Giurco *et al.* (2007) study of Victoria's Latrobe Valley.

The Heat is On

Between 2004 and 2006, the Australian Government's Commonwealth Scientific and Industrial Research Organisation (CSIRO), coordinated an *Energy Futures Forum* involving government, industry and community stakeholders to develop energy scenarios for Australia in 2050 to guide decision-making about future energy technology paths and investment in different options. Nine qualitatively different scenarios were developed:

1. *Power to the People*: businesses and households generate their own energy through a distributed renewable energy generation network in a more decentralised community and greenhouse gas emissions (GHG) are reduced to 50% of 1990 levels by 2050.
2. *Centralised Failure*: failure of the international community to arrive at an enforceable and inclusive climate-change mitigation strategy delays strong action by privatised energy markets, with late investment in new technology achieving minimal GHG cuts so priority shifts from mitigation to adaptation.
3. *Technology to the Rescue:* a global free market "rescues" capitalism (but causes social conflict) and drives a boom in alternative technologies while achieving 50% cuts on 1990 GHG emissions by 2050.
4. *The Day After Tomorrow*: belated action sees moderate take-up of GHG-mitigation technologies but primary focus on adaptation as only 10% of 1990 GHG emissions are achieved by 2050.
5. *Atomic Odyssey*: global GHG agreement for 50% cuts on 1990 emissions by 2050; CCS fails and a switch from coal to nuclear to provide baseload power.
6. *Cultural Revolution*: alliance between US and China to establish a global GHG emissions reduction target of 50% cuts on 1990 emissions by 2050, with an Australian emissions trading scheme driving alternative technologies and energy end-use efficiency improvements.
7. *Clean Green Down Under*: climate crises (e.g. loss of iconic sites) drive strong GHG emission-reduction targets of 80% of 1990 levels by 2050, low-emission electricity generation technologies are now *de rigueur*, as is consumer preference for energy end-use efficiency.
8. *Rough Ride*: no global agreement toward addressing the world's energy challenge sees global conflict and each bloc focusing on their own energy

security, some investment in new technologies (mostly by military) but minimal GHG-emission reduction.

9. *Blissful Indifference*: pressure to introduce measures to address climate change never reaches above other political dialogue – business-as-usual. (CSIRO, 2006).

The CSIRO scenarios are shown below (Table 4), with additional rows showing potential implications for the Hunter Valley. The authors suggest that six of the nine scenarios are likely to deliver sustainability, including the questionable assertion that a shift to nuclear would improve sustainability (perhaps reflecting the influence of uranium mining companies, such as BHP Billiton, in the process).

The CSIRO scenarios – *Clean Green Down Under* (based on strong targets and consumer demand for zero emission technologies) and the *Power to the People* scenario (based on a more decentralised society and distributed energy system with a higher GHG-reduction target) – might also be compatible with the Hunter Valley *Future Beyond Coal* scenarios. The *Cultural Revolution* scenario, based on global agreements for rapid take-up of energy efficiency and renewable energy technologies, and the *Technology to the Rescue* scenario, which is based on free markets and alternative technologies, would also be compatible with both the *Future Beyond Coal* scenarios, but only if greenhouse gas (GHG) targets were raised, clean-energy technologies were adopted, and if general levels of consumption fell.

The CSIRO scenarios reflect the prevailing neo-liberal and climate sceptic ideology of the Australian Government at the time (and its influence on the CSIRO). The scenarios lack strong global and national agreements for high GHG reduction targets (perhaps 80% on 1990 by 2050).

Table 4: Australia's energy futures scenarios

(From CSIRO, 2006.)

System Drivers	Power to the People	Centralised Failure	Technology to the Rescue
Climate Change	Global management regime effective	Global management regime ineffective	Global management regime effective
Geopolitical Stability	Stable	Stable	Stable
Sustainability	Improved sustainability	Sustainability declines	Improved sustainability
Innovation	Significant technological innovations	Late introduction of technological innovation	Significant technological innovations
Energy Technologies	Government and society reorganised with more people living in mid-sized cities, with a subsequent demand for more decentralised government decision-making. Distributed generation is dominant with residential and commercial customers use solar photovoltaic (PV) and fuel-cell systems for power. Carbon capture and storage (CCS) and geothermal electricity technologies play a role.	Late rollout of large-scale roll out of GHG-mitigation technologies sees focus on climate change adaptation rather than mitigation. Failure of the international community to arrive at an enforceable and fully inclusive climate change mitigation agreement and a consequent lack of policy certainty and price signals needed for privatised electricity markets to bankroll new technology deployment.	A technology investment boom, later followed by “alternative” energy technology companies being adopted as part of the mainstream energy landscape with the free market determining the least cost way for Australia to meet its emission reduction target. A suite of alternative energy technologies has been introduced.
	The Day After Tomorrow	**Atomic Odyssey**	**Cultural Revolution**
Climate Change	Global management regime ineffective	Global management regime effective	Global management regime effective
Geopolitical Stability	Stable	Stable	Stable
Sustainability	Improved sustainability	Improved sustainability	Improved sustainability
Innovation	Moderate technological innovations	Significant technological innovations	Significant technological innovations
2050 scenario	Only a moderate number of GHG-mitigation technologies have been implemented. The low technology take-up has Australia questioning whether it would be more cost-effective to focus on adaptation rather than mitigation. Low mitigation technology take-up.	After it became clear in the mid-2010s that CCS was not going to be successful and the continued use of fossil fuels would not allow longer-term CO_2 targets to be met, base-load power production is now largely provided by nuclear facilities, and supplemented by gas-fired and renewables.	An emission-trading scheme has sent the necessary price signals to bring about investment in low-emission infrastructure. As a result, energy end-use efficiency improvements have accelerated well above predicted levels. A suite of alternative energy technologies has been introduced.

	Clean Green Down Under	**Rough Ride**	**Blissful Indifference**
Climate Change	Global management regime effective	Global management regime ineffective	Global management regime ineffective
Geopolitical Stability	Stable	Instability	Stable
Sustainability	Improved sustainability	Sustainability declines	Sustainability declines
Innovation	Significant technological innovations	Few technological innovations	Few technological innovations
2050 scenario	Low-emission electricity generation technologies are now *de rigueur*, as is consumer preference for energy end-use efficiency throughout the economy. There is a significant improvement in solar and hydrogen technologies leading to a high adoption rate of zero-emission technologies in electricity generation.	No global agreement toward addressing the world's energy challenge, except with respect to each bloc's own energy security. Increase in the rate of improvement in energy end-use efficiency driven by government legislation. Conventional technologies remain dominant and the international rate of technology transfer is low.	Public attitudes to climate change have hardly shifted to those held at the start of the century. Pressure to introduce measures to address climate change never seemed to reach above other political dialogue around economic reform, health, aged care and education. Conventional technologies remain dominant.

Latrobe Valley scenarios

The Latrobe Valley is Australia's major coal-fired power generation region using brown coal, but unlike the Hunter Valley, is not a coal-exporting region. Giurco *et al.* (2007: 59) identified three scenarios for the Latrobe Valley, namely:

- ***Scenario A: Bio-industry & renewables focus***: Rapid behaviour change, swift action to avert climate change, backlash against coal/CCS, alternate energy cost-competitive, lack of water, communities seek local self-sufficiency in energy.
- ***Scenario B: Electricity from coal focus***: Business-as-usual with technology – in particular CCS – solving the greenhouse impact problems associated with the utilisation of coal for power generation.
- ***Scenario C: Products from coal focus***: Resource constraints (in oil / water) lead to upheaval and innovation in new areas with a focus on uses for coal beyond electricity generation.

These scenarios have similarities to both the Hunter Valley's *Carbon Valley* and *Future Beyond Coal* scenarios, provide some useful insights into possible transitions for a coal-dependent region, and suggest some potential pathways. The *Products from coal focus* scenario offers some interesting ways that coal can be used as a resource beyond being burnt; for example, as feedstock for producing hydrogen, ammonia, diesel, methanol, plastics and char briquettes (Giurco *et al.* 2007).

A Just Transition to sustainability

The multiplicity of threats to the Earth's biosphere and human societies are so pressing that the US National Research Academy declared in 1999 that there must be a transition to sustainability achieved within two generations. The Academy proposed that such a transition requires: establishing a credible shared vision of a sustainable socio-ecological system; setting goals; establishing mechanisms for stimulating social action to achieve those goals: and establishing effective social institutions that promote these goals (US National Research Council, 1999). A transition in the Hunter Valley from *Carbon Valley* to a *Future Beyond Coal* would be part of such a global transition.

Sadly, 10 years on – if the Worldwatch Institute's 2007–08 *Vital Signs Report* is taken as an indicator of progress – the global transition has yet to begin in any meaningful manner. The *Vital Signs Report* notes that global human population continues to rise, albeit at a somewhat slower rate; the number of violent conflicts around the world remains steady; fossil fuel use is rising while carbon emissions continue an unrelenting rise; climate change is reducing terrestrial biodiversity; global grain production is falling while prices surge; the number of people infected with HIV/AIDS continues its worldwide climb; and progress toward the United Nation's *Millennium Development Goals* to eradicate global poverty has been mixed (Worldwatch, 2007).

The International Union for the Conservation of Nature (IUCN), the world's oldest and largest global environmental network with more than 1,000 government and NGO member organisations, also noted the urgent imperative for a global transition to sustainability in which the needs of people are balanced with the needs of the planet that supports us (IUCN, 2008), but recognised that transitions are fraught with challenges:

> Transition to sustainability is vitally important [but it is also] very scary. We need to calm our fears and build our capacity to hope (Adams and Jeanrenaud, 2008: 4).

The strategy of a *Just Transition to Sustainability* has been proposed by Hunter Valley residents as the preferred pathway to a *Future Beyond Coal*. A Just Transition[7] is a process of social transformation from unsustainable economies towards ecological and social sustainability that aims to create the new, safe, secure, career-building, satisfying and environmentally friendly jobs that are often referred to as "Green-collar jobs" (Gordon and Hays, 2008; Apollo Alliance, 2008; ACF and ACTU, 2008; Mattera, 2009). Particular attention is paid by those advocating Green-collar jobs to supporting workers and communities who are impoverished and already disadvantaged in the labour market, and those who are vulnerable during the change process (PinderHughes, 2007; Gordon *et al*, 2007; Green For All, 2009).

A Just Transition process recognises the needs of both current and future generations for safe, secure and satisfying jobs. Thus, the Just Transition concept links ecological sustainability with issues of class, work and social justice over multiple generations.

A commitment by governments, industry and communities to a Just Transition process has been advocated by labour movement organisations, including the Australian Council of Trade Unions (ACTU, 2008a), the British Trade Union Council (2008), the Canadian Labour Congress (CLC, 2000), environmental organisations such as International Union for the Conservation of Nature (IUCN, 2008), Greenpeace (Greenpeace, 2007, 2008; Bjureby, 2008) and Friends of the Earth (FoEI, 2009; FoEA, 2004). The concept and process has been advocated by United Nations agencies, including the World Health Organization, United Nations Environment Program, International Labour Organisation and the International Trade Union Confederation (UNEP, 2007).

In May 2009, the International Trade Union Confederation (ITUC) ensured that language calling for a "just transition" to a global green economy was included in the negotiating text of a new climate agreement to be discussed at the UN climate change conference in Copenhagen, Denmark in December 2009 (ITUC, 2009). The ITUC called for commitments to a "just transition" for "sustainable, low-carbon economies as the key to guarantee a socially sustainable outcome" and that these goals could be achieved through:

---

[7] In this thesis 'Just Transition' (with capital letters) is used to describe both a formal public policy process and a general concept that links 'justice' with economic and social 'transition' towards sustainability but not necessarily a policy being implemented by a formal governance institution.

> The promotion of the opportunities offered by the 'Green Economy' (the promotion of green & decent jobs and the greening of workplaces, based on sustainable industrial development and an equitable share of the burden of responsibilities and gains) and on the design and implementation of accompanying measures for all the other productive sectors that will have to adapt to the constraints arising from a low carbon economy. The "Green Economy" must have a socially-fair base: democracy, social partner participation in decision making processes and respect of human and labour rights form the baseline conditions in order to ensure a smooth and effective transition towards a sustainable society (ITUC, 2008: 4).

A Just Transition process ensures that no-one's wellbeing is sacrificed in the transition and the concept of a Just Transition, and the process by which it might be achieved, are major themes of this thesis.

1.5 The structure of the thesis

The early chapters of the thesis discuss different approaches to sustainability, including principles and indicators of ecological and social sustainability. The role of resilience as a factor in the sustainability of socio-ecological systems is also discussed.

The characteristics of the Hunter Valley region as a complex adaptive socio-ecological system are examined in Chapters 6 and 7, particularly the role of coal as a powerful attractor in the Hunter Valley socio-ecological system and the growing global influences on regulation, markets and social and ecological disturbance, particularly climate change.

A potential pathway from possible collapse of the Hunter Valley's socio-ecological systems in the *Carbon Valley* scenario towards an alternative trajectory towards ecological and social sustainability in *Future Beyond Coal* scenario is discussed from Chapter 6 and in all subsequent chapters.

In this light, Chapter 6 describes how the Hunter Valley's potential evolution is informed by the panarchic linkages of the region to other socio-ecological systems at different scales around the world (Gunderson & Holling, 2002), and how disturbances from these systems might influence the trajectory of the Hunter Valley towards or way from sustainability. In a similar way, the Hunter Valley's people and economy have an influence in maintaining or undermining the integrity and sustainability of other socio-ecological systems.

The process of system transformation across scales is discussed further in Chapters 6 through to Chapter 10 with respect to some particularly powerful influencing factors (attractors), including principles of a Just Transition, social learning and social movements.

Chapter 2
Methodology

This thesis is primarily based on qualitative research, but does refer to transdisciplinary quantitative research such as the research report, *A Just Transition to Clean Energy in the Hunter Valley (*Bill *et al.*, 2008), which was co-authored by the author of this thesis. Key features of transdisciplinary research are discussed in the following section.

2.1 Transdisciplinary methods

Transdisciplinary thinking is thinking that transcends the disciplinary silos of much academic study. It is thinking that seeks an overarching insight that is informed by, and connects insights gained from, more than one (and often several) fields of knowledge. Thus, transdisciplinary thinking is holistic thinking rather than reductionist thinking.

Transdisciplinary thinking encourages a systemic, multi-dimensional perspective, and is ideally suited to this thesis, which attempts to understand how multiple linked factors operating in and between complex adaptive ecological and social systems influence the evolution of the Hunter Valley.

Rigid, single-disciplinary thinking separates ways of seeing and interpreting the world into non-interacting disciplines. Transdisciplinarity, in contrast, challenges rigidity and lack of holism of specialist knowledge silos, and requires flexibility and fluidity in seeing phenomena as multifaceted, linked entities and events, that can be interpreted from multiple social sciences, ecological sciences, biomedical sciences, arts, and other disciplinary perspectives (Russell *et al.*, 2007: 7).

McMichael (1993) identified that the challenges posed by really complex and multifaceted issues and entities, such as ecosystems, climate, human brains, urban centres, economies that are non-linear, dynamic, self-organising systems, ushered in a new era of science that "accommodates complexity, multiple layers of system-based uncertainties, a high level of decision stakes, and a diversity of interested party perspectives" (McMichael, 1992: 332) and require a transdisciplinary approach to understanding and managing these phenomena.

Albrecht, Higginbotham *et al*. (2001b) defined transdisciplinary thinking as:

> Thinking that goes beyond (transcends) the boundaries of existing disciplines or fields of knowledge in order to more fully understand the complexity inherent in human existence in the natural world (Albrecht, Higginbotham *et al.*, 2001b: 32).

Albrecht emphasises the need for a transdisciplinary approach to environmental and health science studies which recognises that humans are part of complex natural systems with which we interact, arguing:

> We can no longer be content with disciplines and fields of knowledge that only attempt to dissect complex, adaptive systems into discrete and manageable parts.

> Post-mechanistic thinking is creative and process-oriented, and searches for new, more integrative ways of knowing the world (Albrecht, Higginbotham *et al.*, 2001b: 32).

Similarly, Vinetz *et al.* (2005) proposed that transdisciplinary approaches are needed to deal with complex environmental management and social-change issues, such as those investigated in this thesis, arguing that transdisciplinary approaches "will only become more important with increased globalisation, urbanisation, and anthropogenically-driven environmental stress" (Vinetz *et al.*, 2005: 303).

In 2003, along with others, McMichael argued that:

> … attaining sustainability will require concerted interactive efforts among disciplines, many of which have not yet recognised and internalised, the relevance of environmental issues to their main intellectual discourse [and that] the inability of key scientific disciplines to engage interactively is an obstacle to the actual attainment of sustainability (McMichael *et al.*, 2003: 1919).

The authors proposed that the disciplines of demography, economics, ecology and epidemiology are central to developing an understanding of sustainability.

The transdisciplinary character inherent in sustainability research and sustainability science has been emphasised by many practitioners of the field (Kates *et al.*, 2001; Clark and Dickson, 2003; Lowe, 2005; Max-Neef, 2005, Komiyama and Takeuchi, 2006; Rapport, 2007; Perrings, 2007; Kajikawa, 2008).

The following section describes some of features of transdisciplinarity.

Transdisciplinarity

Transdisciplinarity is different from single-disciplinary studies, but it is also different from multidisciplinary and interdisciplinary research. In multidisciplinary research experts from different disciplines work together but from their own disciplinary perspective. In interdisciplinary research, areas of overlap between disciplines are investigated and analysis that synthesises insights from the disciplines is gained, but in both multidisciplinarity and interdisciplinarity the problem definition, research design and analysis is not necessarily informed by the insights of other disciplines. A transdisciplinary approach, in contrast, seeks to develop an understanding of phenomena that transcends individual disciplines in its problem focus, collaborations and consequent research design (Albrecht, 1998; Somerville and Rapport, 2000; Higginbotham *et al.*, 2007; Russell *et al.*, 2007)

Max-Neef reflects the holistic and transcendent thinking of transdisciplinarity by comparing it with a multidisciplinary approach, which he describes as integrating the insights of separate brains while transdisciplinary thinking requires a synthesis that "must occur inside each of the brains" (Max-Neef, 2005: 15).

Choi and Pak (2006), noting that the terms multidisciplinary, interdisciplinary and transdisciplinary are often poorly differentiated, confused and used interchangeably, used a helpful food metaphor to describe the differences between the three approaches and the difference between interaction, synthesis and transcendence. In Choi and Pak's demarcation, multidisciplinarity is an additive process like a salad, in which the ingredients remain intact and clearly distinguishable, while interdisciplinarity is an interactive process like a stew in which the ingredients are only partially distinguishable. Choi and Pak described transdisciplinarity as an holistic process in which the whole is bigger than the parts, and described the approach as like making a cake in which the ingredients are no longer distinguishable and the final product is of a different kind from the initial ingredients (2006: 359).

As mentioned earlier, while participants in transdisciplinary studies apply an integrative and transcendent approach to their research and thinking, they are not required to forget or relinquish their particular disciplinary knowledge and expertise. Instead, the expectation is that they apply their particular knowledge and expertise to real-world problems and inform and enrich other disciplinary insights, and through the combination potentially gain new insights that transcend the limits of single or merged disciplines. These transcendent insights thus inform perceptions of problems to be investigated, research questions, analysis and conclusions (Pohl & Hirsch Hadorn, 2007; Russell *et al.*, 2007; Wilcox and Kueffer, 2008).

However, transdisciplinarity, while gaining insights from various disciplines and seeking to transcend the limits of any one of them, does not necessarily have to be undertaken by teams. Individual researchers can attempt a transdisciplinary approach by applying insights of particular disciplinary insights to inform perceptions of problems to be investigated, research questions, analysis and conclusions (Albrecht *et al.*, 2001). The following section describes how the transdisciplinary approach has informed this thesis.

Transdisciplinary framing of questions

In this thesis, knowledge from various disciplines has been assembled to frame a set of questions (identified previously in the Introduction) to gain a coherent picture of the Hunter Valley region being investigated. Insights from different individual disciplines informed potential questions, but a transdisciplinary approach elicits a question that transcends the limitations of questions informed by individual disciplines through a reflective and expansive process.

Questions informed by individual disciplines, including history, ecology and economics, were considered important in refining the research question. For example a useful question to investigate a changing region might be:

> How is the ecology, society or economy of the Hunter Valley changing?'

Insights gained from these individual disciplines combine to describe the current ecological and social status of the Hunter Valley. Historical perspectives are used to describe changing ecological and human social processes and events. Ecological knowledge is employed to describe the growing impacts of mining on landscapes, biodiversity and the quality of ecological services. Economic knowledge helps describe the contribution of the Hunter Valley coal industry to local industry structure, employment, and to incomes of individuals, corporations and governments.

Multidisciplinary insights drawing from history, ecology, economics and other disciplines, such as health science, then inform deeper and broader-ranging questions, for example:

> What has been the impact of the coal industry on the economic, social and ecological health of the Hunter Valley?

The insights of different disciplines provide a more comprehensive picture of the Hunter Valley than that which is possible from individual disciplines. For example, the multidisciplinary study that combines health and ecology can provide insights into the health impacts of pollution.

An interdisciplinary approach enables a question to be framed that reflects an integration of insights from various disciplines that, in turn, reflects the complexity of the socio-ecological system being studied. A richer question emerges from integration of various disciplines, for example:

> How are coalmining and climate change linked to changing patterns of ecological / social health in the Hunter Valley?

Interdisciplinary thinking encourages investigation of linked entities, such as ecosystems and human communities, to be investigated in a systemic and holistic way. Complexity, resilience and panarchy meta-theories assist in this holistic, systemic analysis. A political economy approach is a multidisciplinary investigation that integrates insights from both politics and economics to expose systemic linkages between (for example) resource ownership, political and economic power, ecological impacts and decision-making.

Finally, the insights from individual, multidisciplinary and interdisciplinary approaches can inform an overarching question that transcends all others and is informed by many disciplines:

> How might it be possible to make a rapid transition to sustainability in the Hunter Valley from its current status as a fossil fuel and climate change hot spot to an alternative *Future Beyond Coal*, in such a way that the wellbeing of vulnerable workers, communities, and the ecosystems they live in, are protected during the change process?

The disciplinary transcendence emerges from a synthesis of insights from each contributing discipline creating an overarching conceptual framework around socio-ecological system transformation, a framework that links natural and human sciences and recognises the complexity of the system being studied across multiple spatial and temporal scales.

The development of the question for this research, from those informed by individual disciplines to the final question informed by a transdisciplinary approach, is shown in the diagram (Figure 7) below.

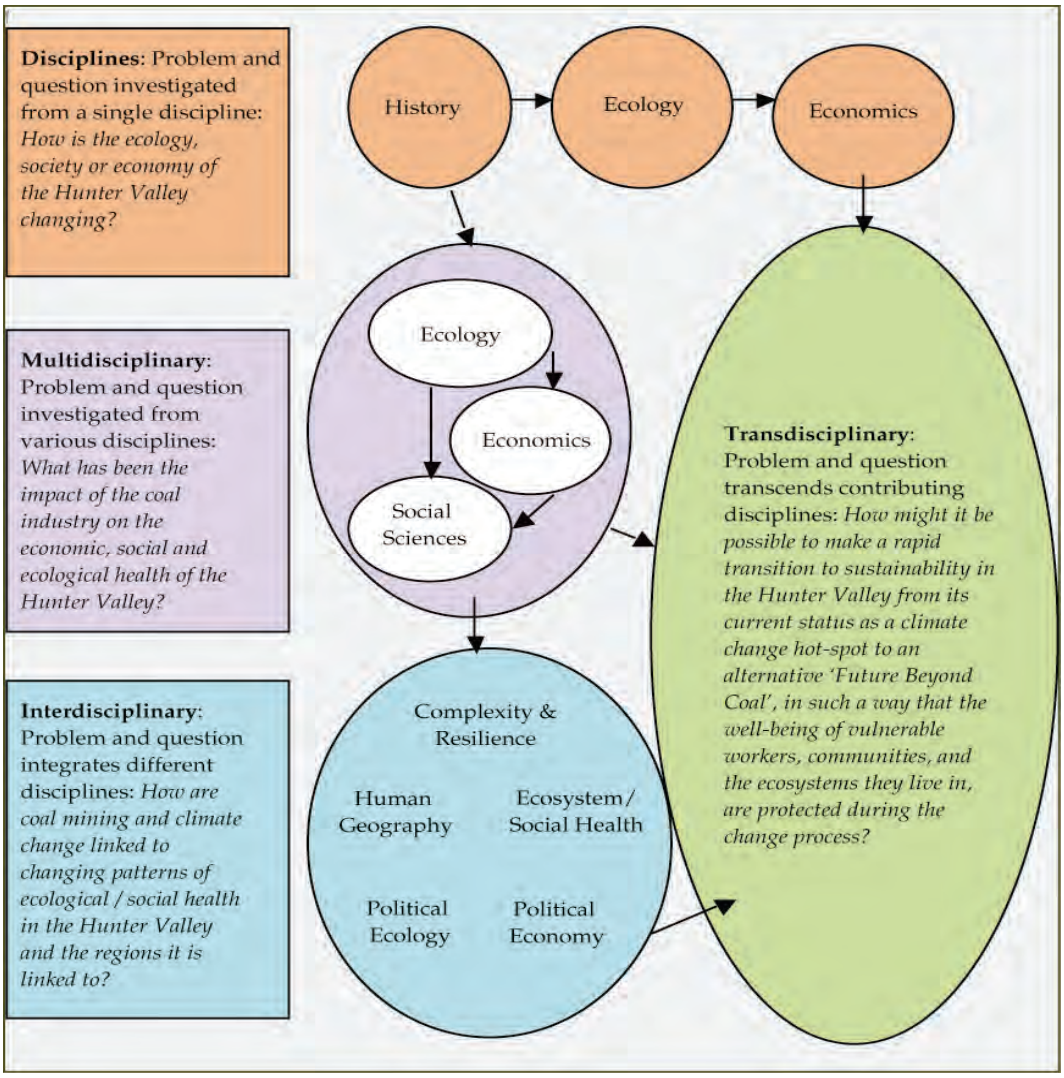


Figure 7: Transdisciplinary analysis of a potential Just Transition to sustainability

(Adapted from Albrecht *et al.*, 2001)

2.2 The case study approach

Mitchell (1983) described a case study as:

> A detailed examination of an event (or series of related events) which the analyst believes exhibits the operation of some identified general theoretical principle (Mitchell, 1983: 192).

The case study methodology is one of five qualitative inquiry traditions identified by Creswell (1998), the others being biography, phenomenology, grounded theory and ethnography.

The use of case studies in social research has evolved over the last century, and was particularly popularised by researchers at the University of Chicago's Department of Sociology who were prolific users of the approach for studies of poverty, unemployment and immigration in the first half of the 20th century. The case study approach was used in various human science disciplines including psychology, anthropology, sociology and medicine, but was criticised as a research tradition by proponents of scientific procedures or experimentation in debates between academics from Columbia University and the Chicago School during the late 1930s, and its popularity subsequently declined (Tellis, 1997). However, the method was popularised again by the pioneers of "grounded theory", Glaser and Strauss, as a useful way of generating new theoretical insights from data collection, observations and analysis (Glaser & Strauss, 1967).

Stake (2003) proposes that there are three types of study:

1. The **intrinsic** case study, in which the researcher is interested in the case as interesting phenomenon in its own right, and the purpose is not to understand an abstract construct or generic phenomenon.

2. The **instrumental** case study, where the case is studied because it reveals something about a generalisable theory or generic issue. The case is used to advance an understanding of the wider issue of interest, being a means to an end rather than the focus of interest because of its own unique qualities.

3. The **collective** case study bundles together a number of particular cases in order to understand a general phenomenon, and help facilitate theorising about a still larger collection of cases (Stake, 2003: 138).

Stake also notes that the boundaries between different types of case study are not impenetrable, and some case studies have elements of more than one type, with a variety of issues of theoretical interest and or generalisability.

The case study examined in this research – the Hunter Valley of New South Wales, Australia – is primarily an *intrinsic* study, but also has potential as an *instrumental* study. The study has intrinsic value as a study of a region, the Hunter Valley, as a complex adaptive socio-ecological system potentially transitioning towards sustainability. However, the case study findings are potentially transferable to other regions.

Yet the study also has potential instrumental value as the Hunter Valley shares common features with issues and struggles in other localities that are engaged in non-sustainable economic activities, a situation that arguably exists throughout much of the world.

The Hunter Valley has many desirable attributes as the subject of a case study. The region exemplifies how human societies can deal with issues of resilience and adaptive capacity to mitigate the impacts of climate change and non-sustainable industries. The potential transformation of a non-sustainable socio-ecological system to a sustainable alternative future is a public policy dilemma being faced by many communities, and by decision-makers in government, industry and civil society.

The Hunter Valley is a socio-ecological system with definable boundaries and a distinctive ecological and cultural identity, and therefore can be easily studied and understood as a distinct ecological and cultural entity.

The Hunter Valley is regarded under the NSW Department of Environment and Climate Change framework as a sub-region of the Sydney Basin bioregion. The NSW Department of Environment and Climate Change (DECC) describes bioregions as:

> Relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems (NSW DECC, 2008)

From a more cultural than an ecological perspective, Sale notes that a bioregion is:

> At the right scale [where] human potential is unleashed, human comprehension magnified, human accomplishment multiplied … not so small as to be powerless and impoverished, not so large as to be ponderous and impervious, a scale at which at least human potential can match ecological reality (Sale 1991: 55).

For the purpose of this thesis, the Hunter Valley is of a geographical scale and has a population and economy that makes it large enough to be possible to draw useful conclusions, but small enough for the research task to be manageable as a postgraduate research project.

Framing questions

How research questions are framed determines whether the issue being investigated is an immediate *topical issue* pertaining to a particular location or place, a *foreshadowed problem*, or an *issue under development* that potentially has wider relevance and gives a case study more instrumental value (Stake, 2003: 143). This case study has been framed to provide insights on a particular issue, *potential transition to sustainability in the Hunter Valley,* but also foreshadows problems and issues under development that are relevant to many places and communities around the world.

The framing of the topic to give it relevance across various places and communities is part of the potential power of the case study as a useful tool for transferring knowledge from one set of circumstances to the wider world. Table 5 (below) shows a potential progression of this Hunter Valley case study from specific topic issue to a more generic set of problems and issues relevant to other places that might be informed by the specific case study.

Table 5: Progression of the Hunter Valley case study

(Following Stake, 2003)

Topic issue: Coalmining and coal-fired power generation in the Hunter Valley region threatens local and global sustainability.
Foreshadowed problem: Coalmining and coal-fired power generation is a threat to sustainability in many regions around the world, and is a major contributor to climate change, and so transition strategies and processes in one region are relevant to other regions.
Issues under development: Transitions from unsustainable to more sustainable economic activity is urgently needed as climate change and ecological and social threats grow around the world. There are many different non-sustainable economies in many regions (e.g. from non-sustainable fishing, forestry, polluting industry, agricultural regions), so the issues relating to transition from coal dependency are relevant to many other communities affected by other non-sustainable activities.

Mitchell (1983) offers a word of caution about generalisation of insights and theories from one context to another, advising that "the validity of the extrapolation depends not the typicality or representativeness of the case but on the cogency of the theoretical reasoning" (Mitchell 1983: 207). However, this research attempts both typicality and cogent reasoning. There is good potential for applying theoretical interpretations from the Hunter Valley case study to other localities affected by non-sustainability. Furthermore, the validity and rigour that have informed this research also provide a valid basis for extrapolation to other contexts.

2.3 The research design

According to Janesick (2003), qualitative research design is about relationships, including those between the researcher and the system being researched. The nature of the relationship affects the researcher's understanding of social settings and influences the development of an authentic and compelling narrative in the study, including the functions of participants, data, description and explanation.

Participant observation

The researcher's residency in the study area, close engagement with the issues being researched, and knowledge of many of the actors in the issues being investigated have provided a very particular relationship between researcher and the system being investigated, and have had an influence on the research process.

The researcher has occupied a participant observer role with respect to the issues being investigated and with many of the informants. Participant observation is a qualitative social research fieldwork methodology that is closely associated with anthropological fieldwork but is also used by other social scientists attempting to understand social phenomena. It has been described as having assumed a somewhat ill-defined and mystical quality (Evans, 1988).

Participant observer methodology has often been used in research into situations such as crime, deviance, race relations and urbanism where acceptance as part of a group can give deeper insight into special meanings and interactions of group members (Jorgensen, 1989).

Participant observation is deemed by Jorgensen (1989: 12) as an appropriate methodology when:

1. little is known about the phenomena under study
2. there are important differences between the views of insiders compared to outsiders
3. the phenomena are somewhat obscured from the view of outsiders
4. the phenomena are hidden from public views.

The participant observer is interested in human meaning and interactions, and according to Jorgensen (1989) these are best viewed from "the perspective of people who are insiders or members of particular situations or settings" (Jorgensen, 1989: 13).

In this research, awareness of climate change, environmental, social health and political responses is dynamic. New disturbances (such as the global financial crisis) have emerged during the course of the research. Informant responses to these issues have evolved over the duration of the study as circumstances have changed and, as an "insider", the researcher has been able to see and feel changes (for example, regarding issues being discussed, learning that is occurring, senses of empowerment being gained, etc.) that might not be apparent to "outsiders".

The participant observer needs to gain access to the situation being researched, developing rapport with the people, situations and settings of the research (Jorgensen, 1989: 14). This has been possible in this research project through a shared history of participation in environment and social justice struggles in the region.

Four degrees of closeness of the researcher (observer) with the group being investigated (participants) have been described (Gold, 1969), ranging from zero (minimal participation) to four (deep participation). The spectrum ranges from the *complete observer* who has no interaction between researcher and subject, through the *observer as participant* who may be involved in a one-off visit or interview. At the more participatory end of the spectrum is the *complete participant* researcher who engages fully in the activities but whose role as researcher is covert. This relationship is not necessarily ethical, unlike the role of *participant as observer* where the researcher is fully engaged with the subjects and their lives, and the role of observer is explicit and known to all (Gold, 1969; Evans, 1988).

This researcher has primarily occupied the *participant as observer* role, having been fully engaged in social movement activities on the issues being investigated, but has been explicit about his role as a participant with informants, including informants, such as local government officials, who are not fellow social change activists.

While it could be argued that the subjectivity of being in a *participant as observer* relationship may blur data collection, analysis and conclusions drawn, this researcher believes that proximity to the issue, and even bias, is not by definition counterproductive for the research, and certainly does not necessarily invalidate the research. Indeed, rather than being a problem, the *participant as observer* relationship has informed the framing of the study question, helping make the research more relevant to community concerns and to advocacy groups and policy-makers working in affected communities.

2.4 Building validity into the research project

Credible academic research needs to demonstrate validity, defined as "the correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account" (Maxwell, 1996: 87).

Maxwell (1996) identified threats to validity as falling into the categories of description, interpretation, theory, generalisability and evaluation. He uses a typology of checks and tests to monitor and eliminate these threats. This approach to the issue of validity is also embraced by other analysts of qualitative research, including Miles and Huberman, (1994), Guba and Lincoln (1989), and Patton (1990) and Van Maanen (1988). The discussion below identifies how the key threats identified by Maxwell were dealt with in this research project

Description and Interpretation

Maxwell (1996) identifies incompleteness or inaccuracy as areas where description might be inadequate for giving a credible representation of data. In this research, the data used was gathered from interviews with key informants and from an extensive search of media comments and articles by relevant stakeholders.

The research relies on actual words spoken by informants and uses quotes from interviews and texts where appropriate. Transcripts were made of recorded interviews based on a *Schedule of Questions* (see Appendix 1). Informants were provided with copies of the transcripts of their interviews for editing and correction. Media sources used are listed in the Bibliography, and these are available in public records (websites, journals, newspapers).

It is inevitable that researchers imposes their own meaning that reflects their culture and values when interpreting qualitative data. Thus there is a potential for invalid interpretation, but this researcher has tried to minimise this possibility by extensively quoting the opinions of a wide range of informants.

Of course, there is also the potential for loss of validity by data being omitted rather than included. Word limits and the need to be concise mean that it is unavoidable, and appropriate, to use only some comments from some informants, rather than an abundance of comments from all of the informants. The researcher has tried to present a wide array of opinions from a representative and diverse range of communities with an interest in the issues being investigated, including residents, mineworkers, farmers, environmentalists, government officials, politicians, trade unions, international governance institutions, and academics.

Theory

Maxwell (1996) has argued that the use of vague and uncritically applied theory is a serious threat to the validity of research. In this research the key theoretical concepts of sustainability, complexity, social learning and social movement development are multifaceted and sometimes contested. The researcher has attempted to minimise potential problems of vagueness and uncritically-applied theory by basing the research on credible academic theory about these issues, by identifying contested theories where appropriate (for example, the diverse and contested meanings of "sustainability"), and by being explicit about his understanding of the theories being used.

Generalisability

Generalisability refers to the potential of an account of phenomena studied to be transferable to other settings. It is not the specific intention of this research to assume generalisability of its findings. It is a case study of processes occurring in a particular locality and community (the Hunter Valley of NSW, Australia), around a particular set of socio-ecological issues (the impacts of mining, power generation and climate change on sustainability), and potential to transfer from non-sustainability to sustainability.

Each locality, community and issue exemplifies its own ecological and social phenomena, and there is great diversity in opportunities and constraints for making a possible transition to sustainability. However, the principles of sustainability, complexity, social learning and other theory that inform this research are widely used in academic study and public policy circles, so the methods and theoretical approaches used, the social and ecological circumstances investigated, and the conclusions drawn could potentially be applied to other settings, making some of the findings generalisable to other contexts.

Evaluation

A reflexive approach to the research acknowledges that many factors, including the class, gender, race, personal history and political disposition of the researcher (and the subjects of the research) influence the questions being investigated and interpretation of data in both qualitative and quantitative research (Athens, 1984; Lincoln & Guba, 1985; Altheide & Johnson, 1998; Ezzy, 2002; Gubrium & Holstein, 1997; Hammersley, 1998).

Making a clear and honest statement of what the researcher brings in the way of values, experience and life situation assists critical evaluation of the research, and whether its validity is compromised by these subjective elements (Ezzy, 2002, Kvale, 1995, Daly, 1997, Collins, 1990, Smith, 1974). The researcher has attempted to explain "where he is coming from" with respect to his personal background and values and his intentions in doing the research in the Preface of the thesis.

Validity checks and tests

Maxwell (1996) uses checks and tests, such as those discussed above, to address validity threats. He also suggests there is a potential role for other techniques, including triangulation, seeking feedback, and use of control groups for comparison, to ensure validity threats are recognised and dealt with appropriately.

Australian geographers Bradshaw and Stratford (2005) identified a checklist for quality assurance to ensure validity, following the sequence covering different stages of the research project. Bradshaw and Stratford's approach has been used in this research, and Table 6 (below) shows actions taken to build validity into each stage of this research

Table 6: Building validity into the research process

(From Bradshaw and Stratford, 2005: 71)

Stage of research	Actions taken to ensure validity
Background and context for research	Check plausibility of research proposal and questions being investigated by consulting with academic supervisors and affected communities – residents, farmers, environmental activists, etc.
Research design and theory	Ensure rigour through review of literature on qualitative research methodology and of relevant theories pertaining tho the research issues – sustainability, complexity, etc. Seek and consider critical feedback from presentations of proposed design and theory with supervisors and at seminars.
Sampling and data collection	Maximise the diversity of informants through use of a variety of informant selection and referral processes. Use a variety of data collection methodologies, including interviews, recording public meetings, media and web searches.
Analysis	Use keyword coding to identify themes. Review relevant literature.
Reporting	Feedback to informants and affected communities during the course of the research at community meetings, conferences media articles. Report to academic reviewers through seminar presentations. Submit articles on research for publication in international academic journals – two articles published in international academic journals based on research, other research findings have been used in academic research reports and policy documents.

Some academics, for example Mischler (1990) and Janesick (2003), have challenged the checklist approach to asserting validity, and have proposed that other processes for validating qualitative research are needed. Mishler (1990) proposes that the emphasis should be on the "trustworthiness of reported observations, interpretations and generalisations" (Mishler, 1990: 419), with trustworthiness being demonstrated by having the researcher provide clear and comprehensive details of their design processes and (where appropriate) using exemplars of credible research as templates.

Janesick (2003) challenges prescriptive approaches to ensuring validity, which she believes are particularly heavily imposed on qualitative research by the strictures of quantitative research. She asserts that qualitative research design should not allow a "slavish attachment to method" to overwhelm qualitative research methodology (Janesick, 2003: 64). Instead, she contends that criteria for asserting the validity of qualitative research should emphasise the uniqueness of the research subject, process and findings. Rather than over emphasising the replicability and generalisabilty of qualitative research as indicators of validity, Janesick proposes that critical analysis of qualitative research should focus on how well the research design (and checks and balances within the design) relate to the subject and the question under investigation, and how well explanations fit the data provided.

The trustworthiness of the research process was established by consulting with a wide range of relevant people with expertise and an interest in the research question during the course of the project. These people included academic supervisors, academic peers, informants in the communities being investigated, and by using relevant academic literature.

Published articles

Two articles on major themes of the research were published in international academic journals: one on the principles and possibilities for a Just Transition in the *International Journal of Environment, Workplace and Employment* (Evans, 2007); and another on complexity theory and transformation of the Hunter Valley complex adaptive system in *Ecology & Society* (Evans, 2008a). Other research findings have been used in academic research reports and policy documents, including a report by the Centre of Full Employment and Equity (CofFEE), University of Newcastle, entitled *A Just Transition to a Renewable Energy Economy in the Hunter Region, Australia* (Bill *et al.*, 2008).

2.5 Informants and data sources

This research project gathered data from a broad range of stakeholders from different community situations about their visions and strategies for achieving a transition to sustainability in the Hunter Valley.

This research is not attempting to survey all Hunter Valley communities in order to document the full variation of views about sustainability to make generalisable conclusions, or to plot the proportion of people holding different views across the Hunter Valley's total population. Scoping the research has involved deciding on the appropriate number and diversity of informants to be valid for the research purpose.

Informants include dairy and beef cattle farmers, horse breeders, small-scale tourism operators, wine growers, power-station workers, mineworkers, elected councillors of local governments, local government authority officers and planners, government environmental activists, residents and householders, adult educators, historians and Indigenous community leaders. Informants were selected because they are:

- leaders of community organisations, including community groups (e.g. Minewatch) and farmers organisations (e.g. Hunter Irrigators Association)
- members of government committees (e.g. the Hunter – Central Rivers Catchment Management Authority)
- elected officials (e.g. mayors of a local government area, trade union officials)
- planners and policy-makers in government agencies
- media spokespeople on local issues relevant to the study.

Some informants were recommended by leaders of local community organisations and through subsequent "snowballing" recruitment (Alston & Bowles, 2003). When asked about criteria for nominating particular informants, a local resident organisation leader stated:

> I thought of the people that would have something to contribute who wouldn't be concerned about speaking clearly and honestly with you. I thought they had expertise to offer. I tried to think of a variety of people, a cross-section. Some are mineworkers themselves, some were involved in the power industry, some were typically impacted landowners and some were community residents that had a genuine concern about what the mining industry's doing to our community, and I thought that they would have something positive to contribute. I included some of our decision-makers in our local government area, as well as our mayor, who are supposedly leading our community in a certain way and should have an understanding of what economic sustainability issues relate to our town (Resident, Upper Hunter).

Discussions with some key informants helped frame questions asked, and led to revision of some questions of particular informants in order to open up more strategic issues relevant to the themes of the study, including, for example, additional questions about social learning and social movement partnerships and activities.

Altogether, 32 interviews were carried out with people in a variety of work situations (see below). Table 7 (below) shows the range of informants' work situations and their geographical location with respect to mining projects. Some informants fell into several work categories (e.g. being both a farmer and a tourism industry operator, or being an environmental activist and a domestic worker), but in these cases they have been classified according to their primary income source.

Table 7: Some characteristics of informants

Primary employment category of interviewee	Geographical location of interviewee			
	Proposed mining area	Current mining area	Former Mining area	Outside mining area
Local government officials	2	2	1	0
Dairy farmer	2	1	0	0
Beef farmer	0	1	0	0
Horse breeder	0	1	0	0
Wine grower	1	0	0	0
Hobby farmer	1	1	0	0
Tourism operator	1	1	0	0
Adult educators	1	0	0	0
Current mineworker	2	3	0	0
Former mineworker	1	0	0	0
Power-station worker	1	1	0	0
Local historian	0	1	0	0
Environmental activist	2	3	0	0
Aboriginal organisation leader	1	2	0	0
State government regulator	0	0	0	1
Total	**15**	**15**	**1**	**1**

Some gaps in the sample of interviewees are apparent, particularly the lack of interviews with coalmining corporation managers and coalmining union officials. Attempts were made to include representatives of these groups in the informant sample, but requests were rejected for various reasons, including lack of perceived value of the research to the potential informant.

The pool of informants for the research was expanded beyond those accessible through interviews. The opinions of key stakeholders from trade unions, industry leaders, government officials, politicians and research institutions were gathered from searches of public policy statements, accessible through web sites, journals and media releases.

2.6 Data collection and analysis

The purpose of the data analysis is to identify, interpret and describe themes, common patterns, and emergent issues among the group and communities that are subjects of the research (Ezzy, 2002).

Data was collected through semi-structured interviews with participants, as individuals or groups, in various locations. Prior to the interviews I sent out a background *Information Sheet* about the research project, and a list of indicative questions on an *Interview Schedule* (Appendix 1), along with a *Consent Form* to prospective informants. I explained my personal context as a person with a long-standing involvement in community-based organisations and advocacy about the impacts of mining in the Hunter Valley (and elsewhere) and about climate change. This may have influenced the character of the relationship of informant and researcher and the nature of the responses, possibly encouraging greater openness in some informants and more guarded responses in others.

Interviews were recorded and transcribed, and subsequently sent back to the informant for checking and correcting, editing and additions. In some cases the corrections were made via phone conversations, in others by the informants sending revised transcripts via email.

A large amount of data was gathered from publicly attributable comments in media articles, including opinion pieces published in the Hunter Valley's largest-circulation local daily newspaper, the *Newcastle Herald*. The *Sydney Morning Herald* was the other major source of publicly expressed opinions along with corporation, industry association and trade union media releases, newsletters, policy statements, web sites and journals (such as *Common Cause*, the journal of the mineworkers' union, the Mining and Energy Division of the Construction Forestry Mining and Energy Union).

The texts of interviews provided by informants and statements made by key stakeholders to public forums, the media, web sites, etc., were analysed using a thematic analysis to identify common issues and policies about environmental, social and economic impacts of coal mining and climate change in the Hunter Valley and globally, including:

- perceptions of sustainability threats
- the impacts of coal-based development and climate change
- social learning and community organising
- perceptions of the Just Transition discourse
- social movement development and actions.

Textual analysis is always subjective, provisional and open to change, and depends on:

> The perspective from which we approach it, including the particular social issues in focus, and the social theory and discourse theory we draw upon (Fairclough, 2003: 16).

Conclusion

The research uses both qualitative and quantitative data to investigate and document the challenges of making a Just Transition to sustainability in a climate change hot spot. The methodology has been rigorous with respect to meeting criteria of quality research design that is appropriate for the question being investigated.

Transdisciplinary thinking is used as the investigative approach, an approach which supports solutions-focused research about real-world issues about the potential for sustainability socio-ecological systems that is informed by a synthesis of a wide variety of disciplines.

The methodology of this research uses appropriate strategies of data collection from a wide range of informants from the Hunter Valley community, government, industry, trade unions and other groups using conventional tools of data collection. The data has provided a rich pool of material for analysis using themes related to the research question.

The research process has provided opportunities for ongoing evaluation of the research quality and validity of data and analysis, including feedback to the researcher from presentations to academic seminars and public meetings, from successful submission of articles for publication in academic journals related to the research issues.

Chapter 3

The Hunter Valley: A socio-ecological system in transition

This chapter provides a short description of the Hunter Valley region from both an ecological and cultural perspective, including a description of how particular ecological and human cultural attractors within the region's socio-ecological system have influenced each other as part of a co-evolutionary process.

3.1 Ecological history

The Hunter Valley incorporates the catchment of the Hunter River, which covers an area of 22,000 km^2 and has evolved over millions of years. During that time the region has experienced major ecological transformations from glacial action, volcanism, major crustal movements, periodic inundation by shallow seas, and continual modification of the coastline (Drysdale *et al*., 2000: 12).

The coal beds that underlie most of the Hunter Valley were laid in deltaic swamps and lowland river environments during the Permian geological era (286–245 million years ago) when the region was connected to the vast Gondwanaland super-continent. At that time, the land that was to become the Hunter Valley was subject to volcanic activity and the climate was changing from polar to cool-temperate. Land and sea levels rose and fell over millions of years as the beds of plant material that made up the ancient forests that covered the land collapsed into the swamps and were compressed under the weight of bands of sand and sediments, eventually becoming the dense black, combustible rock that is coal — a fossil store of plant-based solar energy (Nashar, 1964).

In the more recent Quaternary period, over the last two million years, the region has experienced ongoing volcanic activity, alluvial sedimentation and a shifting coastline as seas have risen and fallen in response to glaciation and Ice Ages. Sea levels stabilised around 6,000 years ago and since that time estuarine conditions and sand deposits have formed along the coastline, including at the mouth of the Hunter River and at Lake Macquarie, Australia's largest coastal saltwater lake, covering an area of 110 km^2.

Rich, dark basaltic clays were formed around the ranges of the Barrington Tops in the headwaters of the Hunter River, and these soils extend to the west across the Merriwa Plateau in the Goulburn River subcatchment. The central portion of the Hunter Valley comprises rolling hills and floodplains through which the Hunter River has carved a broad valley. Rich alluvial soils are located there. In the Paterson and Williams river subcatchments, on the northern side of the Hunter Valley, the soils tend to be shallow, brown podsolic soils, while on the southern edge of the catchment the soils tend to be skeletal and relatively less fertile. The relatively young coastal and estuary areas have sandy infertile soils (Drysdale *et al*., 2000; Geary *et al*., 2000).

The Hunter Valley is located in the transition zone between northern subtropical climates and the cooler mid-latitude climates of Victoria and Tasmania, thus making the climate of the region generally temperate, with warm summers and cool winters. Rainfall averages around 1,100 mm per year along the coast and drops to around 550 mm per year in the Upper Hunter. Most rain falls in summer. The Hunter Valley experiences regular storms with intense winds, lightning and floods. The Upper Hunter is often severely affected by drought, with East Coast Australia having experienced a prolonged drought period since 1990. Environmental scientists and prudent land managers now reject the notion that drought is a natural disaster in favour of recognising it as a reality, that requires adopting a risk management approach (Botterill & Fisher, 2003).

The vegetation of the Hunter Valley is diverse. In the cool and higher region of the Barrington Tops, subalpine environments support snow gums (*Eucalyptus. pauciflora* and *E. stellulata*), Antarctic beech (*Nothofagus moorei*) forest and grasses, while cool-temperate and subtropical rainforest grows in the lower, more sheltered and moist slopes and valleys of the area. Tall, mixed eucalypt woodlands cover the Williams and Paterson river catchments, while on the southern margin of the Hunter Valley the dominant vegetation is dry eucalypt forest with a sparse heath understorey. Wet eucalypt forest is found in the wetter areas of the Lower Hunter, such as the Watagan Ranges. Eucalypt woodlands covered the drier Goulburn River catchment. Coastal forest is dominated by blackbutt (*E. pilularis*), angophora (*A. costata*) and heath, with casuarina, melaleuca and mangroves around the coastal wetlands and estuaries (Drysdale, 2000).

The vegetation map below (Figure 8) shows the extent of the major ecological formations before clearing. Some formations, in particular woodlands have been extensively cleared (Tame, 2003).

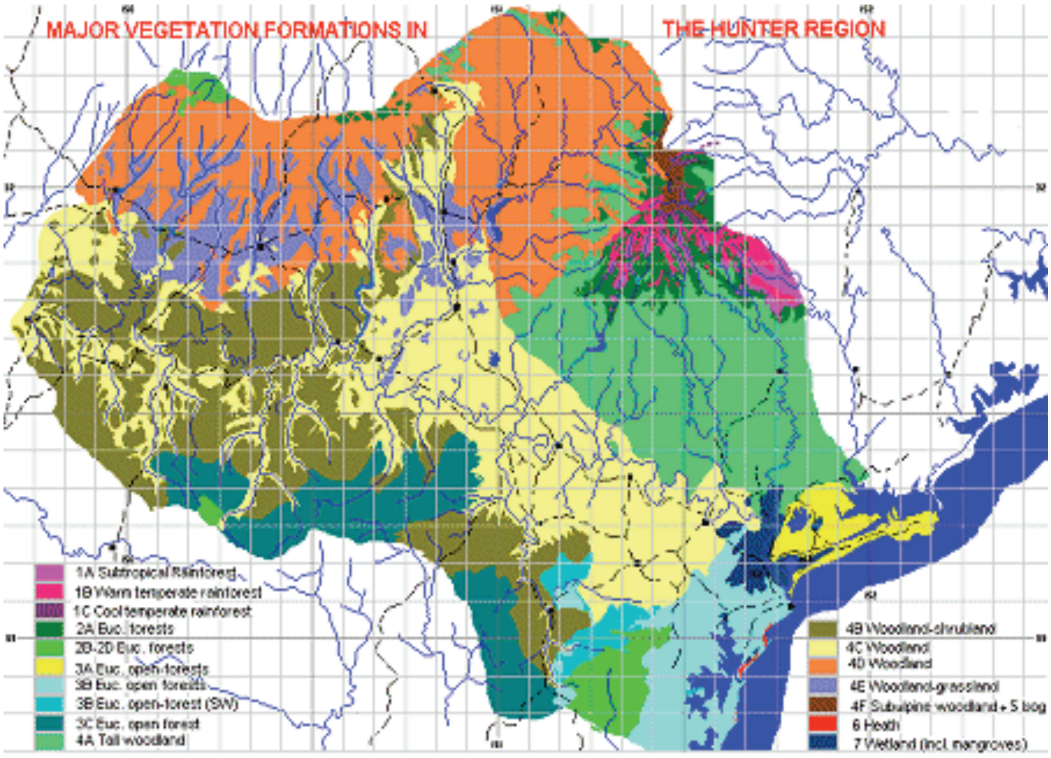


Figure 8: Map of major vegetation formations in the Hunter Valley

(Map: Tame, 2003).

Ecological systems within the Hunter Valley have been radically transformed by human activity over the last 200 years through the combination of agriculture, mining and other industrial development and urbanisation. Vegetation studies noted that 76% of natural vegetation of the central Hunter Valley has been depleted, leaving vast areas of the region now covered by pasture grasses, crops, and coalmines. Two military areas and the Wybong area (site of the proposed Anvil Hill/ Mangoola open-cut coalmine) have a disproportionate amount of the remnant vegetation (Peake, 2006). Clearing and other disturbances have resulted in some ecosystems, and species associations within them, becoming extinct or endangered. The Spotted-Gum-Ironbark forests of the Lower Hunter, for example, which are dominated by *Corymbia maculata,* (Spotted Gum) and *Eucalyptus fibrosa* (Broad-leaved Ironbark), are one example. This ecological association was estimated to have covered nearly 50,000 ha of the Hunter Valley prior to European settlement but is now reduced to about 10% of the estimated pre-European distribution (House, 2003). The ecological community is in danger of extinction unless land use practices are changed (NSW Scientific Committee, 2005). Clearing of native vegetation is listed as a Key Threatening Process under the Threatened Species Conservation Act (1995), a regulatory measure that ought to offer some constraint on mining, agriculture and urban development in the region.

Damming and other river management strategies – such as removing organic material and debris from the rivers – have also simplified the region's river ecosystems, making river flows more predictable but removing habitats and destroying bank integrity (Armstrong, 1983; Healthy Rivers Commission of New South Wales, 2000; Brooks, 2003).

Like many eastern Australian rivers, the Hunter River has lost ecological health, with a large percentage of native vegetation in the riparian zones and the catchment generally removed and replaced by exotic plants (Healthy Rivers Commission, 2002; Peake, 2006). The geomorphic complexity of the Hunter River and its tributaries has been simplified as it has become shallower and broader, with loss of ponds and billabongs, while growing salinity and pollution threats, reduced and predictable water flows and loss of habitats, and its management under an engineering paradigm, further reduce river health (Hindley, 1983; Albrecht, 2000; Brooks, 2003; Boulton *et al.*, 2003; Hillman, 2003). These factors led the authors of the Huddleston Report that examined the threat of flooding in the Hunter Valley in 1948 to declare:

> After one hundred years of misuse and neglect, the Hunter River and its catchment area are in a deplorable condition (Hunter River Flood Mitigation Committee, 1948: 6).

In 2002 the NSW State Government's Healthy Rivers Commission, which investigated the health of all NSW rivers, described the Hunter River catchments as generally worse than that of other NSW coastal rivers (Healthy Rivers Commission of NSW, 2002: 11).

An inventory of ecological damage includes:

- About 30% of the catchment retains mostly native vegetation, but in some areas on the central valley floor 99% has been removed.
- Across the catchment, only a third of streams are in good condition, with stable banks, and about 10% are highly unstable.
- Water quality is extremely variable; and phosphorus, salinity and bacteria are often found at higher than desirable levels.
- About 30% of native fish species appear to have been lost in the Hunter catchment area.
- Much wetland habitat has been lost, and many estuarine and floodplain wetlands have been alienated from the river and are substantially degraded.

At least 18 of the 33 species of migratory wading birds using the estuary have declined in numbers, and the estimated mean number fell by nearly 50% between the 1970s and 1990s (Healthy Rivers Commission of NSW, 2002: 10-11), with further decline since the 1990s (Maddock, 2004).

The Commission concluded that rehabilitation of Hunter River corridors and the adoption of sustainable land use practices are crucial for river health (Healthy Rivers Commission, 2002: 85).

3.2 An Indigenous cultural landscape

People have lived in the Hunter Valley for tens of thousands of years, with estimations of Indigenous people's occupation of 40–60,000 years (Miller, 1985; Turner & Blyton, 1985; Brayshaw, 1986; Albrecht, 2000). Indigenous people of the Worimi, Awabakal, Darkinjung and Wanaruah clans lived within different parts of the Hunter Valley, hunting and gathering from a bountiful supply of birds, fish, shellfish, reptiles, kangaroos, wallabies and plants, using fire to modify the environment to increase desired species, and travelling through the country along well-defined tracks in a culture "holding the oldest collective memory known to man" (Blyton *et al.*, 2004: 6).

The land and Indigenous people of the Hunter Valley co-evolved over millennia, with Indigenous communities demonstrating the capacity to pass one test of sustainability, that of continuity, over time. The culture that survived in the region for thousands of years was guided by a value system and belief that:

> The land held the key to life's secrets. Man was given knowledge to read the land and for every rock, tree and creek he found an explanation for existence. He did not own the land; the land owned him (Miller, 1985: 1).

Indigenous culture has been the dominant culture for the vast majority of human occupation of the Hunter Valley – all but the last 200 years of 40–60,000 years. Indigenous people changed the landscapes of Australia through use of fire, hunting and harvesting through a co-adaptation process that drew from Indigenous cultural values and a deep knowledge of country and land management (Rose, 1995; Langton *et al.,* 1998; Rose, 1999; Howitt 2001; Suchet, 2002). However, over the last 200 years – since British colonisation – a capitalist, agricultural and industrial mode of production has replaced Australia's Indigenous economy and transformed social and ecological relationships. It opened a new phase in the evolution of the Hunter Region socio-ecological system. Unlike Indigenous people's relationships to their country, the current dominant socio-ecological relationship is more focused on transforming rather than adapting to the environment.

Indigenous people still live in the Hunter Valley, and still attempt to influence the ecological and cultural trajectory of the region through advocacy, research and development choices on those small parts of the landscape they still have influence over; for example, the Worimi National Park is jointly managed by Indigenous owners and the NSW National Parks Service. The University of Newcastle's Umulliko Indigenous Higher Education Research Centre program of research into health, law, environment and culture reflects just one part of this ongoing struggle.

As Albrecht (2000) noted in his environmental history of the Hunter Valley, there is an urgent imperative to link reconciliation of colonial Australia with Indigenous Australia with ecological restoration:

> The work of ecological restoration started in this valley to [re-]establish a native sense of place by revaluing that which was and still is native to this region. One way to do this, and one that is particularly important in this period of reconciliation of colonial Australia with Indigenous Australia, would be to have dual names for those places where we know the original Koori words. Both sets of names give us a sense of history and place. Reinstating Indigenous names, because they are so firmly connected to the landscape, will help us discover our environmental history and link reconciliation with ecological restoration (Albrecht, 2000).

3.3 A diverse economy

The Hunter Valley's economy is diverse and mature, with major industries including aluminium smelting and metals processing, transport, machinery and equipment manufacture, defence and aerospace, chemical processing, timber and woodchips, aquaculture, thoroughbred horses and wine, as well as coalmining and power generation. The region also has a significant tourism industry.

The largest employment sector is in retail services (12%), followed by health services (12%), manufacturing (11%), construction (8%), education and training (7%), accommodation and food service (7%), public administration and safety (6%), and professional, scientific and technical work (5%) (HVRF, 2008a).

Agriculture accounted for 2% of employment in 2006, down from 3% in 1996, while mining accounted for 3% of the region's employment in 2006, down from 4% in 1996 (HVRF, 2008a). In the Upper Hunter shires of Muswellbrook and Singleton, 16.2% and 19.9% of the workforce respectively was employed directly in mining, compared to the Lower Hunter localities of Newcastle (1%) and Maitland (4.3%) (HVRF, 2008a).

The region has a higher-than-NSW average employment in "goods-producing" industry sectors (industry sectors that grow, process, extract or manufacture goods; specifically, employment in agriculture, mining and manufacturing), but less-than-NSW average in "knowledge-producing" industry sectors (the high-skill service industries which cover employment in health care and social assistance; education and training; professional, scientific and technical services; financial and insurance services and information media and telecommunications) (HVRF, 2008a).

3.4 The growing influence of coal as an attractor

Coal has had a powerful influence in the ecological and cultural history of the Hunter Valley over the last 200 years, and is a powerful attractor in the Hunter Valley's socio-ecological system and the "'state space' in which the system tends to remain"; that is, its basin of attraction (Walker *et al.,* 2004: 3).

The understanding of regionally distinctive complexity of the Hunter Valley, and the role of coal in the regional complex adaptive socio-ecological system, begins with the region's geological history.

Indigenous accounts of coal

The Awabakal, the Indigenous people of the Lower Hunter coastal region, called coal *nikkin,* and the country around Lake Macquarie *nikkin-bah,* meaning "place of coal" (Grothen, 1988; Maynard, 1996). The Awabakal have a "dreaming" story that describes the creation of coal and its place in human affairs.

According to John Maynard, Indigenous historian and professor at the University of Newcastle's Umulliko Indigenous Higher Education Research Centre, the Awabakal believe coal was formed from dark material that emerged from volcanic activity and fires under the earth that spread across the land, cutting out the light of the sun. The Awabakal ancestors gathered people from all around the region who dug up rocks, sand and tore branches from trees and bushes to bury the darkness underground and, as generations of families walked over the ground under which the material lay, it was compressed under the earth, forming coal (Maynard, 1996; Williams, 2006).

The Indigenous story of the dark and silent pollution from coal is perhaps echoed in current concerns about pollution from coal-fired power stations and the threat of climate change from combustion of coal. The Awabakal belief that coal is best left in the ground has its parallels in climate-change mitigation strategies of environmentalists who advocate a moratorium on new coalmining and power stations.

According to Indigenous elder Ken McBride, the Awabakal people gathered coal found scattered on the beaches and at the base of coastal cliffs and used it for fires for cooking and heating, as an insect repellent and for making tar to waterproof their canoes (McBride, 2003). Thus, coal was a resource which was possibly traded by Indigenous people, but was also something to be wary of. It does not seem to have been a powerful attractor in the social evolution of the Hunter Valley's Indigenous people.

The Hunter Valley's coal industry development

The Hunter Valley's coal industry developed in three phases or eras: Early Colonial; First Coal Rush; and Globalised Market. These phases can be distinguished as the character of various attractors – markets, ownership, scale of operations, ecological and climate impacts, and community responses – have changed.

The influence of coal in the region's cross-scale (panarchic) interactions has also grown over these years through each of the phases identified above – from being of relatively small influence in the first phase to becoming a significant contributor to the global carbon economy and cross-scale influences on the region's socio-ecological evolution from climate change in the third phase.

Phase 1: 1800 to 1900: The Early Colonial era and the emergence of the coal economy and coal communities

The *Early Colonial* era, from 1799 to 1901, saw the dawn of commercial coalmining in the Hunter Valley. An abundance of coal was found at the mouth of the river that was known to the Indigenous Awabakal as Coquun, but which was renamed the Hunter River in September 1797 in honour of Governor Hunter. The first coalmine in Australia was dug at the mouth of the Hunter River, worked by Irish convict labourers brought from Sydney following their involvement in the Vinegar Hill Riots on the outskirts of Sydney in March 1804 (Comerford, 1997).

The settlement at the mouth of the Hunter River was initially called the Coal River settlement, and later Newcastle. The town of Newcastle emerged from a network of coalmining villages, many named after mining towns in England and Wales such as Wallsend, Gateshead, Lambton and Cardiff. Coal was also mined in Lake Macquarie as early as 1842, when the Reverend Lancelot Threlkeld started the Ebenezer Coal Works at Skye Point. After being refused convicts, Threlkeld used Aborigines for labour instead (Ross, 1970).

Conditions for the convict miners around Newcastle were very harsh; they were subjected to abusive and violent treatment, filthy living conditions and dangerous, exhausting work. By the 1830s, though convict labour was becoming replaced by indentured labour from England, Scotland, Wales and Ireland, the industry was still characterised by harsh and dangerous working conditions (Gollan, 1963; Ross, 1970; Comerford, 1997; Moore *et al*., 1998).

The early shipments of Newcastle coal were to Sydney for heating and, later, gas production. Coal River was "the birthplace" of the Australian coalmining industry, but also of the Australian export economy, with the first profitable export from the colony being coal shipped from Coal River/Newcastle to Bengal, India in 1810 (Coal River Working Party, 2006). The importance of the Port of Newcastle increased as coal exports grew from 4,400 tons in 1830 to 30,555 tons in 1840, and 476,500 tons by 1862; between 1860 and 1914 a third of coal produced in New South Wales was being exported (Gollan, 1963; Ross, 1970).

A cluster of coalmining villages grew around the mouth of the Hunter River and extended up the valley to Teralba, Fassifern, and Beresfield during the 1800s. These villages were to become the suburbs and townships of Newcastle, Lake Macquarie and the Lower Hunter. By the late 1800s, many of the mines in the Newcastle area were exhausted, but following the discovery in 1886 of the deep Greta Seam of black coal, which extends from Maitland to Murrurundi, there was a burst of new mine developments around the Lower Hunter towns of Maitland and Cessnock. The development of this rich seam gave a major boost to the industry, with many new pits and nearby miners' villages established as the centre of the industry steadily moved from the mouth of the Hunter River to the upper Hunter Valley.

The early mines were mostly underground mines that used manual rather than mechanical methods of mining. The relatively small scale of the mines kept their environmental impacts small and localised. Miners lived in villages adjacent to the mines that were often named after Welsh, Scottish and north England coalmining towns such as Abermain, Pelaw Main, Stanford Merthyr and Cessnock.

The early coal companies of the Hunter Valley were a mix of local, domestic capitalists in collaboration with British investors: the Australian Agricultural Company; AJ and A Brown; Newcastle Coal and Copper; the Scottish Australian Mining Company. The miners worked in harsh and dangerous conditions.

> [Miners] found their new employers little different to, and the ruling authorities little different from, those they had left behind. They quickly found they had to organise and fight for everything. In this new land there were no benevolent employers, the coal masters were as demanding and exacting in Australia as they were anywhere else in the world (Moore et al., 1998: 3).

The harsh treatment from the “iron fist from the coal barons” (Scanlon, 2005) provoked a countervailing culture of class-consciousness, social activism and larrikinism in the close-knit communities of the Hunter Valley, a culture of that remains a prominent part of the region’s contemporary culture and identity (Walker, 1945; Gollan, 1963; Turner, 1982; Metcalfe, 1988; Winchester, McGuirk & Dunn, 2000; Marsden, 2002).

Metcalfe (1988), in his study of the Lower Hunter coalfields around Cessnock, described the sometimes contradictory trends of a disciplined ‘respectable’ industrial labour movement and the anti-authoritarian and undisciplined ‘larrikin’ culture of rank and file workers in the social development of the Hunter coalfields. Metcalfe described tensions between union leaders and rank and file members of the mineworkers’ union which highlights a tendency towards militancy, but not necessarily strategically targeted towards the political aspirations of union leaders. Metcalfe noted:

> The [Miners’] Federation could be militant, but could not happily tolerate members' 'irresponsibility'. 'Indiscipline' denoted inefficiency to (union) officials, whose job required the means-to-an-end rationality typical of capitalism. Even militant officers complained to me of petty stoppages that 'wasted' days, damaged the union's reputation, retarded development of 'mature' political consciousness and kept miners too poor to afford more 'useful' strikes (Metcalfe, 1988: 122).

Smith (2008) identified that larrikinism is, in some respects, a reflection of worker and individual alienation from capitalist social and economic relations. Smith (2008) asserts that ‘larrikin’ workers create a ‘self’ outside of, and in opposition to, conventional capitalist social relations.

Friendly Societies, pubs, sporting clubs and churches were important cultural institutions in the minefields, providing social cohesion among mineworkers and their families. But it was the miners’ union that provided the main focus of mineworkers’ aspirations (Gollan, 1963). The Hunter Valley’s coalminers formed one of Australia’s first non-craft unions in 1860, the Hunter River Miners Protective Association, a local manifestation of the trade union movement emerging in Britain where many of the miners migrated from. The miners’ union was instrumental in the formation of the Newcastle Trades Hall Council in 1869 (Noble, 2008) and, under various names – the Australasian Coal and Shale Employees Federation (commonly known as the Miners Federation) and its current name as the Mining and Energy Division of the Construction Forestry Mine and Energy Union (CFMEU M&E) – the union has been a stronghold of militant and socialist politics and involved in some of the landmark struggles of Australian labour history. These include the lockout and shooting of miners at Rothbury in 1929, the deployment of troops to break the Coal Strike of 1949 and, more recently, community pickets against Rio Tinto’s efforts to de-unionise their workforce in the late 1990s (Gollan,1963; Ross, 1970; Macdonald & Burgess,1998; McSorley & Fowler, 2001).

While the first annual report of the NSW Department of Mines, published in 1875, reported about 3,000 miners lived in the Hunter Valley (and this was many fewer than the 15,555 gold miners who were working in the Colony at the time) it still indicated the emergence of a major industry (Dept of Mines, 1875).

Phase 2: 1900 to 1980: The *First Coal Rush* and the emergence of the mining barons, industry consolidation, working class solidarity and resistance

The second phase of mining, referred to in this thesis as the *First Coal Rush,* emerged as the South Maitland coalfield was developed on Greta Seam in the 1880s. Coal became NSW's most valuable mineral commodity by 1900, overtaking gold, with a value exceeding £1.5 million. By 1920, coal worth £7.8 million was mined, while gold had declined to only £0.25 million of a total mining wealth of £11.5 million (Dept of Mines, 1920).

By 1900, the Hunter coal industry was burgeoning with many large new mines being opened up and thousands of workers and their families moving to the region to work in them. The mines developed in this phase of the Hunter coal industry were much larger than the small pits of the *Early Colonial* era, with mechanical methods used for the first time, including a coal cutter installed at Greta Colliery in 1889. Though open-cut mining and mechanical loaders were introduced after 1935, the pace of mechanisation was slow, with only 36% of coal in NSW being mechanically cut and only 27% mechanically loaded, even as late as 1946 (Hargraves, 1993).

The development of the South Maitland coalfields added export capacity to the Hunter Valley coal industry. About one-third of all coal produced in NSW between 1886 and 1914 was exported, mostly from what had become known as the Northern Field, with exports initially mostly making up backloads for the British ships bringing goods from Europe (Gollan, 1963).

The pace and scale of labour migration into the coalfields and industry growth was unprecedented in Australia, and may be the most massive and rapid industry development in the nation's history (O'Neill, 2007). By the early 1900s, the South Maitland coalfields were "the greatest in the Southern Hemisphere, and one of the greatest in the world" (Phillips, cited in Metcalfe, 1988: 22). The Hunter Valley coalfields town of Kurri Kurri was the first purpose-built town in NSW, planned and proclaimed in 1902. In the five years between 1899 and 1904 the number of miners on the South Maitland coalfields exploded jumping from only 377 to 10,505 (O'Neill, 2007). By 1924–25, 16,596 miners were working underground in the South Maitland coalfields and 60% of the coal mined in Australia came from the Lower Hunter Valley (Comerford, 1979; O'Neill, 2007:172).

Richmond Main, the largest mine of the era, employed 496 in 1920, rising to 1,165 in 1929, while Pelaw Main employed 300 in 1902, 890 in 1910 and then declining to 800 in 1929 (NSW Mines Annual Reports 1901–1930). By 1939, the Hunter Valley mining boom was beginning to wane, with the number of miners falling to 10,590 (Dept of Mines, 1939), but the industry steadily expanded production over the next four decades. Production was supplying local coal-fired power stations as well as exports. By 1978, coal exports from NSW were 19.66 million tonnes (of which 12.5 million tonnes went to Japan).

The workforce in NSW coalmines stabilised at around 17,000 for most of the first half of the 20th century. There were 17,020 Hunter Valley coalminers in 1945 and 17,737 in 1960, producing 18 million tonnes (Gollan, 1963; Thomas, 1983; New South Wales Department of Mines, 1875-2005).

During this era there was consolidation of the ownership of the Hunter Valley coal resources, with a few dominant corporations, and “mining barons” emerging as the dominant owners. John “Baron” Brown (1850–1930) was the most powerful mine owner, who steadily strengthened his influence from the late 1800s into the 20th century. The Brown family established the Australian Agricultural Company, which challenged the government's monopoly on coalmining, and fought a successful court battle to open up the Hunter Valley’s coalfields to private corporations. Baron Brown was renowned for his harsh and pitiless treatment of workers, responsible for throwing hundreds of Minmi miners out of work for attending the funeral of workmate in defiance of his edict, jailing seven women who harassed scab workers, and victimising and denying jobs to the families of unionists (Scanlon, 2005). According to Turner (1979) his “antagonism to unionism was bitterly unequivocal and even ruthless” as was “his passion for riding the whirlwind and defying the storm of popular disapproval” in his relations with his miners. He was also extremely reluctant to accept the state and Commonwealth arbitration systems (Turner, 1979).

The first decades of the 20th century were characterised by industry consolidation through a series of mergers and takeovers, led by the J & A Brown Company – which by 1930 had become the largest privately owned coal operator in the Hunter Valley coalfields. In the 1960s, J & A Brown engaged in further consolidation of the industry when it merged with Abermain and Seaham operations to form J & A Brown Abermain Seaham Collieries Limited (JABAS. Group), which then merged again with rival Caledonian (100% Howard-Smith) in May 1960 to become the Coal & Allied Company, with Howard-Smith holding a 30% share. After a complicated business restructuring, Coal & Allied won control of the Mount Thorley mine from W Miller in 1989 and added the operation to its existing Hunter Valley mines (Jay, 1994; Andrews, 2004).

In 1977 the Melbourne-based mining house Conzinc Rio Tinto of Australia (CRA), which later became known as Rio Tinto when it merged with the British major shareholder Rio Tinto Zinc, launched a takeover bid of Coal & Allied. CRA began cementing its stake in Coal & Allied, and by March 1993 its shareholding jumped to more than 70%. In 2000, Coal & Allied merged the Howick and Hunter Valley Number 1 mines to create Hunter Valley Operations. Lemington mine was also acquired and integrated into this operation in 2001. In early 2001, Rio Tinto acquired Peabody Resources Ltd’s interests in the Warkworth and Bengalla mines, and this completed the current suite of Coal & Allied operations. Early in 2004 Rio Tinto Coal Australia Pty Ltd (a 100% Rio Tinto entity) took over the management of Coal & Allied; the corporate and head office functions of Coal &

Allied in New South Wales and Rio Tinto's coal interests in Queensland were combined, with Rio Tinto Coal Australia now managing its Queensland and Hunter Valley businesses together from a single office based in Brisbane (Coal & Allied, 2007). Rio Tinto is also a major shareholder in the Port Waratah coal loader in Newcastle.

Various capitalists bought and sold Hunter coalmines, building industry resilience during the cycles of boom and bust at the expense of workers and mining communities, and to a significant extent also at the expense of the health of the Hunter Valley environment.

The mine owners mostly lived outside the district "to enjoy metropolitan amenities and to profit from proximity to congenial concentrations of prestige and power" (Comerford, 1979: 12). Today, the major mine owners are even more likely to be based outside the region, even the country, as globalisation of capital and markets has driven a new era of industry consolidation and ownership of the Hunter Valley coal resource by a few, mostly foreign-owned, transnational corporations, marking the beginning of the next phase of the industry.

Phase 3: 1980 to the present: The *Globalised Market* era, the second coal rush, further consolidation and boom and bust in global markets

The late 1970s to the 1980s marks the third phase of Hunter coal industry, the *Globalised Market* era. This period sees a massive expansion of Hunter coalmining and exports, and major investments in coal-fired power generation as the region's coal resources, and cheap electricity generated from it, became almost completely under the influence of global-scale attractors – markets and global mining and aluminium corporations.

By the 1940s, the Hunter Valley was one of Australia's major mining and manufacturing centres, but was a region whose communities suffered chronic disadvantage (Hunter Regional Planning Committee, 1977: 50). In the late 1970s, the Wran Labor Government decided the region's economy could be boosted by linking it more fully into global energy markets, particularly the global market for coal and as a supplier of cheap coal-fired electricity for the energy-intensive aluminium industry. The Hunter Valley was being labelled as Australia's equivalent of Germany's Ruhr Valley, known for heavy industry – and pollution (Phillips & Ross, 1980: 33)

In June 1980 there were 17 major new coalmine projects being developed, with an additional 15 mines in feasibility stage, making 32 new coal projects altogether. Associated proposed developments included 11 coal washeries, three new coal-fired power stations (Eraring, Bayswater and Mt Arthur), five new dams (including the Glennies Creek Dam) and three aluminium smelters (Phillips & Ross, 1980). Most of these development proposals have come to fruition, though there have only been two (not three) smelters and two (not three) large power stations.

Community concern about the scale of proposed mining and associated heavy industry development and potential local environmental and social impacts was growing, expressed even by the pro-business *Newcastle Morning Herald*, whose editorial writer declared in July 1980:

> The problems posed by coal developments are not those of local residents alone. They will affect everyone who visits the area for business or pleasure. Large areas of the Upper Hunter will lose what is at present a pleasant rural aspect and will become an expanse of open-cut mine with extended amounts of disgorged topsoil (*Newcastle Morning Herald*, 1980).

The NSW Government ignored public opposition to the industrialisation of the rural landscape of the Upper Hunter Valley and pressed ahead with industry expansion, establishing a Coal Export Taskforce in March 1979 to coordinate mine, rail and port infrastructure planning, particularly around the Upper Hunter towns of Singleton and Muswellbrook.

In the 25 years since the Taskforce was established the scale of coal exports from the Hunter has increased five-fold to 80.8 million tonnes, with exports to 18 countries (NSW DPI, 2008: 20). Only a third of the coal mined in the Hunter Valley is burnt regionally in local coal-fired power stations. The NSW Government has never rejected a new mine project proposal, and in 2008 approved a third coal loader for the Port of Newcastle to more than double export capacity to 180 million tonnes annually (NSW DPI, 2008: 45).

The 1980s coal rush was followed by another after 2000. A doubling of global coal prices has prompted a new wave of mine expansion. The withdrawal of China from export markets (so its coal resources could be used domestically to fuel rapid industrial growth as the world' factory) contributed to record prices that saw the often volatile price of thermal coal skyrocket from US$20 to between US$40–60 per tonne in the two years between 2003 and 2005 (ABARE, 2008).

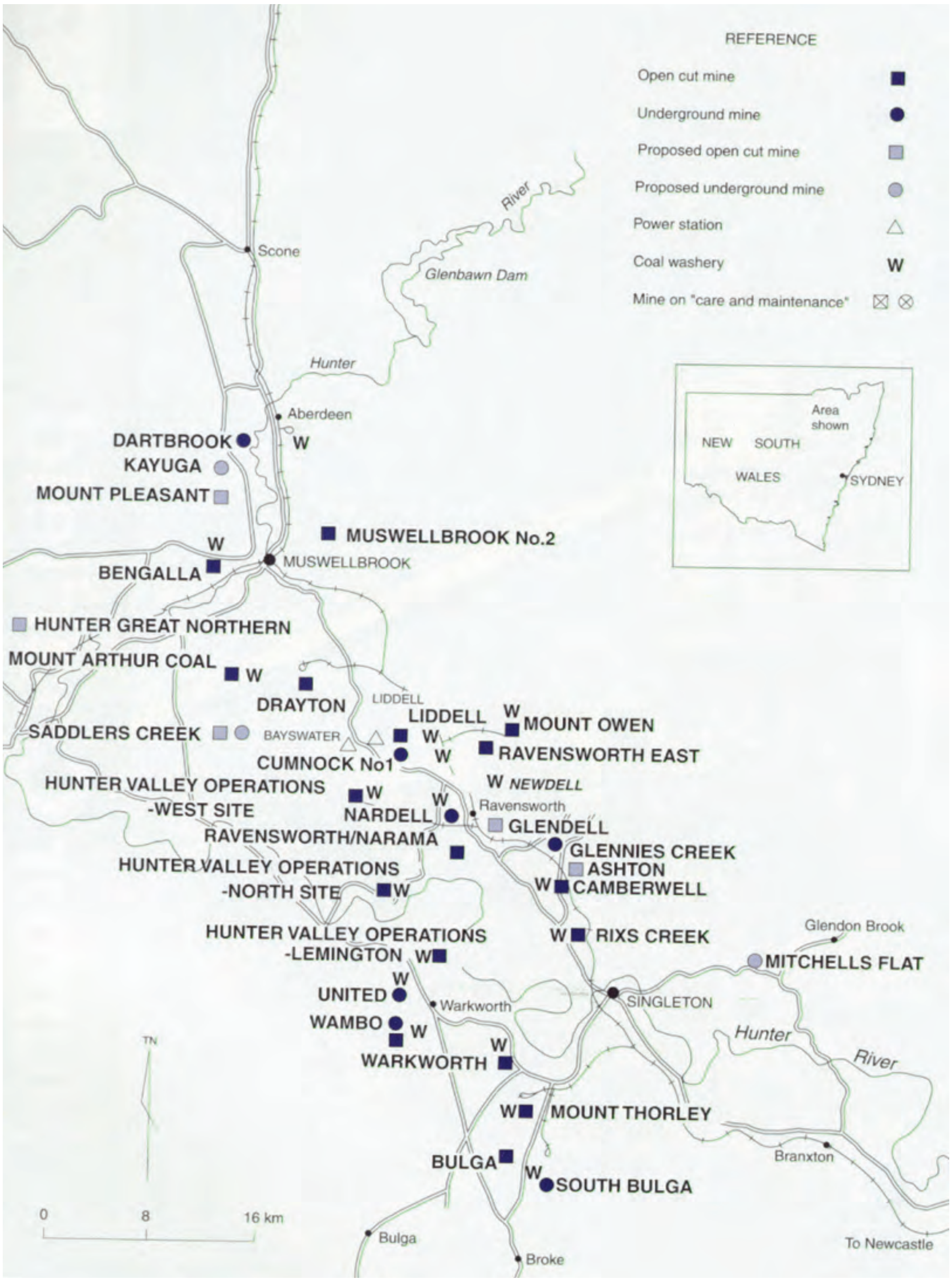


Figure 9: Coalmines surround the towns of Muswellbrook and Singleton

(Map: NSW DPI, 2008.)

In 2008, there were 38 coalmines in the two coalfields of the Hunter Valley (the Hunter and Newcastle coalfields): 18 of them open-cut mines, 16 underground mines and four utilising both methods of mining. Twelve new mines and expansions of existing mines were under construction, and eight new mines were proposed in 2008 (New South Wales DPI, 2008: 30). Most mines are concentrated around the towns of Singleton and Muswellbrook (see map above, Figure 9), but a wave of new mines is now being developed beyond the central Hunter Valley floor, at at Wilpinjong and Moolarben near the Goulburn River in the upper reaches of the Hunter River catchment, while just outside the catchment four new mines are proposed in the Gunnedah Basin and two in the Gloucester region. Coal from these mines will be exported through Newcastle.

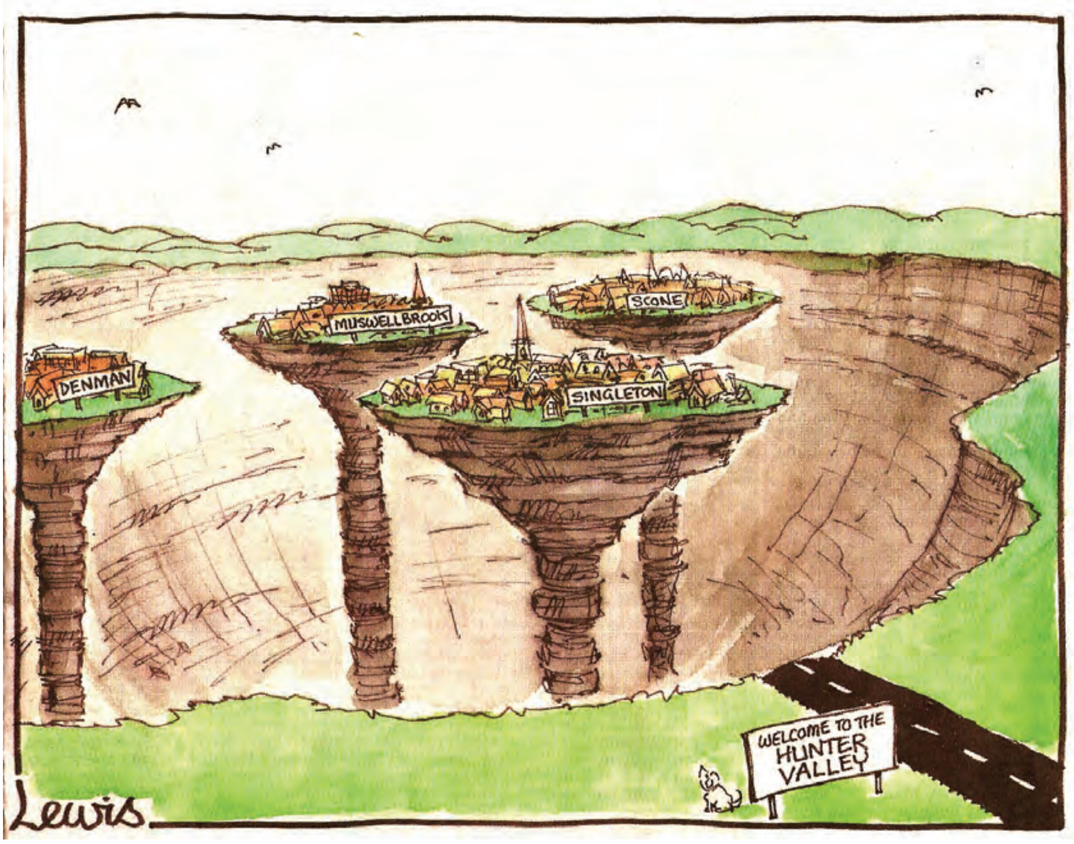


Figure 10: Local environmental impacts of coal mining in the Hunter Valley

(Courtesy: Lewis, *Newcastle Herald*, 10/7/2008.)

The *Newcastle Herald*'s Peter Lewis depicted widely felt community perceptions about the impact of mine expansion in the Hunter Valley in the cartoon reproduced above (Figure 10).

Not only has there been a large increase in the number of new and proposed mines in the Hunter Valley, but the spatial scale of coalmine extraction has grown, with introduction of the highly mechanised mining technologies, particularly long-wall underground mining and vast open-cut mines.

3.5 Global coal driving regional non-sustainability

The *Globalised Market* era has seen a consolidation of coalmining in Australia and globally. In 1980, 35% of the region's coal resource was owned by transnational corporations (Ross & Phillips, 1980), but by 2008 four corporations (BHP Billiton, Rio Tinto, Xstrata and Anglo American) control almost 100% of coal exported from the Hunter (NSW DPI, 2008). In 2007, Centennial Coal – the largest domestically owned coalmining company in the Hunter Valley – was bought by the Swiss–British mining giant Xstrata. BHP Billiton and Rio Tinto are the two largest mining companies in the world, and both have significant Australian ownership of equity. However, Australian equity has diminished since BHP merged with the South African–British-owned Billiton; both Rio Tinto and BHP Billiton were dual-listed on the Australian and London stock exchanges.

Corporate consolidations have been driven by economic liberalisation and globalisation pressures that have removed constraints on foreign investment and freed investment capital to seek maximum returns with the whole world as the market for assets (including resources, research capacity, and personnel) and clients. The largest mining companies have sought a high level of product diversification into a wide range of mineral and energy commodities to smooth out the demand fluctuations that affect particular commodities, and have acquired "world class" assets in many countries (including the Hunter Valley's coal resource) to reliably supply from multiple sources, guarantee long-term supply capabilities, ensure economies of scale and maximise returns to shareholders throughout the economic cycles (Humphreys, 2000; Colley, 2002).

Consolidation enables large corporations to increase their power in negotiations with buyers, governments and workers and their unions; allows them to aim for higher prices and to become price-setters rather than price-takers in global markets; allows them to secure generous infrastructure subsidies for industry expansion, deregulation of environmental and labour laws; and favourable responses to climate-change mitigation – even as concern about the links between fossil fuels and climate change grows in the wider community (Waring *et al.,* 2000; O'Meara *et al.*, 2000; Peoples & Sudgen, 2001; Colley, 2002; Dicken 2003; Monbiot, 2006; Held & McGrew, 2007, Pearce 2009).

The *Globalised Mining* era has seen a dramatic growth in coal production since the 1980s. To compete in global markets, economies of scale are ramped up. BHP Billiton's Mt Arthur mine, for example, has a lease covering 40 km^2, adjacent to the Hunter River and 5 km from the Upper Hunter town of Muswellbrook. The mine, shown in Figure 11 (below) produces over 20 Mt of thermal coal annually from open-cut pits, primarily for export with some used in the nearby Bayswater and Liddell power stations. Plans are underway to expand annual production by a further 8 Mt through a new underground mine using long-wall mining technology.

Figure 11: Mt Arthur mine from the air

(Photo: Lee Rhiannon)

Long-term decline in jobs and employment security

Coal production in New South Wales almost tripled, from 58.29 Mt in 1980 to 156.32 Mt in 2004–05, but during that time the number of mineworkers employed has declined steadily, from 19,867 in 1980 to 11,290 in 2004–05 (NSW DPI, 2006).

Global economies of scale led to the introduction of new mining technologies and work practices; while these led to an enormous increase in labour productivity they also contributed to a steady decline in jobs, and an increase in casualisation and outsourcing of mine work. These new factors in the basin of attraction of the coalmining production process have further strengthened the power of corporations relative to workers and local communities. Workplace power was in a dynamic situation of rough equilibrium (if not equality) between workers and employers when the industry was controlled by mostly domestic and local corporations for many years prior to integration into globalised markets and ownership (Waring *et al*., 2000, Macdonald & Burgess, 1998).

The shift in relative power driven by globalisation processes was boosted further by pro-business industrial relations changes legislated by successive federal governments, and particularly by the Howard Government's *Work Choices* legislation. The Rudd Government's amendments to *Work Choices* leave those workers earning over $100,000 (which includes most mineworkers) outside of collective award protection and further reduces the negotiating and industrial power of trade unions in the industry (CFMEU M&E, 2008c)

Declining employment, job security and union power have led to an increase in the level and density of the non-union workforce in the industry (Macdonald & Burgess, 1998;

Waring *et al.*, 2000; McSorley & Fowler, 2002), add pressure on the mineworkers' union (CFMEU M&E) to support industry expansion in order to maintain its membership base and its political influence.

Return of the boom–bust cycle

The global financial meltdown taking place at the time of writing has created a new disturbance in global mineral commodity markets, with impacts on the Hunter Valley coal industry. In December 2008, industry analysts were noting that the Australian benchmark thermal coal price had dropped by 60% over four months from the April 2008 record level of A$201/tonne, as the global economic crisis led to oversupply and declining industrial output (Mineweb, 2008).

The decline in demand and prices has particularly affected Australian metallurgical coal exports used for steelmaking. Industry expectations are that demand for thermal coal for power generation will be relatively less affected by the current bust in global coal markets than metallurgical coal. Estimates of demand for thermal coal over the next few years range from 1–3% growth to a decline (Freed, 2008; ABARE, 2008; Reuters 2008). Thermal coal demand from Japan, the market for almost 60% of Hunter Valley coal exports, is expected to decline by 3% in 2009 as industrial production declines (Wong, 2008). Japanese industrial production experienced its sharpest ever contraction as a result of the global financial crisis, and production declined by 23% between February and December 2008, with significant further declines predicted in 2009 (International Business Times, 2009)

As the historic boom–bust cycle of the globalised Hunter Valley coal industry reasserts itself under the duel pressures of economic collapse and climate change, the hazards of a carbon-intensive economy and the need to develop adaptive capacity for a transition to an alternative economy becomes increasingly urgent.

3.6 Linked ecosystem-human health distress syndrome

The processes involved in mining and the use of mineral products have harmful effects on both ecosystems and human health at local, regional and global scales (Echavarría, 1999, 2003; Maclean & Warhurst, 1999; Warhurst, 1999; Lebel & Burley 2003; Mergler, 2003; Maclean *et al.*, 2003; Pereira & Komoo, 2003; Noronha, 2003). Lebel & Burley (2003: 828) noted:

> The stress of mining affects the health of ecosystems and, by corollary, the physical and mental health of humans and their social well-being. The exploration, operation, and closure stages of large-scale, small-scale, and artisan mining have deleterious impacts on ecosystems and human health, which are also conditioned by the various operational implications of the particular mineral under exploitation

The ecosystem and health impacts of coalmining and coal combustion in power stations include: climate change impacts arising from CO_2 pollution (including rising average temperatures and linked health impacts of heat stress, changes in disease patterns and food insecurity, discussed previously); health impacts resulting from other pollutants emitted from minesites and coal-fired power stations; and social stress caused by loss of ecosystem services (including loss of biodiversity, landscape degradation and the decline in water quantity and quality) (CSIRO, 2007).

High levels of disturbances to ecosystems and human wellbeing attributable to coal mining and coal combustion in the Hunter Valley have created a linked ecosystem-human health distress syndrome.

Air pollution

The Hunter Valleys coal-fired power stations are among the world's most inefficient and CO_2-polluting on a per capita basis, producing more than 10 tonnes of CO_2 for each Australian per year. This compares with 9 tonnes per capita for the USA's coal-fired power stations and 2 tonnes per capita for China's coal-fired power stations (CARMA, 2007).

The two largest power stations in the Hunter Valley, Bayswater and Eraring, each produce 18.325 Mt of CO_2 each year, making them Australia's two biggest single sources of CO_2. They rank equal 44th in terms of their CO_2 emissions globally, but their CO_2 intensity (CO_2 to power output) is comparable to many of the China's coal-fired power stations, which are often criticised for being "dirty" plants (CARMA, 2007; Davies & Morton, 2007).

The CO_2 emissions from New South Wales's coal-fired power stations are shown in Table 8 (below), along with the employment and production data. Together they emit 78 Mt annually.

Table 8: Coal-fired electricity generators in NSW and CO_2 Equivalent emissions (2006)

Power station (year commissioned)	**Employees**	**Production** (GWH)	**CO_2 e** **MT per year**
Hunter Valley region:			
Bayswater (1985/86)	320	18.5	18.32
Eraring (1982/4)	360	18.5	18.32
Liddell (1971/73)	230	14.0	13.15
Redbank (2001)	40	1.1	1.01
Munmorah (1969)	50	4.2	3.72
Vales Point (1978)	300	9.3	8.46
Total Hunter region	**1,300**	**65.6**	**62.98**
Elsewhere in NSW:			
Mount Piper (1992/3)	150	9.3	8.46
Wallerawang (1976/80)	175	7.0	6.35
Rest of NSW	**325**	**16.3**	**14.81**
Total NSW	**1,625**	**81.9**	**77.79**

Source: GWh derived from ESAA (2006). Employees from ABS, Labour Force Survey, August 2006; CO2e from Carbon Monitoring for Action, http://carma.org/plant (2007).

It is not just CO_2 pollution that is a concern relating to the operations of the Hunter Valley's power stations. Table 9 (below) identifies that concentrations of particular pollutants specifically associated with coalmining and coal-fired electricity power generation (e.g. sulphur dioxide, nitrogen oxides, fine particles) that are released in the environments of the coal communities of the Upper Hunter; they are significantly higher than the concentration of pollutants in the non-coal communities of Newcastle and Scone (National Pollutant Inventory, 2008). Concern about pollution is emerging as a new attractor in the Upper Hunter system[8].

Table 9: Concentrations of pollutants in four Hunter Valley communities

(National Pollutant Inventory, 2008.)

Pollutant	**Concentration (Kg/year) (and major source)**			
	Muswellbrook	**Singleton**	**Scone**	**Newcastle**
Ammonia	3,500 (electricity generation)	210	n/a	n/a
Arsenic and compounds	220 (Coal mining: 190 Electricity generation: 27)	200 (Coalmining: 190)	n/a	0.045
Boron and compounds	180,000 (Electricity generation: 630,000; Coalmining: 14,000)	7,200 (Electricity generation: 4,400; Coalmining: 2,800)	n/a	0.30
Carbon monoxide	8,500,000 (Electricity generation: 3,100,000 ; Coalmining: 3,300,000;	10,000,000 (Motor vehicles: 4,000,000; Coalmining: 3,900,000; Electricity	10,000 (Meat and meat product manufacturing)	510,000 (Motor vehicles: 410,000)

[8] It is not assumed that all the pollutants listed are dangerous to human health, or that the particular concentrations identified in the table signify danger to human health.

Pollutant	**Concentration (Kg/year) (and major source)** **Muswellbrook**	**Singleton**	**Scone**	**Newcastle**
monoxide	(Electricity generation: 3,100,000 ; Coalmining: 3,300,000; Motor vehicles: 1,100,000)	vehicles: 4,000,000; Coalmining: 3,900,000; Electricity generation: 150,000)	(Meat and meat product manufacturing)	(Motor vehicles: 410,000)
Cyanide (inorganic) compounds	7,100 (Electricity generation)	800	n/a	0.0054
Fluoride compounds	640,000 (Electricity generation: 630,000; Coalmining: 14,000)	35,000	n/a	0.44
Hydrochloric acid	2,800,000 (Electricity generation)	370,000	n/a	3.4
Lead and compounds	810 (Coalmining: 650; Electricity generation: 88)	1,500	n/a	8.8
Manganese and compounds	29,000 (Electricity generation: 720; Coalmining: 28,000)	37,000	n/a	1.2
Mercury and compounds	190 (Electricity generation: 170; Coalmining: 9.3)	28	n/a	0.038
Nickel and compounds	1,500 (Coalmining: 1,200; Electricity generation: 240)	1,400		0.50
Oxides of nitrogen	54,000,000 (Electricity generation: 49,000,000; Coalmining: 5,000,000)	9,500,000 (Coalmining: 8,300,000)	59,000 Meat and meat product manufacturing)	54,000 (Motor vehicles)
Particulates (fine)	20,000,000 (Coalmining: 18,000,000 Electricity generation: 2,100,000)	32,000,000 (Coalmining: 31,000,000 Electricity generation: 57,000)	1,600	10,000
Polychlorinated dioxins and furans	0.0025 (Electricity generation)	0.00074	n/a	0.000012
Selenium and compounds	15 (Coalmining)	410 (Electricity generation: 400)	n/a	0.061
Sulphur dioxide	130,180,000 (Electricity generation: 130,000,000 Coalmining: 180,000)	680,000 (Electricity generation: 420,000 Coal mining: 240,000)	n/a	1,700
Sulphuric acid	1,400,000 (Electricity generation)	2,500	n/a	n/a
Total Volatile Organic Compounds	1,100,000 (Coalmining: 420,000 Electricity generation: 250,000)	1,500,000 (Coalmining: 530,000)	10,000 (Mineral, Metal and Chemical Wholesaling: 8,700)	140,000 (Motor vehicles: 45,000)
Zinc and compounds	7,900 (Coalmining)	20,000		26

Human health distress: Respiratory diseases, solastalgia *and 'golden handcuffs'*

In 2005, a transdisciplinary team of researchers from the University of Newcastle, NSW, documented the link between ecological and human health distress. The study recorded higher incidences of respiratory diseases and depression than that occurring in other rural areas of the Hunter that were not being subjected to mining.

The study also found high levels of reported incidences of distress — articulated as grief at the rapid transformation of previously rural landscapes and lifestyles (Connor *et al*., 2004; Higginbotham *et al*., 2006).

This phenomenon of psychological distress caused by the degradation of landscapes and places of residence of individuals and communities was named *solastalgia* by Albrecht (2005), who described the syndrome as:

> The pain experienced when there is recognition that the place where one resides and that one loves is under immediate assault (physical desolation). It is manifest in an attack on one's sense of place, in the erosion of the sense of belonging (identity) to a particular place and a feeling of distress (psychological desolation) about its transformation. It is an intense desire for the place where one is a resident to be maintained in a state that continues to give comfort or solace (Albrecht, 2005: 45).

Even mineworkers are alarmed about the health impacts of their work. Among the region's mineworkers there is reference to the syndrome known as the "golden handcuffs" – a system of financial incentives that deliberately or unconsciously keeps an employee from leaving a job or company, even when they feel the job is undesirable or unhealthy. Many mineworkers feel trapped by golden handcuffs of high wages, but also high levels of mortgages and debt as well as isolating and unhealthy working conditions (Brown, 2007).

The average weekly wage of a mineworker in 2006–07 was $2,083 (NSW DPI, 2008: 294), considerably higher than the national average. One mineworker described the golden handcuffs dilemma that he believes many find themselves in:

> People who come from low-income jobs into the mining industry think that they are set for life and spend up big (e.g. on houses, cars and boats). When they find out the negative realities of the job (like not having the time to enjoy what they have spent their money on), they can't leave because they owe so much money. They then do all the negative things associated with people being in the wrong place at the wrong time – poor health, and family, social and community life. Loneliness and alienation from the community are big problems for many mineworkers (Brown, 2007).

A chronically disadvantaged region

In spite of its historic role as a "powerhouse of the NSW economy" (NSW DSRD, 2007), and being the place of residence of some of NSW's highest income earners, the Hunter Valley has been a chronically disadvantaged community with indicators of social wellbeing historically below Sydney and NSW averages. Unemployment levels in the

Hunter Valley have historically been higher than the NSW average. For example, in 2007–08, unemployment in the Hunter Valley was 5.1% compared to the NSW average of 4.6%. Employment levels and the rate of employment growth in the region tend to be more cyclical and volatile than the NSW average, reflecting the cyclical nature of coal industry's booms and busts (HVRF, 2008a).

In 2008, a mining industry-funded study of the cumulative impacts of coalmining in the Muswellbrook area, conducted by the Centre for Social Responsibility in Mining, identified adverse social changes including a gap between "haves" and "have-nots", increased noise and vibration, loss of visual amenity and decreased air quality. The research identified increased employment and wealth, mine expenditure expanding mine-related businesses, and increased knowledge of safety as claimed mining-related benefits (Brereton *et al.*, 2008). The report was criticised by the Upper Hunter environmental group, Minewatch, for not considering health impacts of mining on local communities (Kelly, 2008a)

Upper Hunter residents are organising politically to demand government investigate the health impacts of the coal industry, and have called for a public health study to be done (Harris, 2009; Kirkwood, 2009a; Singleton Argus, 2009). The health threat confronting residents is graphically depicted below (Figure 12) by Peter Lewis.

Figure 12: Breathtaking air quality in the Upper Hunter Valley

(Courtesy: Lewis, *Newcastle Herald*, 13/4/2009.)

The NSW Government responded to calls for an inquiry by stating it would not conduct a study (or even install a dust monitor in Singleton) on the grounds that the town's population had not reached 25,000. In response, Singleton medical general practitioner, Dr Tuan Au, declared in March 2009, that he would fund his own independent study. Dr Au stated:

> My patients have children who develop upper airways disease or asthma and they go on holidays or move away for a while and the symptoms ease or go away and then they return and they come back again (Au, in Kirkwood, 2009a).

Water: a limit to coal industry growth?

Along with human health issues, water security reflects the impact of coal dependency on the sustainability of the Hunter Valley socio-ecological system's current *Carbon Valley* status. Water is predicted to become an increasingly scarce, contested and limiting resource in the region as climate change impacts grow (CSIRO, 2007a). Coalmines and power stations are the two biggest single users of Hunter River water.

Farmers have stated that the region's rural ecosystems, and the cultural economic diversity linked to them, are threatened by the convergence of the twin perils of coal industry expansion and climate change. Many farmers are finding their businesses threatened by the coal industry's threats to rivers, creeks and aquifers (Figure 13), and are concerned about their inability to compete for water in open-market conditions with cashed-up mining companies or under current government water allocations that prioritise coal-fired power stations (Newell, 2005; Frew, 2006; Thompson, 2007; Upper Hunter Winemakers Association, 2007).

Figure 13: Community alarm about mining impacts on water grows

A sign at Glendonbrook, Hunter Valley (Photo: Lee Rhiannon).

Horse Industry

The coal industry is seen as a threat to the Hunter Valley's thoroughbred horse breeding industry, which also is oriented towards global markets. The Hunter Valley thoroughbred horse industry had a turnover of $430 million in the first six months of 2006, and, along with Kentucky, USA and Newmarket, UK, is one of the three major thoroughbred horse breeding regions of the world (Hunter Valley Thoroughbred Horsebreeders Association Inc 2007: 3).

In 2007 the Upper Hunter Thoroughbred Breeders declared their concern about the sustainability impacts of the coal industry and called for a moratorium on new mines, a cap on coal exports, and an inquiry into the impacts of the coal industry on the long-term environmental, economic and social sustainability on other industries and the region generally, stating:

> The horse-breeding industry needs quality grazing land in a pleasant environment with reliable water and clean air. The scale of coalmining in the Hunter, and the number of new mine proposals and mine extensions, have reached such an extent that the sustainability of the Hunter thoroughbred industry is threatened and an industry that is an historic part of the Hunter's beauty and diversity may be forced from the area (Hunter Valley Thoroughbred Horsebreeders Association Inc 2007: 2.).

Wine Industry

Upper Hunter Valley winegrowers have also called for a moratorium on new mines, believing that wine tourism is not compatible with coalmining. New mines, such as the Anvil Hill mine (now renamed Mangoola by its new owners, Xstrata) have bought out vineyards and wineries adjacent to, or within, their proposed operations, leading to the closure of several wineries and threatening the critical mass of wineries needed by the Upper Hunter winemakers to market themselves as a distinct wine subregion (Upper Hunter Winemakers, 2007).

In a statement to a public meeting on the proposed Anvil Hill mine at Marrickville Town Hall, Sydney on 22 June 2007, a speaker representing the Upper Hunter Winegrowers stated that:

> The Hunter Valley is being swamped by mines, and as more mines open up they inevitably take over land that was previously used for other activities. We are now witnessing the reduction of critical mass of vineyards in the Upper Hunter as the Anvil Hill development buys up vineyards in and around the mine site. This threatens the viability of our industry and reduces the attraction of the area to tourism. There are now many hundreds of square kilometres of beautiful Hunter Valley land that has been dug up in the insatiable thirst for coal (Upper Hunter Winemakers Association, 2007).

The map below (Figure 14) shows the close proximity of the Upper Hunter Valley mines with the region's horse-breeding and wine growing industries, and the proximity of these industries to the Hunter River and its tributaries.

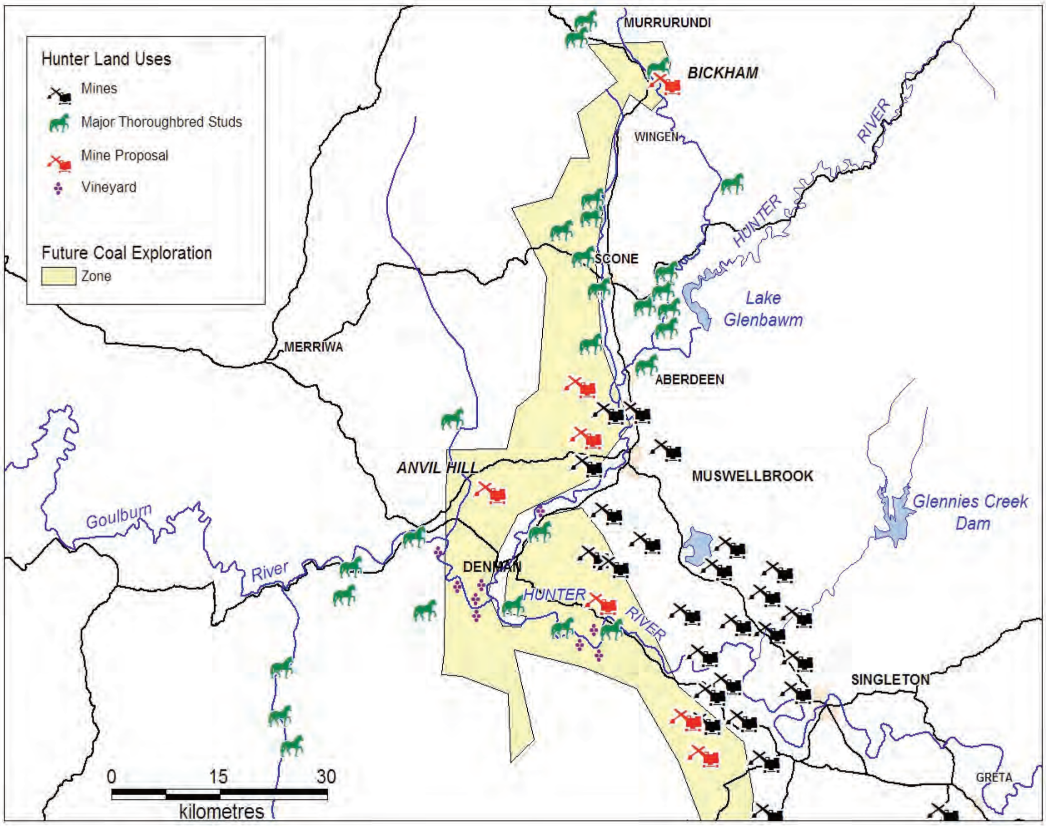


Figure 14: Mines encroach on horse studs and vineyards in the Upper Hunter

(Courtesy: Ecosystem Health Research Group, Rey-Lescure, 2007.)

The calls of farmers for a moratorium on coal industry expansion have been supported by some local governments in the region, such as Newcastle and Singleton (Newcastle City Council, 2006; Singleton Shire Council, 2006), by local residents and environmental organisations (such as Minewatch, the Hunter Environment Lobby and Rising Tide), as well as national and international organisations, including the NSW Conservation Council and Greenpeace (Hunter Environment Lobby, 2003; Anvil Hill Alliance 2005; Hunter Community Environment Centre, 2006; Greenpeace Australia Pacific, 2006).

Even the Hunter's major regional newspaper, the pro-business *Newcastle Herald*, published a lengthy series of exposés about the ecological and social impacts of the region's coal industry in 2005 (Ray, 2005 a-g). In November 2008, the *Newcastle Herald* published an editorial entitled "Energy Revolution" proposing that:

> Australia's days of near-total reliance on massive centralised electricity generation systems must surely be numbered. As more information comes to light about the environmental effects and health risks from huge thermal power stations the idea of building more big coal-fired generators becomes less appealing.… It can be argued that the advent of greatly improved renewable energy technology presages the next stage of transformation (*Newcastle Herald*, 2008b).

3.7 Manufacturing coal dependency

Faced with the challenge of growing pressures from community concern about climate change, locally and globally, the coal industry is doing its best to promote its resilience by "managing" system drivers (drivers being the dominant and emergent influences upon a system). Two of these strategies, political influence-peddling and the NSW Government's royalty addiction, are briefly discussed below.

Australia's "Greenhouse Mafia"

The Australian Industry Greenhouse Network (AIGN) describes itself as "a network of industry associations and individual businesses which contribute to the climate change policy debate and see value in joint industry action on climate change in order to promote sustainable industry development" (AIGN, 2008). Members of the AIGN include the industry associations of Australia's most carbon-intensive industry sectors the Australian Coal Association, Australasian (Iron and Steel) Slag Association, Australian Aluminium Council, Australian Industry Group, Australian Institute of Petroleum, Australian Petroleum Production and Exploration Association, Australian Plantation Products and Paper Industry Council, Australian Trucking Association, Cement Industry Federation, Federal Chamber of Automotive Industries, Minerals Council of Australia, and the National Association of Forest Industries.

During the tenure of the Howard Government (1996–2007), members of the AIGN referred to themselves as the "Greenhouse Mafia", and had enormous success in influencing government policy (Hamilton, 2007; Pearse, 2006, 2009).

Guy Pearse (2006, 2009), who refers to the Greenhouse Mafia as the "carbon lobby", worked for the Howard Government's Minister for the Environment as a policy adviser, a position that gave him the opportunity to observe first-hand how the AIGN used its privileged access to government policy- and decision-making processes to ensure policy-settings were favourable to its interests, and thereby engineer the resilience of the carbon-intensive industries to withstand shocks from regional, national and global ecological, social, economic and political pressures, particularly those emanating from global conventions such as the Kyoto Protocol – which the Howard Government refused to ratify.

Not only is the AIGN credited with convincing the Howard Government to refuse to sign the Kyoto Protocol, it also successfully lobbied for low emission-reduction targets, generous subsidies to research and development of so-called "clean coal" and carbon capture and storage (CCS) technologies, and for a very low mandatory target for renewable energy (Hamilton, 2007; Pearse, 2006, 2009).

The AIGN has continued to actively lobby the Rudd Government since its election in November 2007, making extensive submissions to the government's carbon emissions trading policy development process (along with other industry groups) that have advocated delaying action, market-based approaches, and generous subsidies that protect carbon-intensive industries. The Greenhouse Mafia has succeeded in ensuring that the Rudd Government's Carbon Pollution Reduction Scheme policy has a very low emission-reduction target linked to global initiatives, rather than being a global leader; in fact, leading a race to the bottom. The lobby also succeeded in gaining $3.9 billion of dollars worth of free permits to coal-fired power generators and other carbon-intensive industries (Australian Government Department of Climate Change, 2008b). There is a strong possibility that the level of handouts will be raised even further to subsidise coal exporters.

The Rudd Government has also heavily committed to support carbon capture and storage technologies through:

- development of a new legal framework for carbon capture and storage through the Offshore Petroleum Amendment (Greenhouse Gas Storage) Act
- provision of $500 million over eight years through the National Low Emissions Coal Fund
- annual funding of up to $100 million a year towards a new Global Carbon Capture and Storage Institute (Rudd, 2009c).

Clearly, the coal industry and its Carbon Lobby allies have been effective at manufacturing a perverse resilience for their industries and temporarily stalling a rapid shift to clean energy systems, irrespective of whether the national government is Liberal or Labor-led.

Royalty addiction

Coal exports from NSW were valued at $6.2 billion in 2006–08, and the NSW Government collected more than $840 million last financial year from coal royalties, most of it from the Hunter and Gunnedah basins. Increases in royalties announced in the November 2008 state budget, together with generally higher prices, could raise the annual total to about $1.5 billion (Kirkwood, 2008). However, the proposal was for increased royalty to only relate to coal worth more than $100 per tonne, and since then prices have fallen significantly, so royalty projections would have declined accordingly.

Royalty increases are fiercely opposed by the NSW Minerals Council, but given qualified support by the miners' union, the CFMEU M&E, whose General Secretary, Peter Murray, declared that:

> Some of this additional money should be used to address problems in over-stretched coal mining communities (Australian Mining, 2008).

The Australian Government earns many millions more from taxes paid by coal corporations and mineworkers. The high level of dependence on coal incomes is a powerful driver for government patronage of the coal export industry. The relative priority the New South Wales Government gives to the financial drivers for coal dependency over social in the regional panarchy are depicted in the cartoon below (Figure 15) by Peter Lewis.

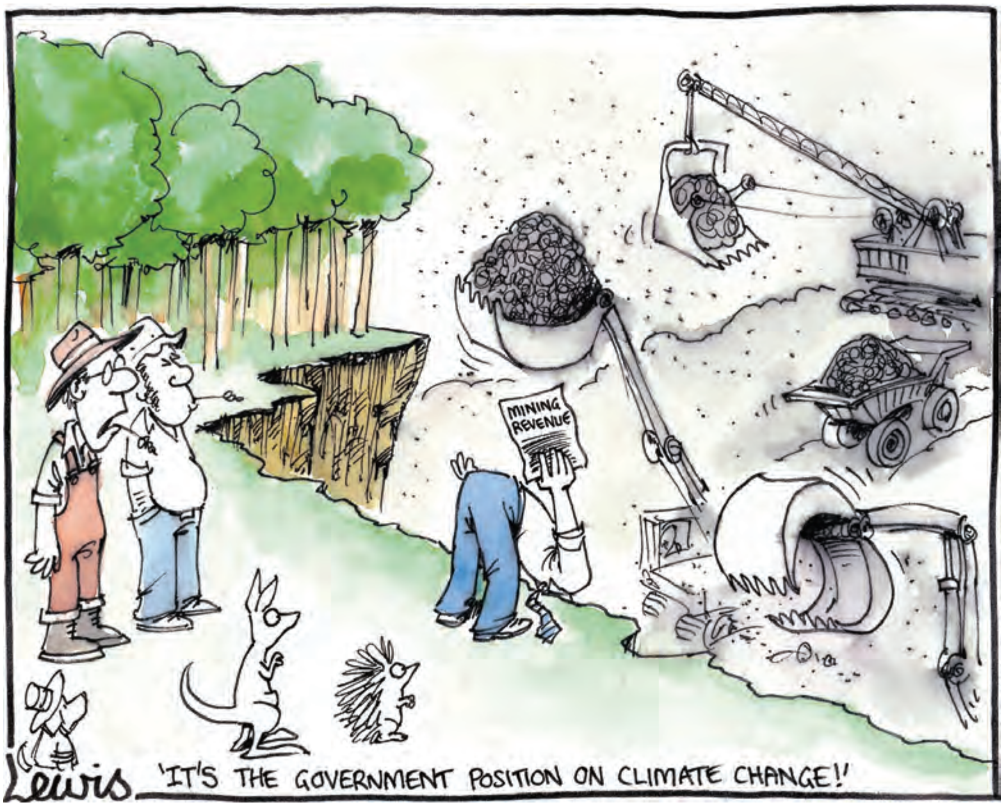


Figure 15: A powerful driver of coal dependency on coal in the Hunter

(Courtesy: Lewis, *Newcastle Herald*, 2/3/2008.)

3.8 Breaking New South Wales out of coal dependency

The New South Wales Government's energy policies threaten to lock the state into coal dependency for the next few decades, well beyond when the rest of the world is likely to shift to clean energy.

There are two main drivers for this trajectory: claims that energy demand will grow and that baseload power generating capacity will need to be expanded and that this can only be met by coal or gas; and, attempts to privatise the energy sector.

The NSW Government derives its energy demand projections from the Owen Inquiry that it commissioned in 2007, which suggested that there might be a potential energy generation shortfall of 2,500 GWh in 2013–14, which was expected to rise to 11,600 GWh by 2020 (Owen, 2007). The NSW Government therefore proposed an expansion of three of the state's largest coal-fired power stations at Mt Piper (near Lithgow in the Western coalfield) and at Bayswater and Eraring (in the Hunter Valley), as well as upgrading the Munmorah power station, which is also in the Hunter Valley. The NSW Government claims the expansions and upgrades may be either coal or gas, but either option will increase greenhouse gas emissions, and lock in fossil fuel dependency for decades.

Rutovitz and Dunstan (2009), however, challenge these forecasts, suggesting they have since been substantially revised downward. They note that the projected shortfall may now only appear in 2017, and by 2020 reach only 3,800 GWh, because additional renewable generation has been included to take account of the national Renewable Energy Target (RET) for 20% renewable electricity by 2020. Furthermore, they assert that projections for energy consumption are reduced due to lower projected economic growth[9].

Rutovitz and Dunstan (2009) indicate how this revised energy shortfall would disappear if moderate energy efficiency measures are put in place. Indeed, they suggest that, rather than an energy shortfall, there is the possibility of a surplus of electricity generation potential of more than 12,000 GWh by 2019–20 if:

- energy-efficiency measures, such as more efficient commercial lighting, and industrial and residential energy efficiencies are undertaken
- 700 MW of cogeneration is put in place
- 50% of the Snowy Mountains Hydro-Electric Scheme output is available to NSW
- a 12.5% proportion of Australia's expected growth in scheduled renewable energy investment occurs in NSW (Rutovitz & Dunstan, 2009: v).

The NSW Government's *Energy Reform Strategy* also attempts to lock in fossil fuel dependency in a partial privatisation that proposes contracting the electricity trading rights of government-owned power stations to the private sector (referred to as the generation trader or "Gentrader" model), selling the retail arms of Energy Australia, Integral Energy and Country Energy, and selling power-station development sites around the state. The strategy makes absolutely no mention of climate change and fails to incorporate any drivers that might ensure that any new power generating infrastructure will be renewable energy technologies, or that existing generating infrastructure will be amortised over time to create a transition from coal to clean energy (as either state-owned, public–private, or private ownership).

The government was forced by a strong community/trade union campaign to maintain public ownership of existing power stations and of electricity transmission and distribution networks, and so it sought to privatise by stealth. While the strategy suggests that the generators would continue to invest in their power stations to improve reliability, increase productive capacity, improve plant safety and extend the life of the plant – without any requirement that they reduce greenhouse gas emissions, other than those imposed by the market through the federal government's emissions trading scheme. The NSW Government will sell potential power-station development sites currently owned by its electricity businesses with buyers of the sites locked into a "use it or lose it" provision that would obligate them to build new power stations within reasonable and commercial timeframes, or risk having the site/s returned to NSW Government ownership to be sold to another private sector interest (NSW Government, 2009: 3)

---

[9] Rutovitz and Dunstan (2009) use figures from the 2007 and 2008 *Transgrid Annual Planning Reports*, which are the basis of the Owen report (Transgrid 2007) and the current projection (Transgrid 2008).

The strategy suggests that generators would contemplate options for retrofitting their power stations to help manage their exposure to carbon costs; for example, by investing in CCS technology (NSW Government, 2009: 20). However, the strategy abrogates any role for the NSW Government for driving new power-generating plant development, or repowering existing power stations, as renewable energy generators (e.g. through solar thermal technologies).

Strong community campaigns will be needed to stop this lock into fossil fuels and to force the government to use the reform process to rebuild the system around renewable energy. A policy report, *Meeting NSW Electricity Needs in a Carbon Constrained World* (Rutovitz and Duncan, 2009), provides a strong factual base for such a campaign. Rutovitz and Duncan identified five scenarios for NSW energy reform, described below (also Figure 16):

- **Scenario A. Coal**: a coal-fired power station comes online in 2017–18, followed by additional open-cycle gas turbines (OCGT) from 2018–19. This is the closest to the scenario suggested by the Owen Inquiry, although the investment date suggested in Owen was earlier and the energy shortfall greater. Cost: $30.7 billion.
- **Scenario B. Gas**: a combination of OCGT and combined-cycle gas turbines is used to meet capacity shortfalls as assumed in the 2008 National Electricity Market Management Company (NEMMCO) projections. Cost: $29.8 billion.
- **Scenario C. Cogeneration and demand-side response**: the shortfall in capacity is met by a combination of cogeneration and demand-side response.
- **Scenario D. Energy efficiency and demand-side response**: the shortfall in capacity is met by a combination of energy efficiency and demand-side response.
- **Scenario E. Combined Distributed Energy**: the measures identified in the report (energy efficiency, cogeneration, and demand-side response) are all adopted, and coal-fired power capacity is reduced by 1,000 MW in 2014–15. Cost: $29.3 billion (Rutovitz & Dunstan, 2009: vii).

The costs and greenhouse-gas emissions of the five scenarios are shown in Figure 16 below. The *Coal* scenario, building a new coal-fired power station, would be both the most greenhouse-intensive option and the most expensive ($30.7 billion cumulative cost). The *Gas* scenario is the next most expensive at $29.8 billion, while all three *Distributed Energy* scenarios are cheaper, ranging from $26.8 billion to $28.3billion. The *Combined Distributed Energy* scenario (Scenario E), has the lowest greenhouse-gas emissions, with an annual saving by 2020 of 7 Mt compared to the gas scenario, and also costs $0.5 billion less than the *Gas* scenario (Scenario B). This scenario costs $1.5 billion less than building a new coal-fired power station and produces 8.4 Mt less greenhouse emissions. The *Energy Efficiency and Demand-side Response* scenario (Scenario D) has the lowest cost, saving about $620 million per year, or about $60 per household in 2020 when compared to the *Coal* scenario (Scenario A). It also saves 2.9 Mt of CO_2 in 2020. The key component of the cost savings is the savings on network infrastructure augmentation.

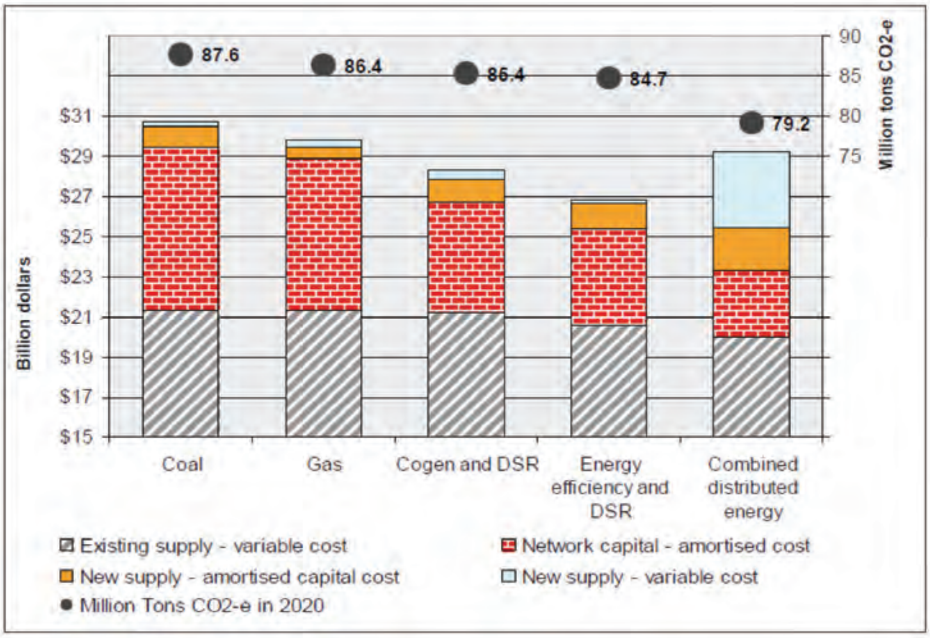


Figure 16: Cumulative cost and annual greenhouse emissions of five NSW energy scenarios up to 2020

(From Rutovitz & Dunstan, 2009: vii.)

Conclusion

Indigenous socio-ecological relationships prevailed in the Hunter Valley for tens of thousands of years, based on autonomous tribes and clans that lived sustainably within the limits of the region's natural resources and ecosystem services. Following British settlement the dominant scale of the Hunter Valley's social networks and economy shifted from a bioregional scale to the global scale as the region's natural resources and ecosystem services became increasingly integrated into global commodity markets and capital flows. As the scale of ecological and human distress syndromes grows it is apparent that this globalised socio-ecological arrangement, in which the region's coal resources are a powerful attractor, is increasingly non-sustainable – and is likely to become even more so as the impacts of climate change grow.

Australian governments, and Hunter Valley business and media interests such as the *Newcastle Herald*, have been celebrating a resources boom, which is credited with having been the backbone of the national and regional economy for the last decade.

However, Richardson (2009) issued a note of caution about how the benefits to governments and the general community of the post-2004 minerals boom (of which Hunter Valley coal export was a significant contributor) may well have been overstated. Richardson argued that only a fraction of increased government tax revenues during the period can be attributed to the mining boom. A large part of the extra income generated was spent by mining companies on increased capacity and few wage earners beyond the immediate mining industry actually enjoyed increases in incomes. Increases in company profits were largely expatriated because so much of the industry is overseas owned. The boost in national income from minerals exports had a damaging impact on other sectors of the economy through increases in interest rates and exchange rates, and gains in resource stocks have been largely wiped out by the 2008 global financial crisis. While the direct benefits may be overstated by minerals industry and government "spin", some direct and downstream economic benefits need to be acknowledged and balanced against costs. However, as regional ecosystem and social distress in mining regions such as the Hunter Valley increase, and climate change impacts intensify, there is growing pressure for regions to move beyond the fossil fuel-based and quarry economy of *Carbon Valley,* to a more sustainable socio-economic system.

Restoration of sustainability to the Hunter Valley therefore requires that the relatively rapid rise in the influence of coal as an attractor in the region's socio-ecological system declines over the next 30 years. Rutovitz and Dunstan (2009) show that this is entirely possible and that over the next few decades the NSW Government's coal dependency, at least for electricity generation, could be ended. This would create the foundation for a potential pathway to an alternative *Future Beyond Coal,* discussed further in later chapters of this thesis. The following chapter discusses key theoretical concepts of sustainability that could inform such a future.

Chapter 4

Approaches to Sustainability

The definitions and approaches to sustainability are examined in this chapter, along with the philosophies that inform them, including the influence of anthropocentric and eco-centric thinking, the concepts of *strong* and *weak* sustainability, and principles of ecologically sustainable development. The relationship of sustainability to two different types of justice – *ecological justice* and *environmental justice* is also discussed. The role of sustainability indicators is also considered, particularly with respect to their relevance to a region such as the Hunter Valley, and to the mining industry generally.

4.1 The emergence of the 'sustainability' concept

The concept of sustainable development emerged in modern political and social policy discourse in the second half of the 20th century, inspired by earlier writings of people such as Henry David Thoreau (1893), John Muir (1911) and Aldo Leopold (1949) about the importance and magnificence of nature and ethical relationships of humans to the land. Early perspectives on sustainability also emerged from analysis of exposure of the harmful impacts of human activities on ecosystem health, overpopulation and ecological limits by researchers and writers such as Rachel Carson (1962), Paul Ehrlich (1968) and Barry Commoner (1971). The environmental social movement that emerged during the 1960s and 1970s achieved some significant public policy and institutional changes to increase environmental protection, including adoption of laws by governments in the US, UK, Australia and elsewhere regarding air and water pollution, and for protection of public health from environmental threats. Local environmental advocacy organisations such as Minewatch in the Hunter Valley, and global organisations such as Greenpeace, Friends of the Earth, and the World Wildlife Fund became influential agents within social policy discourses and activist networks spanning local and global scales.

The publication of the Club of Rome report, *Limits to Growth* (Meadows *et al*., 1972), was influential in raising the need for a transformation of social and economic development away from exponential growth of human population and consumption, and argued that human economic activity had to be cognisant that the world is of finite size, with limits on its capacity to provide resources and absorb wastes.

Publications such as *A Blueprint for Survival* (Goldsmith, 1972), *Small is Beautiful: Economics as if People Mattered* (Schumacher, 1973), *Animal Liberation* (Singer, 1974), and *Gaia: A New Look at Life on Earth* (Lovelock, 1979) were "calls-to-arms" by the environmental movement for social and economic transformation to sustainable societies, and provided intellectual grounding and political inspiration to the emerging social movement (and to this researcher).

The movement then, as now, reflects a wide range of political positions ranging from advocacy of a stewardship of the environment within the current social system

(Passmore, 1974; Nash, 1989), to advocacy of a "natural" capitalism (Hawken, Lovins & Lovins, 1999; Porritt, 2007), to radical social change advocates which include social ecologists such as Murray Bookchin (1962, 1971, 1982), eco-socialists and green philosophers such as Barry Commoner (1971) and Rudolph Bahro (1982), eco-feminists (Merchant, 1980; Mies and Shiva, 1992; Plumwood, 1993), and deep ecologists Arne Naess (1984, 1986), Devall and Sessions (1985), John Seed and Joanna Macy (1988), with each environmental philosophy promoting an alternative set of ethics and values regarding human-human and human-environment relationships that their advocates believe will move socio-ecological systems to sustainability.

Ecological economists, such as Georgescu-Roegen (1971), Daly (1977), Costanza (1989, 1991), Martinez-Alier (1990), and Daly and Townsend (1993), have also been influential in identifying that economic theory needs to be compatible with laws of nature (such as thermodynamic laws), and with a steady-state, low entropy economy proposed by Daly (1977, 1980) as an economic model that could support social and environmental sustainability, in contrast to the growth-dependency of contemporary capitalism. Ecological feminists such as Val Plumwood (2002), Vandana Shiva (1989) and Ariel Salleh (2009) emphasise that the relationships between society and nature, and society and exploitation of women, reinforce the non-sustainability of the current dominant patriarchal paradigm of capitalism.

The World Commission for Environment and Development (WCED) was established by the United Nations General Assembly in 1983. The WCED, established through Resolution A/38/161, had the following terms of reference (United Nations General Assembly, 1983):

> (a) To propose long-term environmental strategies for achieving sustainable development to the year 2000 and beyond.
>
> (b) To recommend ways in which concern for the environment may be translated into greater co-operation among developing countries and between countries at different stages of economic and social development and lead to the achievement of common and mutually supportive objectives which take account of the interrelationships between people, resources, environment and development.
>
> (c) To consider ways and means by which the international community can deal more effectively with environmental concerns, in the light of the other recommendations in its report.
>
> (d) To help to define shared perceptions of long-term environmental issues and of the appropriate efforts needed to deal successfully with the problems of protecting and enhancing the environment, a long-term agenda for action during the coming decades, and aspirational goals for the world community.

The WCED report *Our Common Future* identified a theoretical and programmatic framework for international action on sustainability, and developed the definition of sustainable development which has become widely used by governments, industry and academics, namely that:

> Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987: 43).

The WCED report was followed by the United Nations Conference on Environment and Development (UNCED), the Earth Summit, held in Rio de Janeiro, Brazil in 1992, and a follow-up Summit in Johannesburg in 2002.

The Rio Earth Summit was another landmark moment in sustainability policy-making at the international government level, and resulted in agreements which have had a powerful influence on contemporary sustainability practices, including the *Rio Declaration on Environment and Development, Forest Principles, Agenda 21, the Convention on Biological Diversity* and the *Framework Convention on Climate Change* (which led to the Kyoto Protocol). All were established as legally binding agreements on national governments that signed them.

Agenda 21 called on all countries of the world to undertake a comprehensive process of planning and action to attain sustainability, including a role for cities and regions and for non-government organisations. Chapter 28 of *Agenda 21* (known as *Local Agenda 21*) provides a policy framework for a potentially powerful role for "bottom-up" initiatives, from communities such as the Hunter Valley, to drive the shift to sustainability at the local level that complements, extends, and also can challenge, initiatives driven from the 'top-down' by governments (Cotter *et al.,* 1999).

4.2 Contested pathways to sustainability

The WCED definition of sustainable development is just one of many definitions of sustainability. Basiago (1995) identified over 50 definitions of sustainable development with varying emphasis on ecological, sociological, economic, planning, ethical and methodological domains. Holmberg and Sandbrook (1992) identified 70 definitions, while Fowke and Prasad (1996) identified at least 80. This diversity of often competing definitions indicates that sustainability is an ambiguous and dynamic concept, and one that is contested by various people and institutions that promote a definition of the concept that is skewed to their self-interest.

Ultimately, the critical test of sustainability is not about the various meanings given to the concepts within academia, by industry, public policymakers or politicians, but by what is actually 'sustained' or, as the *Collins English Dictionary* (2000) defines it: "continued or prolonged for an extended period or without interruption".

Three fundamental debates inform different perspectives on strategies for achieving sustainability. They are:

- the relative emphasis that should be given in notions of sustainability to human–centredness (anthropocentrism) or to ecological-centredness (ecocentrism)

- *weak* or *strong* sustainability
- the types of political institutions (particularly the relative role of markets or state regulation) and citizenship needed to achieve sustainability.

The debate between anthropocentrism and eco-centrism is over whether humans are just another species within a biocentric egalitarianism, or whether humans are somehow separate (and above) nature and that human affairs should be organised primarily around managing the environment to meet human needs (Singer, 1977; Eckersley, 1992; Murdy, 1994; Guthrie, 1994; Norton, 1994; Routley & Routley, 1995; Carter, 2001; Lovelock, 2006).

The debate about political institutions and citizenship needed to create sustainability, including the potential roles of markets and regulation as key drivers of sustainability, extends into whether green authoritarianism, a variation of liberal democracy, or an alternative *participatory ecological* democracy is needed to establish sustainability (Chatterjee & Finger, 1994; Doherty & de Geus, 1996; Karliner, 1997; Paterson, 2000; Dobson, 2003; Paehlke, 2003; Eckersley, 2004; Shiva, 2006; Elliott, 2004; Lipschutz, 2004a; Dryzek, 2005; Clapp & Dauvergne, 2005; Beder, 2006; Dobson & Eckersley, 2006; Dobson, 2007).

The debate between advocates of *weak* and *strong* sustainability reflects different views about substituting “natural capital” with “manufactured capital”. Advocates of weak sustainability argue, from an anthropocentric philosophical position, that the integrity of ecosystems, ecosystem services (including biodiversity) and natural capital does not need to be sustained if it can be substituted for man-made capital and converted into commodities, machines, financial capital and human services (Pearce & Atkinson, 1995; Neumayer, 2003).

Weak or strong sustainability

There are two broad types of natural capital: non-renewable natural capital, which includes fossil fuel and mineral deposits; and renewable natural capital. Non-renewable natural capital does not renew itself within a timescale close to the rate that humans use them. Renewable natural capital, in contrast, includes ecosystems and living entities and processes, which are active and self-maintaining using energy from the sun and the Earth’s core (Ayres *et al.*, 1996: 5). In principle, renewable natural capital can be used sustainably.

There is a wide range of views about the necessary balance between weak and strong sustainability, regarding the extent to which natural capital can be transferred into human capital while still maintaining potential for sustainability.

Neo-classical economists do not accept that natural capital is a finite resource whose very finiteness imposes natural limits on economic growth. Instead, neo-classical economists, such as Simon (1981) and Solow (1993), propose that continuous economic growth is possible because production, consumption and trading for human needs can be expanded indefinitely by the ever-increasingly efficient use of energy and materials, and by having the proceeds from resource extraction reinvested in people and more efficient machines (Solow, 1993; Hartwick, 1977; Dasgupta & Heal, 1979).

Solow (1974) proposed the ethics of weak sustainability, when he stated that "earlier generations are entitled to draw down the pool (optimally, of course!) so long as they add (optimally, of course!) to the stock of reproducible capital" (Solow, 1974: 41).

Advocates of strong sustainability, such as Daly (1991), Costanza (1991), Daly and Townsend (1993), Wackernagel, and Rees (1996), and Gowdy (1999), argue from an eco-centric philosophy that ecological integrity and ecological services are the foundations of life for humans and other living things and that, rather than being traded away as "capital", they must be maintained and passed on to future generations of humans and other species as their foundation for sustainability.

There is potential for some substitution between human and manufactured capital and among various forms of natural capital, while still maintaining ecological integrity and ecosystem services. However, some ecosystem services are irreplaceable, and therefore should never be jeopardised (Ayres, *et al*., 1996: 15).

Pearce and Atkinson (1993) attempted to articulate a balance by arguing that sustainability is possible if there is a net accumulation in savings in human-made capital (including knowledge and health) that is greater than the combined depreciation of human-made and natural capital.

Exploring the limits of two opposing paradigms of weak and strong sustainability, Neumeyer (2003) argues that natural capital that serves a life-supporting function for human beings cannot be substituted, and that the precautionary principle must be used as a powerful constraint on development initiatives to reduce this risk. Furthermore, he argues that sustainable development is compatible with strong sustainability, but achieving it would entail lower material flows and probably smaller scale national economies.

Albrecht (2001) identifies the ethical dimension of the debate between strong and weak sustainability, and proposes an ethical framework that links "the good" to realising and maximising latent human potential within actual living and sustainable ecosystems (Albrecht, 2001: 251). He argues that such an ethic offers anthropocentric benefits within a larger eco-centric structure.

The contest and contradictions between weak approaches to sustainability favoured by neo-liberal economists are reflected in the policies of significant global organisations, such as the Earth Summit, the World Trade Organisation, the World Bank and the World Business Council for Sustainable Development (Mebratu, 1998). These global governance institutions tend to emphasise the primacy of achieving social and economic goals, often defining sustainability in terms of eco-efficiency or ecological modernisation, rather than as a condition in which there is genuine ecological sustainability (Hajer, 1997; Langhelle, 2000).

The policies of the Australian Government and the NSW State Government reflect contradictory positions regarding sustainability, which thereby allow them to accept the fossil fuel economy of the Hunter Valley as compatible with sustainable development. The scale and character of development in the Hunter Valley is championed by the local media, as exemplified by a celebratory article in the *Newcastle Herald* in March 2009:

> In a boost for the job security of 10,000 Hunter mineworkers, the region's two biggest coal companies have sealed supply deals worth at least $9 billion in Japan. Union and industry leaders said yesterday's settlements between Rio Tinto and Xstrata and Japanese power station operator Chubu had improved the Hunter's chances of riding out the global economic storm (*Newcastle Herald*, 2009).

The goal of short-term job creation and export income is promoted as sufficient justification for expanding coalmining and locking in coal-fired power generation, even as environmental and climate science demonstrate growing threats to natural capital and ecological integrity at regional and global scales from coal dependency.

The extreme consequences of weak sustainability are graphically exemplified by the destruction of the Pacific Ocean island nation of Nauru whose environment (and natural capital) was destroyed as it was supposedly transformed into human capital in the form of income from phosphate exports. Tragically for the people of Nauru, the human capital has subsequently been frittered away in ill-advised investments leaving them with neither human nor natural capital (Gowdy & McDaniel, 1999).

The diagram below (Figure 17) shows where mining and different stages of mineral use sit in the spectrum of weak and strong sustainability. It shows mining at the weak end of sustainability while avoidance, reuse and recycling are at the stronger end. In this context energy efficiency represents strong sustainability while renewable energy with reuse and recycling of materials also sits at the strong end of the spectrum.

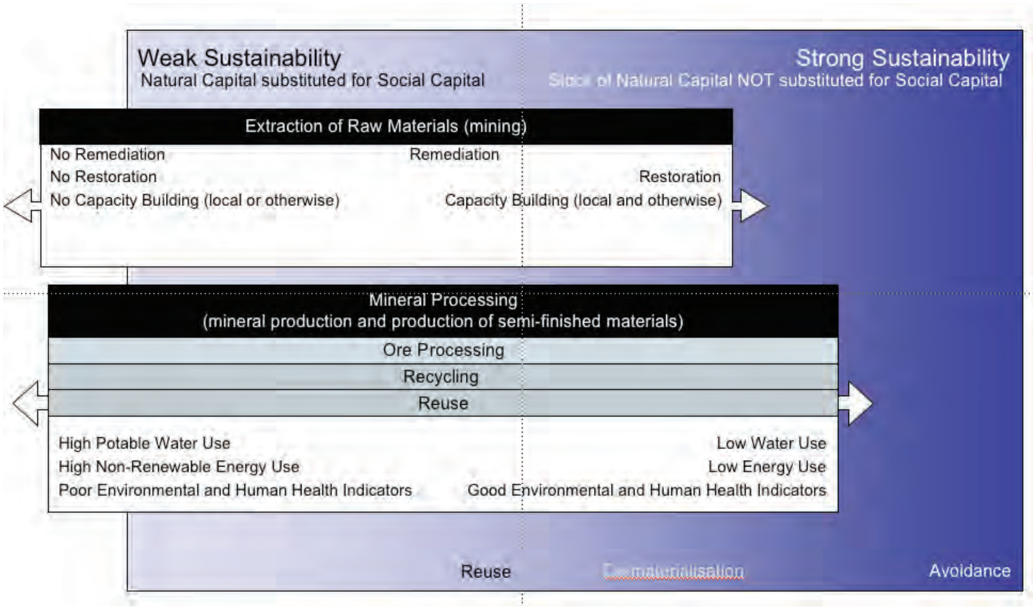


Figure 17: Mining and minerals use of the weak strong sustainability spectrum

(From Giurco, Evans *et al.*, 2009a.)

4.3 Sustainable development: Going beyond rhetoric

The vagueness of the concepts of sustainable development and sustainability enables them to be adopted by institutions driven by diverse values and political agendas.

Johnston (2006) reminds us that discourses about development and sustainability do not emerge out of some "ethereal mist", but emerge as hegemonic and counter-hegemonic struggles that reflect vested interests and are based on dialectical relationships between social actors with material and cultural realities and institutional form (Johnston, Gismondi & Goodman, 2006: 13).

Dryzek (1997) uses discourse analysis to interpret the various assumptions on which sustainability discourse is based. He notes how powerful corporations and governments, who see their interests threatened by established or emerging discourses around sustainability, have tried to co-opt the sustainable development discourse and have "wrapped themselves" in the language of environmentalism and sustainability, while using the concept to actually mean maintaining their profitability and economic growth (Dryzek, 1997: 11).

Other researchers, such as Stauber and Rampton (1995), Rowell (1996), Greer and Bruno (1996), Karliner (1997), Beder (2000) and Hager and Burton (1999), have exposed how industry and governments have used various public relations strategies, including "greenwashing", fear-mongering and scapegoating of the environment movement to demonise and scare citizens and governments away from enacting strong environmental protection, and thereby shift the economic paradigm towards strong sustainability. At the same time they have portrayed themselves as committed to environmental protection and sustainable development while essentially continuing business-as-usual.

Indeed, many governments and corporations suggest they are "on the journey" to sustainability, even though their actions are predominantly non-sustainable and their posturing and motives often cynical (Welford, 1997, 2000, 2001; Karliner, 1999; Beder 2000). Milne *et al* (2006) cite the example of Alcan (owner of Tomago Aluminium, the largest smelter in the Hunter Valley, and taken over by Rio Tinto in 2007) who in their 2002 Sustainable Development report, entitled *Our Journey,* declared:

> Sustainability is not a destination. It is a continuing journey of learning and change. Our values serve as our compass. Our stakeholders provide insights about the best possible routes to travel and ways to make the journey valuable for all who are involved. Our business systems – the combination of our policies, commitments, management systems and metrics – help us define our path and measure progress along the way (Alcan, 2002: 17).

Referring to sustainability as a journey is misleading as it expresses a notion of a never-ending expedition to a non-specific destination, yet it seeks to engender goodwill and a sense of progress. Phillip Sutton, co-author of *Climate Code Red*: *The Case for Emergency Action,* in contrast, asserts that sustainability is indeed a destination that can be clearly contrasted to non-sustainability or extinction (Sutton, 2000).

Porritt (2005) postulates that "sustainable development" is a journey while "sustainability" is the goal:

> The point at which we can genuinely claim we are living within [the Earth's] biophysical parameters (Porritt, 2005: 38).

Diesendorf (2000) also notes that a sustainable society is one that has reached the end-point of sustainability through the process of sustainable development, arguing that a sustainable society has achieved a condition in which ecological and social systems can be demonstrated scientifically to be capable of enduring over time. Indigenous communities are among the few human societies that have demonstrated capacity for sustainability. Indigenous Australian societies, in particular, have proved to be very sustainable, having continued for tens of thousands of years.

Princen (2005) argues for the ecological rationale of societies organising around the principle of "sufficiency". He proposes that this is a more critical principle for sustainability than either "efficiency" or even "cooperation". He suggests that a "moral economy" is needed, an economy that preserves the biophysical underpinnings of its material economy and is guided by an ethic of sufficiency that would keep human consumption within ecological limits in order to maintain the integrity of ecosystems and maintain buffers that help protect resilience.

However, for contemporary capitalist industrialised countries, like Australia, to shift to a "moral economy" and achieve ecologically sustainable development requires adopting values and changing behaviours at individual and socio-economic systemic levels that are compatible with sustaining healthy ecosystems over time. In fact, in the early 1990s the Australian Government adopted a policy framework to institutionalise ecologically sustainable development that, had it been implemented, would have put the country at the forefront of global efforts to achieve sustainability.

4.4 Australia's National Strategy for Ecologically Sustainable Development

Between 1990 and 1992, the Australian Government established a process to identify a *National Strategy for Ecologically Sustainable Development* (NSESD). The process involved a comprehensive nation-wide consultative process to determine the meaning of sustainability and sustainable development and involved the establishment of industry sector working groups covering manufacturing, fisheries, forest-use, transport, tourism, agriculture, energy production, energy use and mining, as well as 21 intersectoral issues (including biological diversity, environmental impact assessment, water resource management, waste minimisation, Aboriginal and Torres Strait Islander peoples, gender issues, public health, occupational health and safety, population, overseas cooperation and development assistance, and research development and demonstration).

The fact that the Australian Government NSESD process actually focused on "ecologically" sustainable development (ESD) that had "ecological" principles at the centre of Australia's public policy discourse and public policy language was a significant achievement by environmental advocates.

As a result of the NSESD process the Australian Government adopted a definition of ESD that differs markedly from the WCED definition of "sustainable development" insofar as ecological processes are recognised as the foundation of life. The definition adopted was:

> Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased (NSESD, 1992: 6)

The NSESD also identified core objectives of sustainable development as an integration of economic, social and ecological dimensions, namely:

- enhancing individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations
- providing for equity within and between generations
- protecting biological diversity and maintain essential ecological processes and life-support systems (NSESD Steering Committee, 1992: 8).

The Australian Government definition of sustainable development is clearly eco-centric and implies strong sustainability. The guiding principles of Australia's NSESD also recognised the importance of the precautionary principle, valuing environmental assets, and engaging the public in decision-making (see Table 10, below).

Table 10: Guiding principles for Ecologically Sustainable Development

- Integrate environmental, social, economic and equity considerations.
- Exercise the precautionary approach to deal with irreversibility or risk where scientific uncertainty or environmental damage is possible.
- Recognising the global dimension of environmental impacts.
- Develop a strong, diversified economy.
- Maintain international competitiveness in an environmentally sound manner.
- Ensure that environmental assets are properly valued.
- Engage affected communities in decisions (NSESD Steering Committee, 1992: 8).

The NSESD consultative process included participants from government, industry, trade unions, research and scientific organisations, and from community environmental organisations in sectoral working groups whose findings were incorporated into the final report of the NSESD. Debate within the working groups over strong and weak notions of sustainability, and the role of ecological sustainability relative to economic and social dimensions of sustainability, was intense according to one informant, Bob Burton, who represented the Australian Conservation Foundation in the *Mining Working Group* (conversation with author, 2006). The outcome of the process was a compromise, with many contradictions between NSESD principles and policy proposals.

The Mining Working Group, for example, identified its challenge as:

> To further develop the mining industry in a way which manages the renewable and non-renewable resources on which it depends in an efficient manner which is also consistent with the principles of ESD (NSESD Steering Committee, 1992: 37).

The contradiction here is that mining, because it extracts non-renewable resources, is inherently non-sustainable and not consistent with the principles of ESD. The Mining Working Group's articulation of its challenge assumes sustainability through efficiency (ecological modernisation) rather than shifting from mining non-renewable resources to an ecological restructuring that creates an economy where there was less material consumption rather than more mining. Sustainability requires reduced materials consumption, primary reliance on renewable resources, and closed-loop materials cycles, including for most minerals (Gardner & Sampat, 1999; Sampat, 2003; Young 1994; Evans 2008b; Giurco, Evans *et al*, 2009a).

Australia's NSESD recognised the intersectoral significance of employment and adjustment issues, particularly equity considerations in the implementation, monitoring and review of the strategy.

The NSESD implicitly supported the "Just Transition" concept (discussed in detail in later chapters), identifying that governments have a vital role to assist workers in particular industries or regions where employment is affected by structural adjustment arising from ESD-related measures, and proposed that efficient and effective structural adjustment by industry sectors was part of the process to achieving a shift towards ecological sustainability (NSESD Steering Committee, 1992: 92-93).

The NSESD principles were adopted by the Australian Government in 1992, and also became the policy foundations of development approval processes of state and local governments. Unfortunately, the initial optimistic hopes that many environmentally-concerned people had for Australia's NSESD process have been thwarted by 20 years of the neo-liberal orthodoxy of Australia's national, state and local governments, led by both Labor and Liberal parties. The ecocentric rhetoric of *ecologically* sustainable development has largely been undermined by an *economic growth* bias, eliciting criticism within the Australian environmental movement, and from business (Albrecht, 1994; Diesendorf & Hamilton, 1997; Bennett, 2001; Christoff 2002; Howes, 2005; Mercer & Mardon, 2006).

However, despite its serious shortcomings, Australia's *National Strategy for Ecologically Sustainable Development* is still a useful policy against which Australian practices around sustainability can be measured and in some cases, challenged.

In 2007 two cases were brought before the NSW Land & Environment Court that challenged developments based on ESD principles. The *Gray vs. The NSW Minister for Planning* case sought to stop the proposed Anvil Hill/Mangoola coalmine in the Hunter Valley on the basis of the greenhouse gas emissions indirectly emitted by the mine due to coal being burnt. Ironically, ESD principles were also invoked in the case of *Taralga Landscape Guardians vs. The NSW Minister for Planning* in an attempt to stop a 69-turbine wind farm from being built. In both cases, the judges referred to the UN Framework Convention on Climate Change and noted that the release of greenhouse gases in Australia would contribute to global warming which would impact on our environment, economy and society. The outcome was that both the mine and the wind farm were approved. In the *Gray* judgement, the judge was satisfied there was a real and sufficient link between the mine project and greenhouse gases emissions. She insisted that the impact of downstream emission of greenhouse gases be internalised as a cost in assessing the economic viability of the project (Global Info Mine, 2007).

4.5 Sustainability built on ecosystem health

The ecosystem health framework identifies the links between ecosystem distress, human health distress and non-sustainability. In the ecosystem health framework human societies are recognised as firmly located within larger ecological systems, as socio-ecological systems, and that sustainability of socio-ecological systems must be based on the maintenance of self-sustaining and healthy ecosystems (Costanza, 1992; Rapport, 1998; McMichael, 2001; Haskell *et al*., 1992; Norton, 2006; Rapport *et al*., 1998; King & Hood, 1999; Holling, 2001; Rapport, 2007).

In linked ecological and human social systems, decisions made by humans are the major attractors, or drivers, of system health or distress (Berkes *et al.*, 2003). As Vitousek *et al* (1986 and 1997) and others noted, the scale of human impacts on the ecosphere are now so significant that the maintenance of ecosystem health is contingent on the ability of humans to live within the biophysical constraints of ecological systems. This requires human societies establishing a symbiotic, rather than a parasitic, relationship with other entities within the ecosystems they live in (Bookchin 1982, Peacock, 1999). Thus, the ecosystem health approach seeks to manage human activities so that ecosystems are able to maintain their organisation, integrity and autonomy over time, are resilient to stress, and are free from "distress syndrome" (Costanza, 1992: 9).

Albrecht (2001) reminds us that health is not a fixed condition, but is a process of continual adjustment to circumstances that put boundaries around physical, emotional and intellectual potential. Maintaining both ecosystem and human health is therefore a process of continual readjustment of socio-ecological systems to the prevailing conditions in order to maximize potential (Albrecht, 2001).

Managing for ecosystem health therefore requires knowing the biophysical and social factors that influence the evolution of complex adaptive systems, knowing the thresholds of key variables that control the system, and responding appropriately to disturbances and feedback signals (Kay & Schneider, 1994; Rapport *et al.*, 1999; Holling, 2001; Albrecht & Higginbotham, 2001; Berkes *et al.*, 2003; Walker & Salt, 2006).

Unhealthy ecosystems and unhealthy human communities display distress syndromes that can be diagnosed. Latent complexity and biodiversity and ecosystem services are lost in unhealthy ecosystems. Human physiological, social, economic, cultural and psychological health become vulnerable or impaired. An anticipatory and preventative intervention at individual, but particularly, community and system scales is essential to prevent distress or collapse (McMichael, 1993; Rapport, 2003; Daily, 1997; Watson *et al.*, 1998; Millennium Ecosystem Assessment, 2005).

Horwitz *et al.* (2001) recognised the close relationship between human health and a "sense of place", noting that the unique ecological and social character of a particular place, its "endemism", contributes to a "sense of place". Degradation of places that are familiar and valued by communities and individuals can lead to psychological distress. Endemic features of places and localities (such as its biodiversity and its physical and cultural landscapes) become part of the identity of people and communities living in them, and changes to these qualities can affect individuals' and communities' identity and image of themselves.

There is a paradox that confronting landscape deterioration can also be an empowering and healing process for communities, as well as stressful. Community mobilisation to challenge linked ecosystem and human health distress has been a feature of life for many people in the Hunter Valley over the last twenty years, and as (Horwitz *et al.*) note: "landscape deterioration and the threat of loss can lead to a greater sense of community" (2001: 259).

Such a commitment to the greater good can be seen in the Hunter Valley context when, in March 2009, calls by residents of the Hunter Valley for a public health study on the impacts of coalmining on local health have received widespread support, including a local medical doctor offering to voluntarily conduct a heath study, and many other local residents offering to assist (Singleton Argus, 2009b).

4.6 Resilience and adaptive capacity for sustainability

C.S. (Buzz) Holling, who is credited with first proposing the concept of resilience with respect to ecological systems, wrote that:

> Resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes ... and still persist (Holling, 1973: 17).

When writing about the resilience of terrestrial ecosystems and global change, Holling (1986) proposed that resilient systems display three characteristic capacities: they can absorb disturbance, self-reorganise after disturbances; and can learn and adapt.

The complexity and interconnectedness of socio-ecological systems provide foundations for sustainability, as strongly networked but diverse entities within the system provide stability. Managing for resilience of socio-ecological systems requires an anticipatory approach that identifies emerging and potential threats and opportunities, and recognises limits and thresholds, the points where disturbances can overwhelm the controlling mechanisms of the system. Thus, managing for resilience is "all about knowing if, and where, thresholds exist and having the capacity to manage the system in relation to these thresholds" (Walker & Salt, 2006: 63).

Positive feedback that reinforces existing processes, and negative feedback that indicates ecological, physical or economic distress, need to be recognised and responded to as part of adaptive management and learning to boost resilience in co-evolving, linked human and ecological systems (Berkes *et al.*, 2000). However, high levels of specialisation, mutual dependence and loss of redundancy can also make complex systems vulnerable if pressures build up and the controlling mechanisms within the systems, for example, policies and regulations, markets, and governments, trade union leaders or investors, do not pay attention to the feedback signals and allow resilience to be lost. Loss of resilience creates vulnerability (Kasperson & Kasperson, 2001; Adger, 2006).

Homer-Dixon (2002) argues that the convergence of incremental stresses within the complex globalised socio-economic system can cascade as a set of linked disturbances that easily overwhelms the resilience of even the richest and most powerful societies. Climate change is an example of incremental stresses that have accumulated to pose critical challenges to social, political and economic stability and order within the ecosphere, and human societies and economies.

The globalised economy is another complex adaptive socio-economic system where over-specialisation and reliance on a few sites of production, or a few technologies, has led to a loss of redundancy and diversity, and therefore capacity to respond to climate change threats. Whereas in early times there were many diverse local industries that produced food, energy, clothes, manufactured goods, etc., many have been rendered uneconomic and inefficient by globalised markets and neo-liberal economic policies such as "free trade" and tariff removal. Australia and the Hunter Valley are good examples of how, instead of promoting diversity and innovation of energy technologies, energy production and supply has been surrendered to a relatively few centralised "lowest-cost" sites of production, and thereby reducing the flexibility of governments and energy generators to meet energy needs from smaller, local scales, using renewable energy technologies. Maintaining the capacity to meet energy needs in this system now requires enormous perverse subsidies, such as massive investments in carbon capture and storage, and failure to internalise the 'true costs of coal' (Diesendorf, 2007; Lowe, 2005; Saddler, 2008).

While efficiency and low costs have had some benefits in the short term, over-specialisation – which leads to loss of redundancy – undermines diversity, spread of risk and capacity to respond to new disturbances such as climate change, Peak Oil and Peak Coal, and, in fact, increases food, water and energy insecurity.

Resilience and feedback

A resilient socio-ecological system responds to negative feedback. At the global scale, climate change is feedback indicating that human activity has disrupted the natural balance of the atmosphere and oceans and the ecosphere. Among its many impacts are threats to the wellbeing of ecosystems that human communities rely on manifesting in many ways. These impacts include loss of water and food security that is leading to civil disturbances, malnutrition and starvation and mass migration, as exemplified by the conflict in Darfur, Sudan. Communities that lack resilience due to their precarious environmental, social and economic circumstances, often exacerbated by climate change, are particularly vulnerable. The United Nations Environmental Programme (UNEP) has declared the conflict in Darfur, Sudan, as an example of a climate change-induced conflict, as climate change has transformed the region from sustainable agricultural land into a partial desert, pitting vulnerable communities in brutal conflict with each other (UNEP, 2007).

The Intergovernmental Panel on Climate Change (IPCC) estimates that there will be 150 million environmental refugees by 2050, part of what the IPCC calls the Social Cost of Carbon, but this may well be a gross under-estimation as sea levels are rising at a faster rate than the IPCC reports predicted (IPCC, 2007b; Richardson *et al*, 2009; Karl *et al*, 2009).

Currently in Australia, we see negative feedback due to growing coal dependency in regions such as the Hunter Valley where coal mining and coal-fired power generation and exports threaten ecosystem and social health and weaken the resilience of socio-ecological systems.

Coal mining and coal-fired power stations are major users of river water and water security is one feedback that is reaching a critical threshold for ecosystem health and industry social licence to operate in coal mining regions, such as in the Hunter Valley and in south-east Queensland. In 2007, water security for the Tarong and Swanbank coal-fired power stations in south-east Queensland was threatened by drought, and secured only through a 40% cut to allocations for domestic water consumption through mandatory water use restrictions (Bligh & Wilson, 2007).

In the Hunter Valley, conflict between residents and the coal industry over the region's water resources is also a powerful negative feedback indicating loss of social licence of coal-fired power stations to operate. Macquarie Generation draws half of its water for cooling the generators for the Bayswater and Liddell power stations from the Hunter River during "high-flow events", but drought restricts its capacity to do so (Wilkinson, 2007). In the decade leading up to 2007, Eastern Australia was experiencing a prolonged drought and Macquarie Generation was forced to issue a drought impact statement warning that electricity output could be affected. Indeed, it eventuated that farmers' water allocations were reduced to zero while water for power generation was guaranteed and quarantined as high security (Connor, Higginbotham *et al.*, 2008).

Thus the resilience of the Hunter Valley socio-ecological system is threatened as non-coal economic and cultural values are marginalised in order to accommodate water-intensive coal industries.

4.7 Justice *in* and *to* the environment

The concept of justice is relevant to both the social and ecological dimensions of sustainability of socio-ecological systems. The ethical core of the concept of justice involves consideration of others - "giving what is deserved" - and its practical dimension is about "figuring out both what is deserved and who it is that deserves it" (Sterba, 2006: 148).

Principles of justice can be applied both *in*, and *to*, the environment (Berkes *et al.*, 1998; Ostrom 1990; Bromley 1992; Bryant, 1995; Low & Gleeson, 1997; Sterba, 2006). Justice *to* the environment entails humans respecting the rights of other species, ecosystems and the ecospshere as a living entity to exist, to thrive and to have a share of natural resources sufficient to enable this to occur, and fair treatment insofar as their right to survive and thrive is ensured. The concept of justice *to* the environment therefore focuses on extending the concept of justice beyond anthropocentric eco-centric relevance and both relationally, procedurally and distributively.

Sterba (1994) argued that anthropocentric and non-anthropocentric environmental ethics are not incompatible, arguing that they can be reconciled with respect to various ethical principles, including:

- A *principle of human preservation*: Human behaviour towards the environment recognises that preference for *human* interests should prevail for the preservation of *human* basic needs.

- A *principle of human defence*: Humans defence of themselves (and their loved ones and property) against harmful aggression from other humans and from other species is logical and consistent with the way all species behave.
- A *principle of disproportionality*: The caveat that it is not morally permissible to attain one's needs at the expense of the basic needs of other people, other species or ecosystems.
- A *principle of rectification:* The requirement for compensation and reparation to be made if the other principles (above) have been violated (Sterba, 2006: 150–57).

The eco-centric application of justice was described by Low and Gleeson (1997: 2) as *ecological* justice: "the justice of the relationships between humans and the rest of the natural world". Ecological justice asserts the rights of all organisms and ecosystems to justice insofar as having a fair share of the services of ecosystems that have been over-appropriated by humans (Baxter, 2005) and promotes the possibilities for symbiotic, rather than parasitic and destructive relationships between humans and ecosystems (Peacock, 1999; Albrecht, 2001).

In contrast to ecological justice, the quest for justice *in* the environment is referred to as *environmental* justice, and is about distributive, procedural and relational justice with respect to how environmental benefits and burdens are distributed and managed in societies. It is about political and economic equality within and between human communities (Beder, 1996; Low & Gleeson, 1998; Athanasiou, 1998; Schrader-Frechette, 2002; Agyeman *et al*., 2003a; Bullard, 1999).

The sustainability principles of inter-species equity exemplifies justice *to* the environment (ecological justice) , while the principles of inter- and intra-generational equity and public participation enact justice *in* the environment, and the precautionary and global dimension principles relate to both dimensions of justice.

Hillman (2004) argued that the environmental justice paradigm pays attention to procedural, distributive and relational elements of the justice framework, including who is regarded as an 'official stakeholder' and is represented in decision-making (Hillman (2004). Arguably, similar consideration can be extended in an ecological justice paradigm to all species, though this does not necessarily mean equal rights among all species.

Hillman (2007), whose studies relate to management of the Hunter River catchment, noted that the top-down engineering-based paradigm that has been a dominant element of environmental management in the Hunter Valley, but this approach to environmental management is challenged ethically and politically by the environmental justice paradigm.

The "practical application of environmental justice in natural resource management depends upon moving beyond generic principles to a situated understanding which requires knowledge of both historical and geographical contexts, including how decision-making frameworks develop and the nature of the biophysical environment itself" (Hillman, 2006: 695) and suggests that the convergence of ecological complexity and

contested perceptions of ecosystem health requires an holistic, transdisciplinary and inclusive approach to ecosystem management, based on an historically and geographically situated, and ecologically informed, vision of sustainability, in which environmental justice is interdependent with ecological justice (Hillman, 2006).
Low and Gleeson also argue that action on both environmental and ecological justice issues is necessary, and related. The appropriation of so much of the planet's resources by humans means that not only are the environments of other species being degraded – an *ecological* justice issue – but this, in itself, reduces the quality of environments for all humans, as well as those specifically located in degraded environments, thus making it an *environmental* justice issue.

Dobson (2003), however, cautions that a mutual reinforcement of the concepts of sustainability and both environmental and ecological justice cannot necessarily be taken for granted. He argues that one is not necessarily a precondition for the other. Dobson notes (2003: 87) that there are many ways that policies for the two concepts can have contradictory agendas unless questions are asked about:

- *Sustainability and justice for who and what?*
- *What elements of sustainability or justice, or both, are a pre-condition for each other?*
- *What natural capital needs to be protected for the future, and for whose benefit?*
- *What is the community of justice?*
- *What constitutes a benefit and a burden, and who decides?*

Dobson concludes that the potential contradictions and conflicts implied in these questions can be reconciled if the objective of sustainability as "preservation of biodiversity" and of justice as "equal distribution of opportunity" are applied with future generations considered as part of the community of justice. When this happens, Dobson argues that:

> Not only is social justice compatible with the sustaining of critical natural capital, but that social justice demands the sustaining of critical natural capital and its fair sharing around the community of justice (Dobson, 1998, quoted in Dobson 2003: 90).

Dobson's reconciliation of justice and sustainability, recognising that justice must be done to the environment because there is a mutual dependence of all present and future generations of living things on the environment, is a very useful framework for thinking about sustainability. Similarly, Low and Gleeson's assertion, that justice *to* the environment (the elimination of "environmental bads") and justice *within* the environment (the distribution of "environmental bads"), is accepted as linking necessary preconditions for sustainability. As Low and Gleeson state: "justice *within* the environment is enfolded within the question of justice *to* the environment" (Low & Gleeson, 1998: 19. Thus there is a dialectical interplay between these two sites of justice that is contingent on power struggles played out in particular localities (such as the Hunter Valley), that reflects local cultures, aspirations, political histories and institutions (Low & Gleeson, 1998: 27). Justice refers to the fair treatment and an impartial share of the benefits of society to individuals and groups of people, and, for some people (discussed later in this section) it also includes other sentient beings.

The concept of justice, as human rights, is referred to in many of the principles of the *Rio Declaration*, adopted at the Earth Summit in 1992, including:

- The need for public participation of all concerned citizens, including equitably meeting needs of present and future generations (Principle 3).
- The right for public participation of all concerned citizens and access to information and legal redress (Principle 10).
- The principle of justice regarding prevention of transfer of environmental hazards between nation states (Principle 14).
- The application of the precautionary approach by states (Principle 15).
- Acknowledging the need for internalisation of costs, embracing the equity principle of 'polluter pays' (Principle 16) (United Nations Environment Program, 1992).

The adoption of these principles suggests that, on paper at least, international governance institutions such as the United Nations and protocols such as the *Rio Declaration* recognise that justice and sustainability are linked concepts. However, as Dobson (1998) noted (and discussed earlier), the two concepts are not synonymous, or even necessarily mutually reinforcing.

The environmental justice movement and coal dependency

The environmental justice movement emerged out of the struggles of African-American communities living in the petrochemical industry belt along the Mississippi River in the US states of Mississippi and Louisiana in the 1980s. These people were living with high levels of toxic chemicals in their environments, along with high levels of ill health and poverty. The environmental justice movement signifies the convergence of the social justice and the environment movements. The movement noted that:

> Wherever in the world environmental despoilation and degradation is happening, it is almost always linked to questions of social justice, equity, rights and people's quality of life in its widest sense (Agyeman et al., 2003a: 1).

The environmental justice movement acknowledges that development in an inequitable world is an inherently inequitable process, which creates victims and beneficiaries, as "environmental bads" (pollution, landfills, toxic waste incinerators, nuclear waste storage sites, etc.) are located in communities of social and economic disadvantage. Such disadvantage is particularly evident in Indigenous, black, coloured and immigrant communities, and the environmental justice movement has had to challenge policy and decision-makers (including people within environmental organisations) to help overcome the linked oppression of poverty, political marginalisation and exposure to environmental health risk (Goldman & Fitton, 1994; Bullard, 1990; Schrader-Frechette, 2002).

The environmental justice movement challenges the blindness of governments and industry to marginalised communities, and also challenges the mainstream environment movement. Environmental justice movement advocates attribute the blindness of the environment movement, to the links between poverty, race, gender and environmental risk, to several factors including the lack of cultural diversity in the environment movement and the historic domination of theory, organisational leadership and strategy articulation by white middle-class males from Anglo-American (or in Australia, Anglo-Australian) backgrounds. Environmental justice advocates also claim that there is such a strong focus on national and international issues (indicated by the location of the offices of major movement organisation in large metropolitan centres), that the large environment movement organisations have a general blindness to local issues and the communities where impacts are actually felt (Dowie, 1992; Ferris & Hahn-Baker, 1995).

In the Australian context, the Indigenous environmental justice movement has challenged the concept of "wilderness" espoused by environmental organisations such as The Wilderness Society and the Colong Committee for Wilderness. Langton (1996, 1998) argued that the concept of wilderness in the Australian context is a form of blindness and racism that perpetuates the myth of Australia as *terra nullius* (an "unowned land"), prior to British invasion and settlement, and "denies the imprint of millennia of Aboriginal impacts on, and relationships with, species and ecologies in Australian environmental history" (Langton, 1998: 18).

In 1994, the Aboriginal and Torres Strait Islander Commission (ATSIC) proposed that, from an Indigenous perspective, wilderness was a culturally based concept, "land without songs or ceremonies" (ATSIC, cited Langton, 1998: 19). In response to this sort of Indigenous criticism, the National Forestry Policy process adopted a culturally based definition of wilderness that implicitly recognised prior Indigenous ownership and occupation of the land, specifically defining it as:

> Land, that together with its plant and animal communities, is in a state that has not been substantially modified by, and is remote from, the influences of European settlement, or is capable of being restored to such a state (Commonwealth of Australia, 1997).

However, it is important to note that while the environmental justice framework focus on the ethical and political questions of distribution of environmental "goods" and "bads" is a powerful movement linking environmentalism and justice, Dobson (1998) reminds us that environmental justice will not, in itself, deliver sustainability. The movement's focus is on redistributing environmental goods and bads but not on actually eliminating environmental bads. Dobson states:

> Note that "environmental justice" does not here mean "justice to the environment" but refers rather to a just distribution of environmental goods and bads among human populations (Dobson, 1998: 20).

The environmental justice movement does not explicitly address issues of unsustainable consumption or production processes. It has therefore been described by Dryzek (2005) as only weakly ecological and "has little appreciation of the role of complex ecosystems in sustaining life on earth" (Dryzek, 2005: 212).

A transition from coal dependency to genuine sustainability in the Hunter Valley, and to climate change more broadly must address justice *in* and to the environment. Loss of one or other would deliver weak sustainability (lack of ecological justice) or what has been described as 'eco-apartheid' (Jones, 2008a) (lack of environmental justice) as any 'sustainability' is illusory if it benefits only some privileged sectors of the population to the exclusion and cost of the 'sustainability' of others. From an environmental justice perspective, Jones (2008a) advocates 'eco-equity' as an ethical alternative to eco-apartheid.

A shift from coal-fired power to genuine sustainability demands a systemic approach that pays attention to both ecological and environmental justice. A clean renewable energy is not likely to emerge in the Hunter Valley within the next decade or two, but even if it did, the on-going sale of coal from the Hunter Valley to export markets would constitute eco-apartheid. Degradation of landscapes by mining would continue to harm current and future residents in mining regions. Pollution from coal mining and power stations would continue to harm the health of ecosystems and humans in the countries where Hunter Valley coal is burnt. Moreover, consumers purchasing commodities made from cheap coal-fired power produced in countries such as China and India, also enact ecological and environmental injustice as they are benefiting at the cost of ecosystems and current and future generations.

Justice to *and* in *the environment through equitable sharing of the Global Commons*

There has been considerable policy debate about how human impacts on the environment can be shared in an equitable way while human societies also live within the ecological constraints of the Earth.

A powerful discourse of concerns about the health and equitable access to the Global Commons, (the atmosphere, water, forests, fisheries or grazing land that we all share and must use sustainably) has emerged over the last decade. The discourse around the Global Commons embodies a critique of commodification, privatisation and enclosure of the essential resources for life, and promotes ecological sustainability and equitable use of the Global Commons through democratic and accountable governance of the Commons (Ostrom, 1990; Buck, 1998; Goldman, 1998; Committee on the Human Dimensions of Global Change, 2002; Johnston, 2006).

Climate change has been a major focus of justice *to* and *in* the environment within the Global Commons discourse. The Global Commons Institute, a UK-based NGO, proposes that greenhouse gas emissions are part of the Global Commons and has proposed a policy approach to shrinking and equitably sharing these emissions called *Contraction and Convergence*. "Contraction" refers to the need to reduce global emissions of greenhouse gases to a level that would result in establishing a scientifically-justifiable tolerable atmospheric concentration – a global “budget” of greenhouse gas emissions. This budget would decline over time until a stable point is reached.

“Convergence” allocates shares in that budget to nations on the basis of equity. This means that shares in the atmosphere are equitable among the world’s people and that the current situation where the people of some countries effectively deprive others, because essentially allocations are attained on the basis of wealth, would cease. After convergence, all countries would contract their greenhouse gas emissions equally until the necessary contraction limit is reached. Broad (1999) proposes:

> The fundamental advantage of this approach is that its per capita basis provides an organising principle for the negotiations which all the parties recognise as fair and equitable. Essentially, humanity is facing a global security crisis and needs to drastically ration what is currently a vital resource, the absorptive capacity of the atmosphere. As Europeans discovered in two World Wars, a rationing system works best when it is perceived to be fair. As the Global Commons Institute puts it, this is equity for survival (Broad, 1999: 141).

The *Contraction and Convergence* model has been widely supported by developing country and European national governments and many non-government organisations as part of a climate protection framework designed to support an emergency climate stabilization program (Baer *et al.*, 2008). It is supported because it maintains potential for on-going development in low-income countries within an equitable framework, a policy proposal that has also been referred to as *Greenhouse Development Rights*, and in which:

> It is critical to lay the groundwork for a common global understanding of “comparability of effort,” and for assessing it in a coherent and transparent manner … In particular, it means that the populations of the North must come, somehow, to an understanding of the rich/poor division that defines our times, and to its implications for their own role in solving the climate problem, and for the roles of others. For it is not enough for the rich to reduce their own emissions: they must also help to launch a global transition to a low-carbon world, and they must help the poor adapt to the inevitable changes that await them (Baer *et al*., 2008: 26).

Contraction and convergence and Greenhouse Development Rights are examples of the principles of justice applied both *in* and *to* the environment. They are examples of institutionalising justice systemically in a way that links local and global scales of decision-making and action.

Conclusion

Sustainability is a contested concept with various interpretations that range from weak to strong, depending on what is being sustained and the extent to which eco-centric or anthropocentric values prevail. This diversity of definitions reflects various values and economic and political interests within and between human communities. Consequently, unified action towards sustainability is difficult, though not impossible, to achieve but travelling along the pathway of sustainable development involves engaging in debate and conflict, learning and action to stop harmful practices, adapting to changing environments, and repairing damaged ecosystems which are the biophysical foundations of all life.

On the positive side of the ledger, diversity about the meanings and strategies for achieving sustainability provides opportunity for engagement of the public in dialogue about visions, strategies and relevant indicators of sustainability.

Framing of the sustainability debate is crucial to outcomes. The WCED 1987 definition of sustainable development is widely used by corporations and governments, and the anthropocentrism it reflects is used to justify a utilitarian and economics-driven approach to human/ecosystem relationships and sustainability. This approach perpetuates over-consumption of the Earth's resources, and overshoot of the planet's capacity to sustain healthy ecosystems and provide ecosystem services to all species and all humans. However, it is possible to interpret the WCED definition as providing a rationale for meeting human needs equitably within the constraints of the Earth's carrying capacity.

The Australian Government's 1992 definition of ecologically sustainable development (ESD) is less ambiguous and more clearly eco-centric than the WCED definition. It fits within the strong sustainability framework, recognising that ecological health is a foundation for sustainability and must be sustained.

Sustainable development and the achievement of sustainability require social justice. The social justice principles of inter-generational and intra-generational equity promote justice *in* the environment, and the denial of these rights has catalysed the environmental justice movement. The lack of equal protection of all people and communities in environmental decision-making, policy and actions irrespective of class, gender, race and political or economic power is evident in the Hunter Valley, with survey results of many residents' attitudes today (see HVRF, 2008), sharing the concerns of residents in 1980, who declared that:

> A common theme running through this increasing community concern about the new developments is the lack of consultation and participation of the people of the Hunter region in decisions which will fundamentally affect the quality of life and the whole direction of development of the region in which they live. "WHO ASKED US?" is precisely the question many people are asking (Phillips & Ross, 1980:2).

The degradation of the Hunter Valley's ecosystems and the linked human health distress discussed in the previous chapter, show that *ecological* and *environmental* justice are integrally linked in popular perception and thus political campaigns for sustainability combine struggles for justice *in* the environment with struggles for justice *to* the environment.

Chapter 5
Sustainability Indicators

A transition to sustainability implies movement towards the goal of sustainability, but for any journey there needs to be an indication that we are moving forward rather than backwards or away from our destination. Sustainability indicators are quantitative and qualitative markers used to determine progress towards or away from sustainability. Using sustainability indicators as a measure of progress helps managers and other stakeholders identify the links between policy goals and outcomes, the efficacy of actions taken to achieve goals, and support for decision-making through repeated measurement of systemic feedback (Cobb *et al.*, 1995; Redefining Progress, Tyler Norris & Associates, and Sustainable Seattle, 1997; Moldan & Billharz, 1997; Meadows, 1998; Farrell & Hart, 1998; United Nations Department of Economic & Social Affairs, 1998; Hart, 1999; National Research Council, 1999; Hak *et al.,* 2008).

There are many potential indicators of sustainability because of the diversity of subjective human values that are used to define progress. Values influence the choice of indicators that different people and social institutions regard as important, and therefore what should be measured: "We measure what we care about" (Meadows, 1998: 12).

Sustainability indicators are useful tools for decision-making and for raising awareness about changing environmental and social conditions if they are meaningful and relevant to the policy goal. According to Chambers *et al.* (2000) a good indicator must be clear and easy to interpret. It must be relevant to the user and use comprehensive, credible, accessible, transparent data. Good indicators reflect issues that are significant and are capable of provoking and inspiring change within the sphere of influence of the user. They need to be linked to targets and reflect change and trends over time at an appropriate scale (Chambers *et al*, 2000: 16)

Ecological and Carbon Footprints

The *Ecological Footprint Index,* developed by Wackernagel and Rees (1996), is a measure of how much biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates using prevailing technology and resource management practices. The *Ecological Footprint* is usually measured in global hectares (gha). The Ecological Footprint (including its sub-set the "Carbon Footprint") has many of the positive indicator attributes recommended by Chambers *et al*. It is a concept that can be measured and accounted for in concepts that people can easily understand and compare. It is dynamic and therefore can guide management practices to measure change towards sustainability.

The Global Footprint Network, an international collaboration of researchers using ecological footprint analysis as a tool to inform public policy and decision-making, proposes that a country that requires less than 2.1 gha per person has resource demands that are globally replicable, but beyond that level demands are non-sustainable (Global Footprint Network, 2009).

The average Australian uses 7.8 productive hectares to support their lifestyle, equivalent to resource demands requiring four Earths (WWF, 2008a: 34). Australians have the third-highest ecological footprints in the world, the USA and the United Arab Emirates having 9.4 gha, New Zealand 7.7 gha, while the UK has 5.4. gha, Canada 7.1 gha, Japan 4.9 gha. China has 2.1 gha and India and Indonesia each having 0.9 gha (World Wildlife Fund, 2008: 34).

According to the World Wildlife Fund's *Living Planet Report*, in 2005 the single-largest demand humanity put on the biosphere was its Carbon Footprint, "the amount of gaseous emissions that are relevant to climate change and associated with human production or consumption activities" (Wiedmann & Minx, 2007:2). The global Carbon Footprint grew more than 10-fold from 1961 (World Wildlife Fund, 2008: 16). The Carbon Footprint, due to emissions from fossil fuel use, is also the most significant factor contributing to the Australian Ecological Footprint, constituting approximately half of the total Australian Footprint (Victorian EPA, 2008).

While Ecological Footprint analysis can account for upstream inputs of consumption of an individual population, industry or corporation, including its Carbon Footprint, the *Ecological Footprint Index* does not usually reflect downstream impacts or the "cost" of loss of ecosystem services. Hence, the conventional analysis of the Ecological Footprint of Australia, the Hunter Valley, or of the coal industry, might take into account the impact of upstream inputs but does not take into account the impacts of the burning of coal overseas. Given that Australia and the Hunter Valley are currently heavily dependent on coal exports, the downstream national and regional Ecological Footprints are significantly higher than the 7.8 gha identified above.

Ecological Footprint analysis can be used with other indicators to give an even richer picture of sustainability. The United Nations Development Program, in its annual *Human Development Report*, uses the *Human Development Index* as an indicator of social wellbeing that combines measures of life expectancy, literacy, educational attainment, and Gross Domestic Product (GDP) per capita for countries worldwide. A *Human Development Index* (HDI) higher than 0.8 is considered "high human development" (Global Footprint Network, 2009), and Australia has among the world's highest HDI.

Indicators of social sustainability

Indicators and measures of social or community sustainability have been constructed for urban and rural contexts in many parts of the world, with participation of community members identifying the aspects of social life that they deem important for local sustainability. Public participation is also used to identify indicators which measure whether these aspects are improving or declining in quality or quantity, to establish a framework for local information gathering and analysis, and to monitor changes in indicators (Pepperdine, 2000).

Domains of social sustainability span economic, demographic, cultural and political dimensions including involvement in decision-making; leadership; access to, and availability of, key goods and services including transport and other infrastructure; education and information; health and safety; community support in terms of participation in civic life; community pride and spirit; community cohesion; neighbourliness and cooperation; and access to justice (Pepperdine, 2000; Redefining Progress *et al.*, 2006).

The California-based activist think-tank, Redefining Progress, advocates the use of a *Genuine Progress Indicator*, in combination with the *Ecological Footprint Index*, as a measure of progress towards sustainability at the local and regional scales. The *Genuine Progress Indicator*, unlike the *Human Development Index*, does not use GDP growth as an implicitly positive indicator of sustainable development and, instead, measures the economic contributions of government, industries, households and volunteer sectors as positives while subtracting factors such as crime, pollution, and family breakdown (Talberth *et al.*, 2007). Like ecological footprints, social sustainability indicators that only measure sustainability trends within one socio-ecological system in isolation from other systems at other spatial scales do not necessarily encompass the full range of social sustainability issues relating to the community. Indicators need to reflect external relationships, such as the impacts of the local economy on the sustainability of people living outside the region, as the sustainability of one region or population cannot be achieved at the expense of another. For example, if the region's economy is based on a socially or ecologically harmful commodity, such as manufacturing landmines or cluster bombs, heroin production or fossil fuel exports, then it cannot credibly be regarded as genuinely sustainable if its trading to other systems causes distress in those communities. Environmental justice and ecological debt principles suggest that social sustainability indicators that take account of external social and ecological relationships need to be developed, measured and evaluated.

Environmental justice issues could be accounted for by incorporating sustainability indicators from a range of communities to which the focus population has economic, social or ecological links, as part of the sustainability assessment of the focus community. Sustainability indicators that account for environmental justice must also ensure that indicators from all sectors of the local population (particularly low-income, coloured and impoverished and marginalised communities) are accounted for, so that differential costs and benefits of development among different sectors of the population are picked up.

Social sustainability indicators referring to justice should include measures of progress towards a Just Transition in regions where the economy is not sustainable. These indicators might take into account factors such as levels of unemployment, new jobs created, and community engagement in development decision-making.

5.3 Ecosystem health: A strong sustainability indicator

Ecosystem health is another indicator of sustainability that has potential to be used in conjunction with indicators such as those described above to give a picture of whether or not a region is moving towards sustainability. As with any indicator the useful application of ecosystem health indicators involves identifying the ecological and social goals and the development of appropriate indicators that measure progress toward these goals (Costanza 1992). According to Rapport *et al.* (1998), the assessment of ecosystem health should utilise indicators that reflect properties of the organisation, vigour and resilience of the ecosystems being studied or managed.

A healthy ecosystem is one that is strongly sustainable – in that it has the ability to maintain its structure (organisation), its energy and productivity (vigour) over time, and be capable of maintaining or restoring the integrity of its structures and functions in the face of external stress (resilience). Assessments of ecosystem health therefore should encompass indicators that reflect these properties (Rapport *et al.*, 1998; Costanza and Mageau, 1999).

These features can be measured: organisation, by number of species and ways that material and energy can be exchanged among ecosystem members; vigour, by gross productivity and metabolic activity; and resilience, by the time taken for an ecosystem to recover from disturbance, the magnitude of the disturbance beyond which there is regime change, and a combination of these two features (Costanza & Mageau, 1999).

Other indicators of ecosystem health include the presence of key processes that maintain internal equilibrium by adjusting physiological processes to changing environments (homeostasis). Absence of disease, diversity and complexity, the availability of management options, the extent of subsidies that need to be imported into the ecosystem to enable it to maintain services, whether critical habitats remain intact, capacity to sustain healthy human populations, and the impact and damage the ecosystem has on neighbouring ecosystems are other indicators of ecosystem health (Costanza *et al.*; 1992; Rapport, Costanza & McMichael, 1998; Rapport *et al.,* 1998; Dennison & Abal, 1999; Costanza & Mageau, 1999).

Aguilar (1999) proposed an integrative holistic ecosystem health indicator (HEHI) for measuring ecosystem health that integrates diverse ecosystem health indicators, including both ecological and social variables that are important for management objectives and current understanding of systems. Variables are then selected and assigned a benchmark or threshold value and weighted to reflect their relative importance to the health of the system and to management goals (Aguillar, 1999; Muñoz-Erickson *et al.,* 2007).

With so many potential indicators of ecosystem health, it is necessary to be clear on the rationale for choosing particular indicators (or variables within the holistic indicator) that best fit the purpose and available resources. This choice can be informed by being unambiguous on operational goals for ecosystem health. For example, the goals might be to maintain a diversity of habitat types, to restore threatened plant and animal communities, to support vital ecological functions and maintain resilience in a particular ecosystem under threat, such as the Hunter River.

This stage in the process is followed by selecting indicators which are ecologically relevant and scientifically and socially defensible, and which fit the organising framework and the available capacity for data collection and analysis of the manager. In a mining region, such as the Hunter Valley, indicators of ecosystem health include biodiversity, water and air quality, noise levels, river flows, riparian and other habitat health, nutrient cycles and pollution, erosion and landscape changes.

Managing for ecosystem health requires identifying target values for the chosen indicators. These might range from desirable to tolerable, given that restoration of pristine conditions may not be possible in the short term. The final parts of the process are monitoring and evaluation linked to adaptive management to determine whether the management or restoration processes achieve the goals or needs adjustment (Levy *et al.*, 2003).

5.4 Applying sustainability indicators to communities and regions

In 1997, the Newcastle City Council initiated a *Pathways to a Sustainable Hunter* project, in partnership with other local governments in the Hunter Valley. The project supported a wide range of local and regional environmental education, environmental management, urban renewal, and public health projects, and local and regional economic development projects. It included regional State of the Environment reporting through the Hunter Regional Organisation of Councils (HROC), now known as Hunter Councils, and the identified sustainability goals and indicators (Hunter Regional Organisation of Councils, 2000; Institute for Sustainable Futures, 2000).

The project identified ecological, social and economic goals of a *Sustainable Hunter* (see Table 11 below). These included living within the constraints of the local environment, conservation of resources, public health and safety, and diversity in employment and cultural opportunities.

Table 11: Hunter Councils' sustainability goals

(Institute for Sustainable Futures, 2000: 4)

- Resources are used efficiently and waste is minimized by closing cycles.
- Pollution is limited to levels which natural systems can cope without damage.
- The diversity of nature is valued and protected.
- Where possible local needs are met locally.
- Everyone has access to good food, water, shelter and fuel at reasonable cost.
- Everyone has the opportunity to undertake satisfying work in a diverse economy.
- Peoples' good health is protected.
- Access to facilities, services, goods and other people is not achieved at the expense of the environment.
- People live without fear of personal violence from crime or persecution.
- Everyone has access to skills, knowledge and information.
- All sections of the community are empowered to participate in decision-making.
- Opportunities for culture, leisure and recreation are readily available to all.
- Diversity and local distinctiveness are valued and protected.

These laudable and ambitious objectives informed the community consultation process that identified appropriate indicators, under the auspices of the slogan "Measure what we treasure" (Hunter Regional Organisation of Councils, 2000). The objective was to regularly provide the regional community and decision-makers with information using these indicators (Table 12, below) so that the effectiveness of regional policies and programs could be determined.

The intention was also to increase community understanding of sustainability, the prospects for the Hunter Valley to achieve it, and to provide feedback for individuals and families on the impact of their activities on sustainability, and direct appropriate action towards ecologically sustainable development. It was also intended that the community would be involved in a participatory decision-making process to review the indicators of regional progress and to provide early warning of potential problems, so that the people of the region could demonstrate and responsibly manage the linkages between social, economic and environmental well-being (Hunter Regional Organisation of Councils, 2000).

Table 12: Hunter Councils' sustainabilty indicators: Measure what we treasure

(Institute for Sustainable Futures, 2000: 5-17)

1. **Native vegetation** measured by area of native vegetation approved for clearing annually.
2. **Water quality** measured by Beachwatch water quality: *Enterococci* compliance.
3. **Air quality** measured by number of days on which visibility and pollutant level standard is exceeded.
4. **Greenhouse gas emissions** related to electricity consumption.
5. **Availability of appropriate housing for all** measured by the number of households on Rent Start Assistance Scheme.
6. **Respiratory illness** measured by annual admission to hospital with respiratory illness.
7. **Immunisation rates** measured by overdue immunisation for children aged 18 months old.
8. **Transport** measured by vehicle registrations per resident.
9. **Unemployment** measured by percentage unemployed in the Hunter.
10. **Hunter Regional economy** measured by the Hunter Leading Index.
11. **Range of employment** measured by the diversity of employment by industry sectors in the Hunter Region, benchmarked against the Sydney Major Statistical Region and the whole of Australia.
12. **Perceived community confidence** in the Hunter Region Economy
13. **Community participation in decision-making** measured by perceived opportunity to participate in community decision-making.
14. **Perceived adequacy of social support networks**.
15. **Perceived level of personal safety**.

These indicators cover ecological, social and economic dimensions of sustainability at the local scale but, as discussed earlier, the indicators provide no information, and suggest no consideration of, the sustainability impacts of the region's external links to other regions and on global sustainability, such as accounting for the climate change impacts of the export of coal from the Hunter Valley.

By 2009, the commitment of Hunter Councils and Newcastle City Council to an over-arching sustainability monitoring and reporting system seems to have been lost. No sustainability reporting system is available on either organisation's web site, and while Newcastle City Council has an annual *State of the Environment Report* (as it is obliged to under the NSW *Local Government Act 1993*) the 2007–08 reports on environmental elements of air, biodiversity, community "greening", weeds and feral animals, energy and greenhouse, coast, bushfires, etc., as isolated entities, lacks comprehensive goals or targets, does not integrate social and ecological issues, and gives no overall picture of an holistic socio-ecological system moving towards or away from sustainability.

5.5 Applying sustainability indicators to the mining and minerals industry

Sustainability indicators such as the Ecological Footprint can be used by managers and other stakeholders to be able to determine whether or not particular economic activities, industry sectors, or worksites such as mines and power stations, are demonstrating sustainability.

Developing an analysis of whether or not an industry contributes to strong sustainability needs to consider the ecological and social impacts of the industry in all affected ecosystems, ecosystem services and communities at different spatial and temporal scales. It needs to take account of cumulative impacts of the full range of the industry's activities that includes linkages between local and global sites of production and consumption, the lifecycle impacts of commodities produced and consumed, and the role of the industry in political advocacy around particular policies and governance regimes (for example, the activities of the Australian Industry Greenhouse Network, discussed earlier).

There have been various attempts to develop sustainability indicator projects focused at the mining and minerals industry at global, corporate and mine-site scales. These include various industry-wide initiatives to develop Codes of Conduct (International Institute for Environment and Development, 2002, Minerals Council of Australia, 2005, International Council on Mining and Metals, 2003), corporate Sustainability Reports, and the NGO-led projects such as the WWF-led *Mine Certification* project (Solomon *et al*., 2006). The Center for Science in Public Participation, a US-based NGO that provides research, education and technical advice to grassroots groups, non-governmental organisations, regulatory agencies, businesses, and indigenous communities on natural resource issues, especially those related to mining, led a project to develop a *Framework for Responsible Mining* project (Miranda *et al*., 2005).

The *Global Reporting Initiative* provides guidelines for sustainability reporting at the level of a corporation (Global Reporting Initiative, 2002). In 2005, additional indicators were incorporated specifically for the mining and minerals industries, including environmental indicators such as "biodiversity impacts of total land disturbed and not rehabilitated", "materials stewardship" and "large volume mining and minerals processing waste"; social indicators including "resettlement", "operation closure", "emergency preparedness" and "land rights"; and economic indicators such as "revenue capture, management and distribution" and "value added" (Global Reporting Initiative, 2005).

Azapagic (2004) proposed a set of sustainability indicators for the mining industry that attempts to show the industry as part of a complex social, ecological and economic system, with various stakeholders being key influences (or drivers) in different dimensions of sustainability and at different times and stages of the mineral lifecycle.

Lifecycle issues include ecological, social and economic issues. Mine-closure issues, for example, include post-mining environmental rehabilitation and restoration of ecosystem health and services to pre-mining conditions. It also includes post-mining social and economic sustainability issues in the mining region.

Azapagic summarised the key sustainability issues for the mining and minerals sector, including issues such as:

- Economic issues: distortion of local or national economies through phenomena such as the "Dutch Disease" in which other economic sectors (e.g. manufacturing and farming) are undermined by inflationary and exchange rate effects of mining-dominated economy (see Corden & Neary, 1992).
- Environmental issues: noise, lights, traffic, air quality.
- Social issues: displacement of communities, loss of cultural heritage (Azapagic, 2004).

Azapagic identified a comprehensive list of potential indicators for measuring some economic, environmental and social dimensions of mining on sustainability, but there are other indicators she did not include that might give a more complete picture of sustainability including equity impacts (such as the disparity in incomes within mining communities); displacement of other economic activities due to mining; loss of income from land sterilised by mining; costs of loss of ecosystem services (such as water, clean air), climate change impacts, human health and distress.

Azapagic's indicators reflect that mining can, at best, contribute to weak sustainability, as the industry inherently involves consumption of non-renewable resources at faster than replacement rates and the substitution of natural capital for human-made capital.

Indicators of sustainability for mining and minerals industries are helpful, and are the focus of ongoing research (including research about future scenarios for minerals in society in which this author is a collaborator (Giurco, Evans *et al,* 2009a, 2009b). Essentially, a transition to a sustainable society is likely to highlight the role of new social values and more effective governance regimes to institutionalise sustainability principles within the mining and minerals industries, and in society more generally. Issues such as reduced and more equitable global consumption, corporate social responsibility, the internalisation of the real social and environmental costs of goods and services are likely to be on-going, and increasingly urgent, topics of discussion. The prospect of a decarbonised and dematerialised economy and closed-loop production/consumption cycles has consequences for commodity futures, including coal, and for the sustainability of mineral-rich regions (Giurco, Evans *et al* 2009a, 2009b).

Conclusion

Sustainability indicators are needed to show progress towards or away from sustainability, and to assist decision-making at global, national, regional and local scales. Ecological Footprints (including Carbon Footprints) are useful indicators that can be applied at different spatial scales and through the complete life cycle of commodities to indicate whether or not sustainability is being achieved.

A full picture of sustainability requires integration of various social and ecological indicators. Indicators of ecological health are necessary for informing policy-makers and decision-makers about the impact of development on ecosystem health and the ecosystem services on which all forms of life depend , yet these indicators do not seem to be widely used in much of the discourse about sustainability indicators, or to be reflected in the most popular measures of sustainability, such as Redefining Progress's *Genuine Progress Indicator* and the Global Footprint Network's integration of *Ecological Footprint* and *Human Development Index*. This may be because different factors used to measure ecosystem health in different localities can be difficult to translate as meaningful comparisons across ecosystems, or to summarise in a simple figure or index (a quality that gives the *Ecological Footprint* its appeal). Clearly, there is more work to be done.

Measuring progress towards sustainability is important, but making a transition to sustainability is the work that indicators need to inform. Most measures of sustainability in the Hunter Valley, Australia, and globally – particularly ecosystem health and consumption exceeding biocapacity, but also the gap between rich and poor within and between nations – tell us that we are going in the wrong direction: towards non-sustainability. Therefore it is not surprising that governments do not want to know about its indicators (such as those presented in *State of the Environment* reports) and instead the emphasis in government announcements and daily television news reports is on a narrower range of economic indicators, such as the *Stock Exchange Index*, *Consumer Confidence* and *Gross Domestic Product*, that are not true indicators of sustainability. The *Newcastle Herald*, for example, invariably celebrates development proposals such as new mines and coal loaders in terms of potential jobs or increased exports, but rarely mentions the impact of these developments on the environment or on affected communities, until residents make these impacts an issue.

Clearly there is much work to be done to shift societal values so that attention focuses on real indicators of sustainability, that reflect the health and well-being of the planet and its population.

The Just Transition process (which can also be measured by indicators such as levels of participation and consensus, discussed in detail in later chapters) could help drive understanding of the complex picture of facilitating social transformation towards sustainability.

As the authors of the *Community Indicators Handbook* note:

> Indicators are powerful. They frame debates, steer planning, affect budgets, and motivate action … Many communities, inspired by the goal of achieving long-term health and sustainability, are making good strides towards finding better measures of progress. But [community members] understand that measuring progress is not the same as making it, and they are now turning to action (Redefining Progress *et al.*, 1997: 42).

A transition to sustainability could be measured as a function of indicators discussed in this and other chapters. These indicators include measures of ecological justice such as ecosystem health and integrity, and ecological footprints within regional and planetary biocapacity; and by measures of environmental justice including genuine human progress (access to health, education, housing, employment, etc) and the procedural, distributional and relational equity with respect to environmental "goods" and "bads". Indicators of a Just Transition, such as community engagement and informed consent for the trajectory for ecological-economic restructuring, would also be part of the equation that could be articulated as:

> S (sustainability) = EH (ecosystem health) + EF (equitable ecological footprints within planetary and regional biocapacity] + GP (genuine human progress) + EJ (procedural, distributional and relational equity) + JT (a Just Transition).

Chapter 6
Transformation to a *Future Beyond Coal* in a global panarchy

The evolution of simple systems is often predictable because of the simple linear, causal relationships between variables within them, but the evolution of complex biophysical and human social systems, in contrast, is often characterised by surprise and uncertainty. Therefore complexity theory, with its emphasis on non-linear relationships between variables, is useful for examining the evolution of complex systems (Clayton and Radcliffe, 1996; Levin, 1998; Berkes & Folke, 1998; Holling, 2001; Gunderson & Holling, 2002; Berkes *et al.*, 2003; Folke *et al.*, 2004; Resilience Alliance, 2005; Lebel *et al.*, 2006; Olsson *et al.*, 2006; Gallopín 2006).

This chapter discusses the potential evolution of a complex socio-ecological system, the Hunter Valley, towards sustainability, with specific attention to the influence of the region's coal industry as a powerful attractor in the system.

6.1 Resilience

The social and ecological systems of the Hunter Valley exist as complex systems in their own right, but they are also linked to other complex social and ecological systems operating at multiple spatial and temporal scales. These systems include households, workplaces, neighbourhoods, townships, cities, industries, ecosystems, nations, continents, the planet and the cosmos. Powerful influencing factors ("attractors") and disturbances work both within, and between, complex adaptive socio-ecological systems and understanding the most influential attractors, and how they operate, assists understanding of the dynamics and potential evolutionary trajectory of the system, and how to apply adaptive management strategies to achieve a transition to sustainability (Berkes, Colding & Folke, 2003).

Attractors within socio-ecological systems rarely operate in isolation, but tend to work in conjunction with each other, creating a "basin of attraction" which is continuously buffeted by disturbances, "stochasticity" (randomness and disorder), and decisions of actors that tend to move the system off the influence of any one attractor (Walker *et al.*, 2004). Walker *et al.*, (2004) suggest that a socio-ecological system can sit in more than one basin of attraction (for example, within a particular political basin as well as a particular ecological basin) and that together these basins create a "stability landscape". They use a "ball in a basin" metaphor to describe how the basin that a particular socio-ecological system (SES) changes in response to multiple disturbances. These disturbances test the resilience of the system and its ability to stay within a particular basin of attraction or move into an alternative basin.

Walker *et al.* (2004) identified that resilience is influenced by four features of an SES: its *latitude* or the maximum amount the system can be changed before losing its ability to recover; its *resistance* or the ease or difficulty of changing the system; its *precariousness* or how close its current trajectory is taking it to a limit or threshold which, if breached, makes recovery difficult or impossible; and its *panarchic influences* from other (sub)systems at scales above and below the scale of interest.

A system with a lot of latitude has many states in which it can sit before it loses its ability to recover. This is shown in the diagram below as the width of the basin of attraction (L). A system with a lot of resistance to change can withstand greater pressures or disturbances, and is shown diagrammatically as the depth of the basin (R). A high level of latitude and resistance indicates that greater forces or disturbances are needed to change the state of the system out of one basin of attraction into another. A system with a high level of precariousness is close to "the edge" or to a critical limit of a key variable (Pr). Finally, powerful panarchic influences (Pa) will change the latitude, resistance and precariousness of the system potentially "embedding" it further into a particular basin of attraction or increasing its vulnerability to fall into an alternative basin which may be more or less desirable (Pa) (Walker *et al.*, 2004).

If the resilience of the system is weakened sufficiently the system will move into an alternative basin of attraction where it will be subject to different attractors which may fundamentally change the character of the system.

Emergence

The notion of "emergence", the coming forth of something new from the old, is an important concept in the field of complexity and understanding how complex adaptive systems evolve. Emergent system properties become recognisable and persist as features in complex adaptive systems, and if they are strong enough they can overwhelm the resilience of an SES. Being aware of emergent properties – including what they are, where they come from, how they relate to each other, and how they might be exploited – helps us manage the potential trajectory of socio-ecological systems.

In the Hunter Valley, emergent properties with a potentially powerful influence on the evolutionary trajectory of the region's SES include the impacts of climate change and associated threats of higher average temperatures, greater heat stress and increased severity and frequency of extreme weather events (Jones and Hennessy, 2000; CSIRO, 2007a). Other emergent properties are increasing ecological and human health distress from coalmining and coal-fired power generation (Conner *et al.*, 2004), loss of the coal industry's social licence to operate, as community outrage about the impact of coal dependency grows (Ray, 2005a-j; Evans, 2008a), and Peak Coal and Peak Oil (Kavalov & Peteves, 2007; Zittel & Schindler, 2007; Mohr & Evans, 2009; Campbell, 1997, 2005; Campbell & Laherrère, 1998; Heinberg, 2004, 2007).

However, emergent properties, and the trajectory towards which they might drive the Hunter Valley, cannot necessarily be predicted or explained by simply combining individual component behaviours. Cumulative and cross-domain linkages and disturbances in complex adaptive systems can combine to cause cascading change across ecological, social, economic and political domains pushing the SES in surprising and unpredictable directions, with potentially chaotic impacts (Holling, 1986; Scheffer *et al.*, 2001; Kinzig, 2001; Westley *et al.*, 2002; Gallopín, 2002; Folke *et al*, 2003; Carpenter & Brock, 2004; Walker & Meyers, 2004; McDaniel & Driebe, 2005)

Ecological and human actors within socio-ecological systems have the capacity to "learn" from accumulated experience, and to adapt to changing environments to achieve the best outcome for their integrity, efficiency and survival (Holland, 1996; Berkes & Folke, 1998, 2003). An anticipatory approach to change enables managers to identify emergent properties and to model their potential impacts through scenario building, experimentation, monitoring and evaluation. There is enormous scope for learning in response to changing environments, new disturbances and emergent properties, and for unleashing potential for innovation, novelty, creativity and adaptation (Waldorp, 1994; Holland, 1996; Holland, 1998; Holling & Gunderson, 2002; Peterson *et al.*, 2003; Olsson *et al.*, 2004; Keen *et al*., 2005; Anderies *et al.*, 2006; Olsson *et al*., 2006).

In the Hunter Valley SES, local communities, industry, environmentalists, governments, trade unions, and other stakeholders, are attempting to use adaptive management strategies to achieve their preferred outcomes, which range from keeping the SES in its current basin of attraction in which coal is a powerful attractor, to shifting it into an alternative basin where coal and linked ecological and human health distress are no longer powerful attractors.

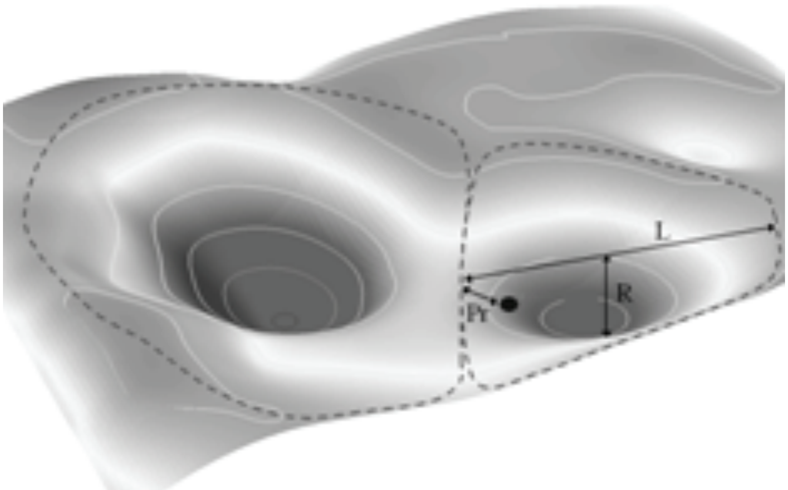
The diagram below (Figure 18) shows the Hunter SES in its current *Carbon Valley* basin of attraction with an alternative *Future Beyond Coal* basin of attraction adjacent. The Hunter Valley SES is under the influence of many attractors that hold it in its current basin, such as its climate, topography, biodiversity, natural resources and human communities, but the diagram shows that it could move to an alternative basin if the emergent attractors become powerful enough to drive the system across thresholds.

The Hunter Valley SES remains in its current basin of attraction: *Carbon Valley*

The Hunter Valley socio-ecological system currently sits in the *Carbon Valley basin* with heavy domination of the coal industry attractors – cheap coal, markets, industry political power, etc., but emergent disturbances and pressures (climate change, ecosystem distress, human health distress, etc.) test the resilience of the system.

Dominant attractors: Cheap coal, markets, industry political power, government support, perverse subsidies, social licence to operate.
Emergent attractors: climate change, ecosystem distress, human health distress, challenges to social license to operate, Peak Oil, Peak Coal

Future Beyond Coal *Carbon Valley*



The Hunter Valley SES moves into an alternative basin of attraction: *Future Beyond Coal*:

As the scale of pressures from emergent disturbances overwhelm the resilience of the system it moves into an alternative basin of attraction (a *Future Beyond Coal* basin) where the major attractors are strong climate change mitigation strategies and targets, renewable energy technologies, renewable energy markets, etc

Dominant attractors: climate change mitigation strategies and targets, renewable energy technologies, renewable energy markets, investment and subsidies, more localised economies.
Emergent attractors: Healthy and sustainable ecosystems and communities

Future Beyond Coal *Carbon Valley*

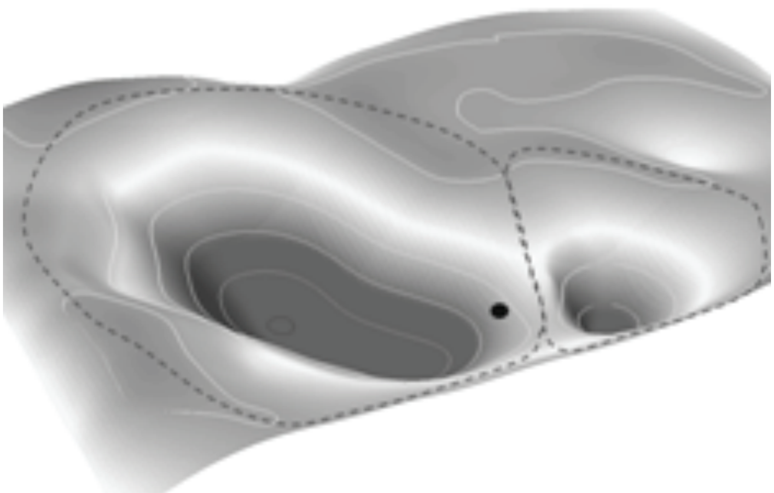


Figure 18: Three-dimensional stability landscape with two basins of attraction

(Adapted from Walker *et al.,* 2004.)

6.2 Resilience thinking

Walker and Salt (2006) argue for managers to use “resilience thinking” as an essential tool for maintaining sustainability. Change is both an opportunity and threat, and there are places and times (such as now, when humanity needs to prevent potential climate chaos, recover from economic crisis, and overcome persistent poverty and conflict) when it seems obvious that the socio-ecological systems we live in need to move out of undesirable basins of attraction and away from the influence of attractors that lock human societies into pathological conditions.

Resilience thinking is a helpful alternative to maintaining a “perverse resilience” of undesirable states, where the need for change is denied and resisted by powerholders in society and managers of socio-ecological systems. As Walker and Salt note:

> Things change – and to ignore or resist change is to increase vulnerability and forego emerging opportunities. In doing so we limit our options (Walker & Salt, 2006: 9).

Resilience thinking requires recognising how latitude, resistance, precariousness and panarchic influences are changing in an SES, and particularly the potential of cascading cross-domain regime shifts that once underway cannot necessarily be controlled.

While, as Kinzig *et al* (2006) noted, many interactions from outside the system cannot be predicted or controlled by actors within an SES, the most strategic management strategy to either prevent regime change, or to drive regime shifts towards a more desirable state, would pay close attention to those variables that are most susceptible to outside forces and most likely to be breached first. Resilience thinking would seek to build (or undermine) the resilience of those influential variables as much as possible.

Engineered and ecological resilience

Holling (1973, 1996) discusses two types of resilience within socio-ecological systems – “engineered” and “ecological” resilience. He proposed that these two types of resilience reflect a tension between efficiency and persistence, between constancy and change, and between predictability and unpredictability, that leads managers to rely more on one form of resilience or the other (Holling, 1973).

Ecological resilience reflects the inherent qualities of an SES and the amount of disturbance the system can take before it is pushed into a different regime. It reflects resilience based on “going with the flow”, accepting and responding creatively to change, and surviving through unpredictability. Engineered resilience, in contrast, “regulates the flow” and promotes efficiency, persistence, constancy and predictability within an SES (Holling, 1973).

Human society is marked by attempts to “engineer” resilience in order to maximise predictability, stability, and efficiency in response to natural and human-induced disturbances. Engineered resilience can create an illusion of sustainability and may help maximise economic output or social control, but may simply serve to isolate human societies from profound ecological and social change processes, reflecting human arrogance about the power of engineered 'solutions' to ecological and social problems. In this respect, Folke *et al* noted:

> Short-term success of increasing yield in homogenised environments reinforces mental models of human development as being superior and largely independent of nature's services. Short-term successes allow managers to shift their attention from the original purpose to efforts to increase organisational or economic efficiency and to control variation in nature. The perception, or belief system, of humanity as independent of nature is reinforced (Folke *et al*., 2002: 19).

Ludwig *et al* (1993) identified a paradox, namely that suppressing disturbances and the diversity of environments has created an illusion, among some managers of social and ecological systems of optimal management, of an apparently stable and predictable system when, in fact, management practices that rely on engineered rather than ecological resilience may actually reduce management options and compromise the system's capacity to buffer change when disturbances eventually overwhelm the system's engineered capabilities. The Mississippi River under flood and hurricane conditions is one example, and, closer to home, is the belief that controlled burning of Victorian forests could have prevented the devastating and tragic February 2009 bushfires.

The engineering of technological 'solutions' such as dams, controlled burning, irrigation and other human actions to minimise threats to human safety or economies from the unpredictability or scale of harm from natural systems may create an illusory resilience because the feedback from the environment and society is masked, but, in reality, a pathological or maladaptive condition may be assisted to persist. Blindness that the apparent condition of stability is illusory, rather than real, creates actually poses grave risks:

> Short-term success makes navigating nature's dynamics appear to be a non-issue and as a consequence knowledge, incentives and institutions for monitoring and responding to environmental feedback erode. Societies become vulnerable without recognising it (Folke *et al*., 2002: 19).

In the contemporary Hunter Valley, efforts to engineer resilience of a non-sustainable carbon-intensive economy while masking feedback from the cumulative ecological and social impacts of mining, coal-fired power generation and climate change include the region's Salinity Trading Scheme, which allows coalmining corporations to buy rights to release the super-saline water that accumulates on minesites during times of high river flow. Yet these high river flow events may become less frequent as climate change impacts grow. The $450 million that the NSW Government proposes to spend building the Tillegra Dam in the Hunter River catchment is allegedly supposed to guarantee urban water security, but, given that there are cheaper and more effective ways to do this, in fact the dam may well be a perverse public subsidy to guarantee water security to coal- or gas-fired power stations and linked carbon-intensive industries.

Carbon capture and storage (CCS) technologies are perhaps the most concerted and expensive effort to engineer the resilience of the coal industry. CCS has both a "technological" engineering role in attempting to remove carbon dioxide from releasing to the atmosphere, and a "social" engineering role in attempting to give the public the impression that a solution to greenhouse gas emissions from coal-fired power is necessary, possible and imminent (New Gen, 2008).

6.3 A pathological and perverse resilience

Engineering to maintain the resilience of an undesirable socio-ecological system state is referred to as "negative resilience" (Gallopín, 2006) or "perverse resilience" (Ráez-Luna, 2008). These forms of resilience occur where pathological social relationships that are oppressive and exploitative of humans and ecosystems are rendered resistant to change by economic and political subsidies.

Ráez-Luna (2008) proposes that three interacting institutions of human societies – material capabilities, social institutions, and ideas – are dialectic structures that emanate from both politico-economic systems (sociosystems) and ecological systems and need to be critically analysed to understand system dynamics. Material capabilities include natural resources, labour, technology and accumulated wealth, and, like social institutions and ideas, may either work to stabilise the current order or for change over time. Thus, these institutions can be seen as dissipative structures within socio-ecological systems, and their characteristics and the interactions between them are powerful influences on the potential for system transformation. Therefore control over material capabilities, social institutions and ideas is a critical issue defining the character of human-human and human-nature relationships and is the focus of hegemonic contestation:

> Humans cannot be understood just as part of ecosystems. In sociosystems, for every material flow, there are a number of ideational flows. And every materials flow in a sociosystem is channelled through concrete human groups, distributed in concrete human ways, justified in exclusively human terms. Human and non-human nature interpenetrate each other, but they are not the same (Ráez-Luna, 2008: 325).

Thus, to analyse transformation of complex adaptive socio-ecological systems, Ráez-Luna challenges us to analyse the human social dimension of socio-ecological system transformation, and therefore to link social change and social movement theories with socio-ecological system transformation theory.

Ráez-Luna (2008) uses Gramsci's concepts of "hegemony" and "hegemonic structures", in the social contest for consent, or otherwise, for a particular set of social and economic relationships. Hegemony and the persistence of hegemonic structures are useful frameworks for explaining pathological relationships within complex socio-ecological systems. Particular groups of people exercise hegemonic and counter-hegemonic power in society, using persuasion, concession, and coercion, to influence the trajectory of socio-ecological systems and their potential for sustainability. Ráez-Luna identifies this hegemonic struggle as occurring in all stages of the evolution of socio-ecological systems, affecting their stability, their collapse and their reorganisation and their renewal post-collapse.

Ráez-Luna (2008) also notes there is a hegemonic contest over genuine resilience and sustainability, and that that there is a perverse resilience of non-sustainability imposed on relatively less powerful and less stable Third World/Global South communities from the major centres of global power and accumulation in the First World/Global North. According to Ráez-Luna, the presence of inequity in incomes and relative accumulation, in relative underdevelopment (including poor local infrastructure) between the centres of non-hegemonic power and the centres where power is concentrated reflects attempt by global powerholders (with the support of their national and local collaborators) to lock in a perverse resilience of their economic and social advantage. This is achieved at the cost of resilience in the regions being exploited, bringing forth political contestation between hegemonic and counter-hegemonic social movements as each attempts to increase and consolidate their power in order to maintain, or reconfigure, politico-economic cross-scale structures.

Ráez-Luna proposes that the Third World is locked into a cycle of very fast rotations through the four phases of the adaptive cycle of complex adaptive systems described by Holling (1986) (shown in Figure 19 below): conservation; release/collapse; reorganisation/renewal; and accumulation/exploitation..

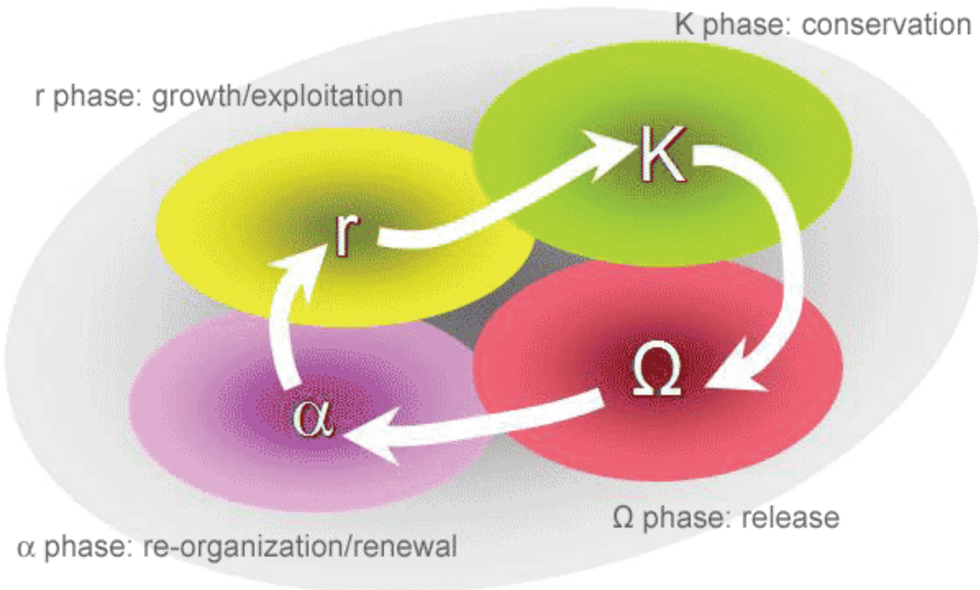


Figure 19: The four phases of the adaptive cycle

(Holling 1986.)

Ráez-Luna proposes that the Third World is often stuck in the renewal, growth and exploitation phases, with little time spent in the more stable conservation phase (that the First World tends to sit in) and where wealth is accumulated. He believes that wealth does not accumulate at the local level in Third World countries because it appropriated and exported at the cost of local ecological and social wellbeing. Thus stability is undermined and the system moves rapidly into the collapse phase.

The Hunter Valley exhibits features of the hegemonic/counter-hegemonic struggle over genuine versus perverse resilience that Ráez-Luna discusses with respect to Third World/First World relationships. The Hunter Valley situation is typical of many natural resource extraction regions in both First and Third World countries, including the other major mining regions of Australia (such as the coalfields of the Latrobe Valley of Victoria and the Bowen Basin of Central Queensland, the bauxite and other mining regions of Queensland's Gulf and Cape, and the Pilbara region of Western Australia).

In these centres, large-scale mineral extraction supplies global markets at the cost of regional ecosystem health and sustainability, but to the benefit of global mining corporations, their investors and their political patrons in government. The Hunter Valley's socio-ecological system can be seen to be subsidising the perverse resilience of the Australian economy based on non-sustainable resource extraction and export (Australia's 'quarry' economy) and fossil fuel dependency.

In common with many Third World regions, the Hunter Valley's socio-ecological system has moved through a rapid cycle over the last 200 years, with the collapse of an ecologically and socially sustainable Indigenous culture; the socio-ecological system has reorganised around the socio-economic relationships of a colonial settler society. In this society there has been accumulation of wealth, but much of the region's wealth has been appropriated by non-resident corporations and by the state government via royalties, while the region's natural capital has been sacrificed to sustain a precarious conservation phase in illusory stability.

Thus, the Hunter Valley remains in a condition of chronic disadvantage relative to other regions of Australia, a disadvantage that may be further exacerbated in a post-coal era when the local resource is exhausted (or the global economy moves *Beyond Coal*) leaving the region's environment degraded and precluding other economic activity that relies on healthy ecosystems. Enormous wealth is being appropriated from the Hunter Valley, but significant environmental and social engineering is required to maintain an illusion of ecological and social sustainability. The region's resilience is thus perverse rather than genuine, and its sustainability is illusory and precarious.

The Hunter Valley and Third World regions share the unfortunate attribute of being sites of hegemonic power where global powerholders exploit local resources, and in so doing jeopardise sustainability. Genuine sustainability cannot be achieved if the resilience of one community, corporation or country is achieved by undermining the resilience and sustainability of other people or places. Therefore, there is a need for critical analysis of whether resilience in any one place, community or industry is genuine or perverse.

6.4 The Hunter Valley within a global panarchy

The concept of a *panarchy* was proposed by Holling and Gunderson (2002) to describe the co-evolution of nested complex adaptive systems. Within a panarchy, small systems nested in larger systems tend to evolve more quickly than the larger systems in which they are nested. Larger systems (such as global climate systems, landscapes and historical cultural values) tend to be more stable and enduring than smaller systems (such as local micro-climates, habitats and cultural fads). Qualities embedded in larger systems (such as climate, topography, gene pools, and enduring cultural values and knowledge) can have a determining influence on whether smaller systems collapse, and how they reorganise after collapse.

While larger systems endure longer than smaller systems over space and time, they do change. Disturbances from many smaller systems have a cumulative, compounding affect on the larger systems and overwhelm their control mechanisms, pushing them beyond critical thresholds, catalysing a collapse into a new phase of the evolutionary cycle of the larger system. The declining health of the Hunter River catchment from the cumulative impacts of various landuses exemplifies this process. The global financial crisis of 2008 was caused by the cumulative impact of millions of speculative, toxic, high-risk investments and debts, loss of confidence in credit markets, declining production and trade and loss of jobs in the US and then spilling out across the global economy.

The Hunter Valley sits within a panarchy that extends across regional, continental and global socio-ecological systems. The region's ecosystems and communities are products of, and influenced by ecological and social forces from these bigger systems that have been operating for many millions of years (in the case of ecological processes) and for tens of thousands of years (in the case of social processes).

The diagram below (Figure 20) shows the Hunter Valley nested in the global energy market, one of the many socio-ecological systems in which the region's socio-ecological system is nested (others being continental Australian ecosystems, society, economy and energy markets). Global energy markets are, in turn, nested in many other larger social and ecological systems, including the global climate system and ecosphere. The diagram shows some feedback links up and down the nested systems linking the Hunter Valley, global energy markets and the global climate, in one iteration of a global panarchy

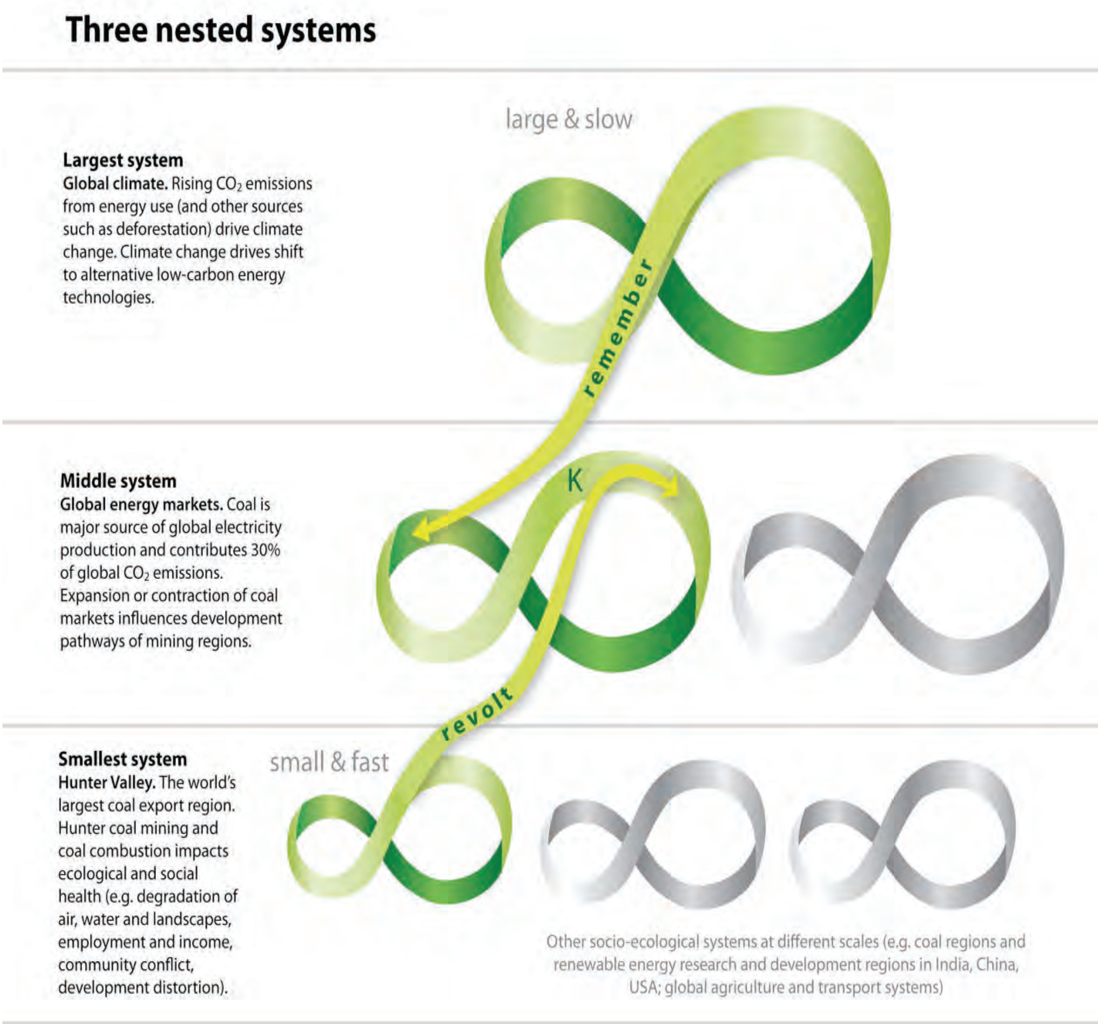


Figure 20: The Hunter Valley within global energy markets and climate panarchy

Showing the Hunter Valley nested within global energy markets which in turn are nested in the global climate system (Gunderson and Holling, 2002, as used in Evans, 2008a)

In the panarchy shown above, the largest system – the global climate and ecosphere – is theoretically the slowest-moving system. Disturbances from multiple smaller systems, the fossil fuel-based energy markets in the Hunter Valley and in the many other coal-dependent economies in North America, Europe, Japan, China, and India (places where some Hunter Valley coal is exported to), have unsettled the larger global climate system.

Global driver: Climate change

Climate change and Peak Coal are two global-scale disturbances to the global market for coal that are likely to become significant over the next decades. Peak Coal is a condition where the amount of coal produced is less than global demand, causing potential demand to be unfulfilled, energy insecurity, and a shift in investment towards alternatives.

Climate change science tells us that the melting of polar ice-caps, retreat of glaciers, projected sea-level rise, and the thawing of arctic tundra are occurring at rates that are more rapid than those projected by the Intergovernmental Panel on Climate Change (IPCC) in its 2007 report. These phenomena are likely to unleash feedback processes that may drive average global temperatures to more than 4° C above pre-industrial temperatures within as soon as 50 years, unless bold action is taken (IPCC, 2007; Hansen, 2007; Rahmstorf *et al.*, 2007; Lenton *et al.*, 2008, Richardson *et al*, 2009).

Australia and the Hunter Valley are not immune from climate change impacts, which have been described earlier. The vulnerability of the Hunter Valley to climate change-induced severe storm events was very much in the mind of the region's people when the region experienced widespread stormwater and flood damage in June 2007. The coal ship the *Pasha Bulker*, waiting offshore to be loaded with Hunter Valley coal for export to Asia, was driven onto Newcastle's Nobbys Beach during these fierce storms. The links across the global panarchy between local coal, global markets and climate change exemplified by the grounding of the *Pasha Bulker* were humorously depicted in cartoon form by Peter Lewis (Figure 21 below).

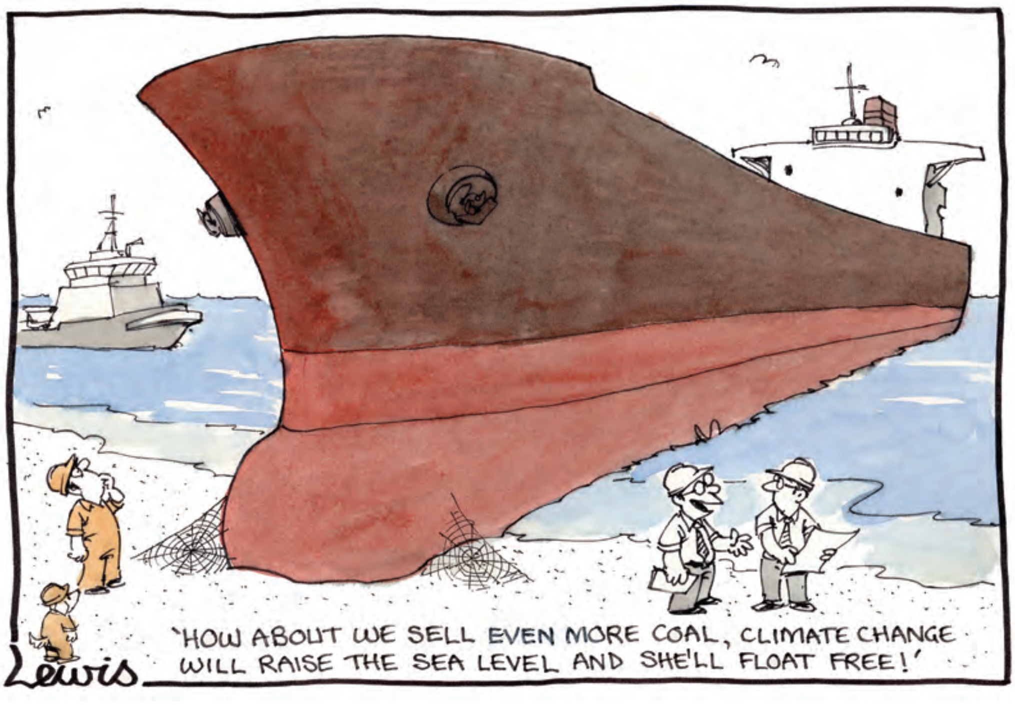


Figure 21: Feedback loops between Hunter Valley coal and climate change

(Courtesy: Lewis, *Newcastle Herald*, 7/6/2007)

Strong action on climate change is likely to include a curb on coal. The eminent climate scientist James Hansen, director of NASA's Goddard Institute for Space Studies in New York, for example, has described coal as "the single greatest threat to civilisation and all life on our planet". He proposes that there needs to be an immediate moratorium on new coal-fired power stations to prevent runaway climate change and to create a realistic chance to bring carbon dioxide concentrations down to less than 350 parts per million, which he identifies as the minimum level necessary to stabilise the climate and the planet's ecosystems (Hansen, 2009).

Global driver: Peak Coal

Two reports published in 2007 indicated the likelihood that coal production globally will peak around 2025 according to reports by the German-based Energy Working Group (EWG) (Zittel & Schindler, 2007), and by the Institute for Energy (IFE) for European Commission Joint Research Centre (Kavalov & Peteves (2007). The US National Research Council's Committee on Coal Research, Technology and Resource Assessments to Inform Energy Policy also indicated that Peak Coal might occur sooner than many industry and government analysts have projected because outdated methods of reserve estimation have been used, stating that:

> Present estimates of coal reserves are based upon methods that have not been reviewed or revised since their inception in 1974, and many of the input data were compiled in the early 1970s. Recent programs to assess reserves in limited areas using updated methods indicate that only a small fraction of previously estimated reserves are economically recoverable (US Board on Earth Sciences and Resources, 2007: 5)

The EWG report found that since 1986 all nations with significant coal resources (except India and Australia) that have made the effort to update their reserves estimates have reported substantial downward revisions, with some countries – including Botswana, Germany, and the UK – downgrading their reserves by more than 90%.

China and the US hold the key to the future of coal, according to Zittel and Schindler (2007) in their EWG report, yet the indications are that in these two critical markets the duration of heavy reliance on coal is only a few decades. According to Zittel and Schindler (2007) China reports 55 years of coal reserves at current consumption rates, but if quantities consumed since 1992 (the last year reserves figures were updated) are subtracted this declines to 40 to 45 years, assuming constant rates of usage. In fact, as consumption has been increasing rapidly that timeframe is likely to shrink further.

In the light of these factors, the EWG report's authors state:

> Either the reported coal reserves are highly unreliable and much larger in reality than reported or the Chinese coal production will reach its peak very soon and start to decline rapidly (Zittel and Schindler, 2007: 28).

The US is the world's second-largest producer after China and has already passed its peak of production for high-quality coal (from the Appalachian Mountains and the Illinois basin). The era of high-quality coal is nearing its end and the efforts to produce the coal are steadily increasing. Production of high-quality bituminous coal has declined since 1990 but was replaced by growing extraction of sub-bituminous coal in Wyoming and Montana. However,

> It is very likely that bituminous coal production in the US has already peaked, and that total (volumetric) coal production will peak between 2020 and 2030 (Zittel & Schindler, 2007: 39)

Kavalov and Peteves (2007) conclusions support the EWG research, indicating that growth in total volumes can continue only for 10 to 15 years. Their review of recent market trends suggests the following:

- The supply base of coal is being continuously depleted. World proven reserves (i.e. the reserves that are economically recoverable at current economic and operating conditions) of coal are decreasing fast, unlike world oil and gas reserves, which are proportionally enhanced and are maintaining their levels.
- The bulk of coal production and exports is becoming concentrated within a few countries and market players, which creates the risk of market imperfections.
- Coal production costs are steadily rising all over the world due to the need to develop new fields, increasingly geologically difficult.
- Conditions and additional infrastructure costs associated with the exploitation of new fields (Kavalov & Peteves, 2007:4).

With respect to global markets they noted that Australia is gradually becoming the ultimate global supplier of coal as other traditional key exporters like South Africa, Indonesia and USA face significant challenges in the development of their coal reserves and export capabilities. Former large net exporters China and the US are gradually turning into large net importers with an enormous potential demand, together with India. According to Karvalov and Peteves, all of Australian thermal coal exports are equal to only 5% of Chinese thermal coal consumption. Exports from other possible large producers (Russia, Kazakhstan, Colombia) face substantial logistics problems (Karvalov & Peteves, 2007:4).

University of Newcastle researchers, Mohr and Evans (2009), have undertaken research that is consistent with the findings of Zittel and Schindler (2007) and Kavalov and Peteves (2007), and have developed a model that indicates that worldwide recoverable coal resources suggest coal production will peak between 2010 and 2048 on a mass basis and between 2011 and 2047 on an energy basis.
Together, these trends suggest that while there is currently a growing world demand for Hunter Valley coal the market is short term only, and Peak Coal, locally and globally, is likely to drive a rapid shift of investment from coal into alternative energy technologies so that future energy security can be guaranteed.

The global ecological and financial crises provide disturbances for a potential transition to a Post-carbon society, as Keynesian responses by governments to tackle these crises simultaneously direct public investment into energy efficiency, renewable energy and

Green jobs. Whether the stimuli are sufficient to drive system transformation is an issue being contested in political forums between those who see the linked climate change, Peak Coal/Oil and economic crisis as opportunities for the lack of resilience of the current global development paradigm to be exposed and an alternative trajectory to be supported, or for the current paradigm to be propped up through a perverse resilience, in what Perelman calls an "absence of realism" in a "perverse economy" (Perelman, 2003: 104).

The following section discusses how a longer-term transformation from the current *Carbon Valley* to a *Future Beyond Coal* scenario might evolve in the Hunter Valley is discussed in more detail later in this chapter.

6.5 Potential transformation pathways for the Hunter Valley

There is no single trajectory that the Hunter Valley's socio-ecological system will automatically move towards, but there are various potential pathways. A potential transformation towards a *Future Beyond Coal* might occur as climate systems, Peak Coal and global economic system disturbances overwhelm the control mechanisms that currently maintain the region's *Carbon Valley* status quo.

Feedback from one domain, such as the ecological or economic domain, reinforces feedback from others, and the potential influence of these linkages needs particular attention. The pace of change may become very rapid as disturbance has a synergistic and reinforcing impact across domains creating a cascading threat to the status quo (Scheffer *et al.*, 2001; Kinzig *et al.,* 2001).

It may be that the coal industry, propped up by engineered perverse resilience, is able to temporarily reduce the impact of disturbances such as water stress or loss of social license to operate, and continues to expand. Current trends suggest this is likely to leave the Hunter Valley in an ecologically degraded, socially stressed, economically marginalised condition of non-sustainability.

Therefore two possible future scenarios emerge: a business-as-usual *Locked-in Carbon Economy*; and an alternative transformation to a *Future Beyond Coal*. These scenarios are described in the Figure 22 below. Thresholds associated with different ecological, social, economic and political dimensions that may interconnect to influence a cascading effect into these states are also shown.

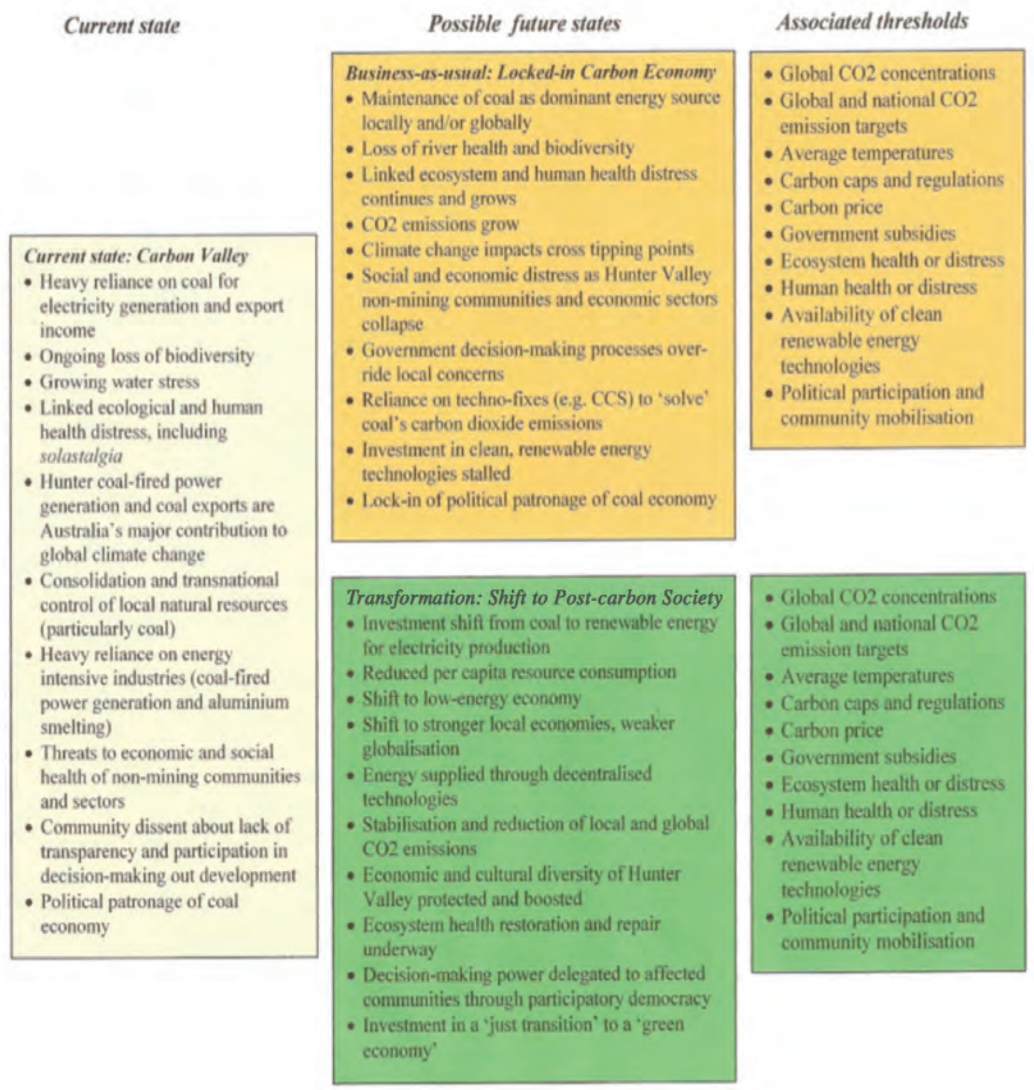


Figure 22: Two potential states of the Hunter Valley and associated thresholds

(Following Kinzig *et al.*, 2001)

6.6 The transformation of systems through four stages of the adaptive cycle

The following sections describe the potential transformation of the Hunter Valley's socio-ecological system over the next few decades from its current *Carbon Valley* to a *Future Beyond Coal.* The description uses the four phases of a complex adaptive system (as described by Holling, 1986), and is based on processes described in the previous chapter. Potential transformations of three nested systems, at three different scales, are described, that is: the regional-scale Hunter Valley CAS; the global energy market; and the global climate system.

The Hunter Valley: Socio-ecological system transformation at the regional scale

The Hunter Valley socio-ecological system was relatively stable over the last 40–60,000 years of Indigenous-dominated socio-ecological relationships, shown as a *conservation* (K) phase in Figure 23 below. The advent of British colonisation and the introduction of large-scale clearing and resultant ecosystem health distress from agriculture, mining and urban settlements coincided temporally and spatially with displacement of Indigenous people from their lands and the replacement of Indigenous socio-ecological relationships with capitalist, industrial productivist relationships. These impacts created sufficient disturbance to drive the system into the *release* (Ω) phase (sometimes referred to as *collapse*), which is the current system status as *Carbon Valley*. The collapse is well advanced but not yet complete. It is a relatively short phase compared with the previous K phase, and the extent of the collapse depends on the scale of coalmining and coal-fired power generation (and other ecologically harmful activities), how long these activities persist, and the extent of its ecological and social impact and resulting ecosystem-human health distress.

Collapse in supply of coal (due to local resource exhaustion) or collapse in demand (due to strong climate change mitigation strategies targeting coal, global energy market adjustments in response to Peak Coal, or global economic collapse), and/or loss of the coal industry's social licence to operate may drive the evolution of the Hunter Valley's socio-ecological system out of its current *collapse* phase and into a new phase, a *reorganisation* (α) phase in which there is reorganisation towards a more sustainable development trajectory for the region. This phase would be a time of political contestation (and hegemonic and counter-hegemonic struggle) between advocates of competing ideas for influence over the nature of human/ecological relationships in the region. In this phase, if advocates of a *Future Beyond Coal* prevail, then investment may shift from coalmining and coal-fired power to renewable energy systems, environmental rehabilitation. Coalmines would be phased out and ecosystem health and human health would begin to be restored. This phase is likely to be relatively more rapid than the previous phases, perhaps spanning 10–50 years given the urgency to address climate change threats and the timescale involved in major infrastructure write-offs and investments.

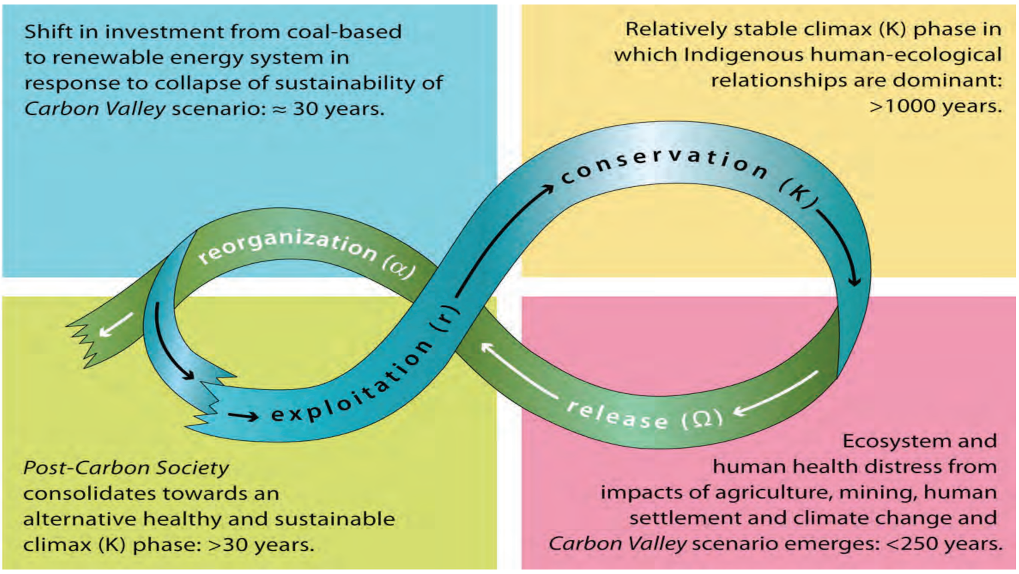


Figure 23: Evolution of Hunter Valley to a *Future Beyond Coal*

(Adapted from Gunderson & Holling, 2002, in Evans 2008a)

The potential reorganisation of the system will consolidate as the natural, human and financial resources currently locked-up in the *Carbon Valley* economy are liberated. Innovation will drive the form of social and economic development in the re-organisation and consolidation.

Disturbances from larger systems to which the Hunter Valley is linked – that is, the global energy market and global climate – will influence the trajectory of the *reorganisation* of the region's socio-ecological system and the potential for a particular set of values, and institutional arrangements, to become dominant, and be attractors around which the system will consolidate during the *exploitation* or consolidation (r) phase. In this phase, ecosystem health and social sustainability around alternative *Future Beyond Coal* set of human-ecological relationships and an alternative economy will mature until it reaches a new *conservation* or climax (K) phase.

The global energy system: The transformation of an intermediate-scale system

The potential transformation of the second level of the panarchy, the global energy system, from fossil fuel dependency to a global *Post-carbon Society* is described in Figure 24 below.

In this iteration of the panarchy, the current global energy system that is dominated by fossil fuels is the *conservation* (K) phase. This fossil-fuel-based energy system is starting to collapse (*release*) as global concerns about climate change grow, new regulatory and market mechanisms begin to constrain the cost advantage of fossil fuels, and investment begins to shift towards renewable energy technologies. We are currently at the cusp of this *release* (Ω) phase, and in some European countries and states of the US (e.g.

Scandinavian countries and Spain, and Iowa and California in the US) a collapse is already well underway as investment in coal-fired energy systems has stopped.

The *reorganisation* of the global energy system will see energy markets transform rapidly as energy investment shifts to renewable energy technologies: wind, solar and geo-thermal. As the most dynamic of these technologies take off, energy markets will consolidate around them in the *exploitation* phase. The potential technologies of the *Post-carbon Society* will emerge as the innovation and capital "wealth" of a system that is currently locked into fossil fuels is released, and as the "liberated" research capacity and financial investment are directed to alternative technologies. Technological innovation, regulation and markets will determine which mix of technologies becomes dominant and is where investment is ultimately directed, with different mixes of technologies deployed in different places.

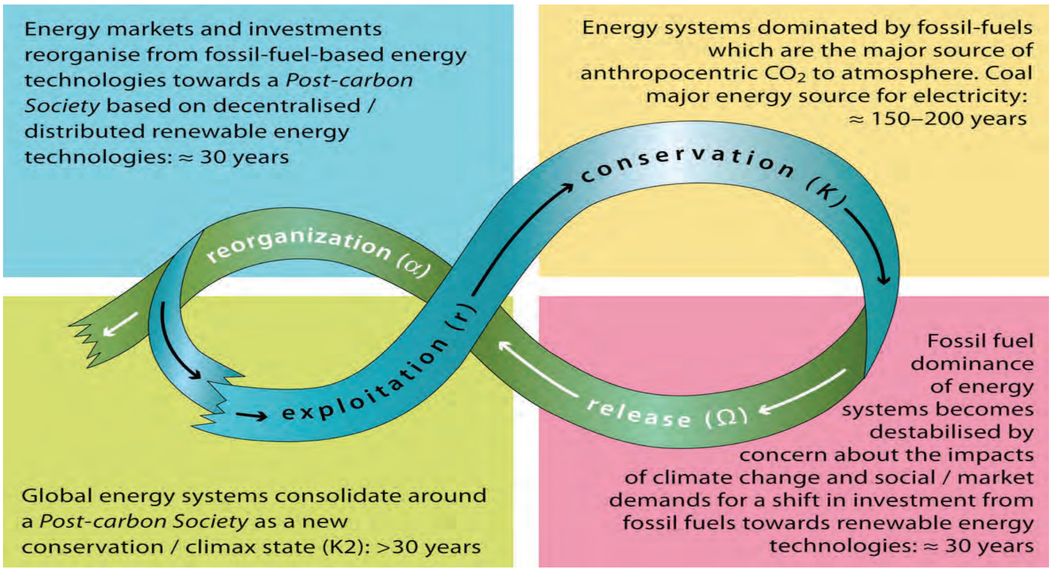


Figure 24: Evolution of the global energy markets in a *Post-carbon Society*

(Adapted from Gunderson & Holling, 2002, in Evans 2008a)

The system will "lock up" resources around these technologies (and the social arrangements that support them) in a global *Post-carbon Society* which will be the new *conservation* phase (K2)

The global climate system: Transformation of the largest system

The potential transformation of the largest system, the global climate system, through phases of the adaptive cycle is described in Figure 25 below. In this scenario the relatively stable global atmosphere of the last 10,000 years – the *conservation* (K) phase – is collapsing as greenhouse gas emissions have risen over the last 250 years from pre-industrial levels of 260–290 parts per million of CO_2e by volume (ppmv) to current levels of around 385 ppmv (IPCC, 2007a). The emissions that have destabilised the system come from multiple sources in many smaller nested systems, including fossil-fuel-based industrial societies around the world as well as from deforestation, transport and other sources (IPCC, 2007a).

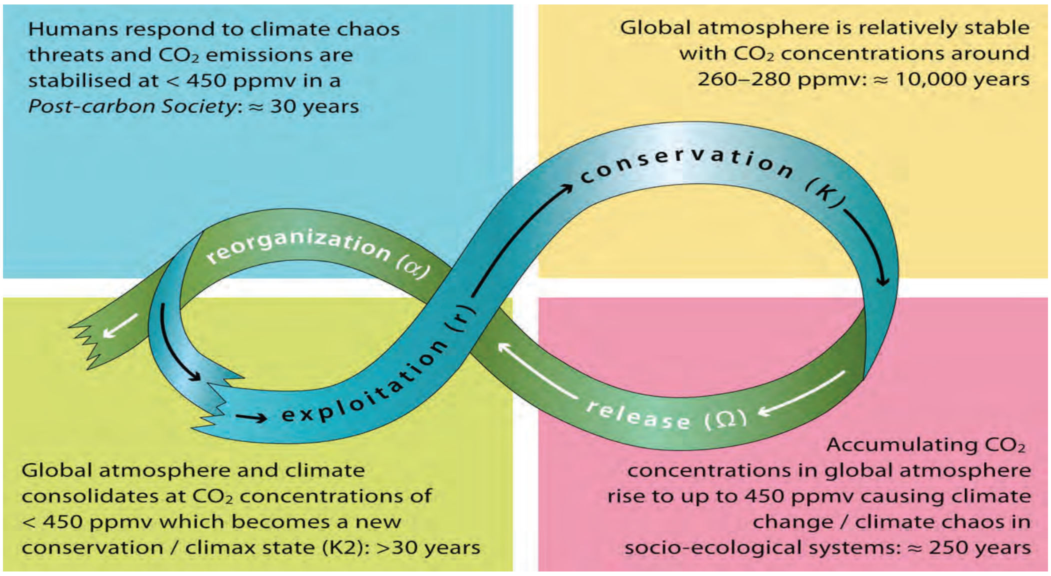


Figure 25: Evolution of the global climate system in a *Post-carbon Society*

(Adapted from Gunderson & Holling, 2002, in Evans 2008a)

If CO_2 emissions stabilise in responses to climate change mitigation initiatives then the system will stop collapsing and will stabilise, moving into a new *reorganisation* (α) phase. The current *collapse/release* phase of the system, during which climate change continues, will persist for decades yet, and the *reorganisation* phase will happen towards the middle of the 21st century as the climate stabilises. If mitigation measures are too weak to enable stabilisation by mid-21st century, then *reorganisation* will be later.

A new state of climate equilibrium will form during the *exploitation* phase, hopefully below the 350 ppmv level of CO_2 identified by scientists as the maximum level of CO_2 concentration allowable to prevent climate chaos (Hansen, 2008). The system would then enter a new *conservation* (K2) phase in which the atmosphere stabilises at this level (or lower).

Conclusion

This chapter has described potential transformation scenarios for the Hunter Valley and the larger systems to which it is linked in a global panarchy, in terms of theory about the evolution of complex adaptive systems. Attractors drive the trajectory of the Hunter Valley and other socio-ecological systems, and hold them in different basins of attraction. Cross-scale disturbances from larger and smaller systems may become so large that the resilience of any, or all, of the systems may be lost and critical thresholds of controlling variables are crossed. The systems may then move into an alternative basin of attraction, possibly as a cascading process, that transforms structures and functions.

The Hunter Valley's socio-ecological system, that was relatively stable for tens of thousands of years under the influence of an Indigenous land management regime, has been overwhelmed in a relatively short time, with linked ecological and social collapse that has accelerated as disturbances from political and economic globalisation have increased in scale. The collapse is likely to become even more dangerous and chaotic as climate change and exploitation of the region's coal resources become powerful attractors in the regional and global basins of attraction.

These threats indicate an urgent need to shift local regional and global socio-ecological systems from their current non-sustainable trajectories, even though the Hunter Valley's current *Carbon Valley* status appears resilient, as global demand for coal grows and the scale of coalmining and exports from the region expands.

However, this apparent resilience is "pseudo-resilience" as various perverse subsidies lock the system into what Allison and Hobbs (2004) call a "rigidity trap" where highly connected, rigid, and inflexible social institutions create a pathological condition. In this state the system is unable to move into a new phase of renewal despite the non-sustainability of its current condition. However, pressure is building up on the Hunter Valley's SES from internal contradictions and from growing negative feedback disturbances from the larger global systems. Climate change, Peak Coal/Peak Oil and loss of social licence to operate are beginning to overwhelm controlling variables that hold the system in its current basin of attraction.

The power of larger-scale disturbances make it extremely unlikely that the engineered perverse resilience of the region's coal dependency can be sustained for long. Transformation in one form or another is likely. Transition can be manageable and harmonious and towards sustainability, if ecological and social resilience and adaptive capacity are sustained, rather than sacrificed. If these qualities are lost then transition to healthy and sustainable ecological and social systems may not be possible. In these circumstances, the trajectory of transition is unclear and the process of transition may be both chaotic and traumatic.

Resilience, genuine or illusory, is a contested quality of an SES, as hegemonic and non-hegemonic social forces challenge each other, attempting to drive the system on one trajectory or another and to manage for real or illusory resilience. Ethically, sustainability and genuine resilience beat the alternative in terms of benefits to all species and current and future generations of humans.

The following chapters investigate how genuine resilience of the Hunter Valley's regional SES and global energy markets and climate systems might be achievable through a Just Transition process, social learning and social movement development.

Chapter 7

A Just Transition to sustainability

As noted in previous chapters, a potential transition to sustainability is a politically contested process, as various vested interests promote alternative visions of sustainability from weak to strong, and to seek advantage during the transition process to protect or strengthen their power and hegemony in society.

The analysis of the Just Transition process in this research is particularly focused on the potential of two social movements: the labour and the environment movements, to work together with governments to shift energy systems from the basin of attraction in which they are currently situated (and which the coal industry dominates) to an alternative basin, as part of a transition to sustainability.

Mutual benefit through social movement unionism

Obach (2004) notes that both the labour and other social movements can benefit from alliances on shared issues of concern; when divided they represent relatively weak movements compared to the power wielded by those corporations but, when allied, they represent a movement capable of posing a challenge to elite powerholders and bringing about dramatic social change (Obach, 2004). Thus, when these social movements work together they can increase their influence as attractors in socio-ecological systems.

Alliances of the labour movement, with organisations and campaigners focused on public health, gender, race, peace and global justice, have given progressive social movements a "greater chance of dominating the [political] agenda through political veto power over economic elites and their government supporters" (Schnaiberg & Gould, 1994: 160). The union/community campaign for *Your Rights at Work*, which is credited as having had a major influence on the outcome of the 2007 Australian election, is an example.

However, alliance-building is a contingent and dynamic system variable, as Obach (2004) notes:

> Organisations will agree to share resources and coordinate action when doing so will better enable them to achieve their goals and will refrain from coalition activity when it is not necessary to achieve their ends or if their potential partners are pursuing goals counter to their interests (Obach, 2004: 282).

Thus, the organising principles around which counter-hegemonic power is built links civil society organisations to build shared power through collaborative campaigns around class, race, gender, global equity and other forms of structural oppression within contemporary societies.

The Just Transition process seeks to build collaboration between the environmental movement and the labour movement, as a strategy for social change linking ecology, class and work. The emergence of Just Transition partnerships extends the concept of social movement unionism into the realm of environment and social justice, including climate change.

Social movement unionism, also referred to as community unionism (Banks, 2002; Tattersall, 2004), is an evolving concept that, at its most general level, has been described as a model of unionism that links the working-class struggle, culture and political power of trade unionism to other social movements, and which recognises the importance of political, racial, migrant, consumer and other identities forged beyond the workplace. Social movement unionism moves the traditional agenda of trade unions beyond economic or political unionism into new forms of community and workplace organisation and practice that links the labour movement agenda with that of the wider civil society (Brecher & Costello, 1990, Waterman, 1991; Munck & Waterman, 1991; Broad, 1995; Brofenbrenner & Juravich, 1998; Eimer, 1999; Von Holdt, 2002; Reynolds, 2004; Tattersall, 2005; Tattersall & Reynolds, 2007; Fairbrother, 2008).

Successful collaborations embodying social movement unionism can help turn the paralysing and divisive "jobs versus the environment" debate that had been a prominent aspect of many environmental campaigns (such as the campaigns to protect old growth forests in Australia, Canada and the US from logging) into a "jobs and the environment" discourse (Seigmann, 1985; Rose 2000, Burgmann *et al.*, 2002; Clawson, 2003; Obach, 2004; Norton, 2004; Gottlieb, 2005; Senier, 2007, Steele, 2008).

While there have been some widely publicised issues of conflict between the labour movement and environmentalists (for example, over forestry), it is in fact more common for environmentalists to be on the same side as labour movement organisations over issues of workplace health and safety, "right to know" laws and international trade, as well as generally being in alignment in electoral politics (Obach, 2004). As Obach notes:

> The key question from this [labour movement] perspective is whether environmental goals will have a positive or negative impact on the economic and workplace interests of workers (Obach, 2004: 282).

In 2000, the Canadian Labour Congress (CLC), a pioneer in the theory and organisation of the Just Transition to sustainability concept, identified that Just Transition is a challenge that needs to be met to secure workers' long-term security:

> Failure to create a Just Transition means that the cost of moves to sustainability will devolve wholly onto workers in targeted industries and their communities. We want to preserve and enhance the global environment for its own sake and for the sake of our children and the world that they will inherit, for the sake of their own productive future. Just Transition is essential for this process and, as such, represents the way forward to a sustainable future (CLC, 2000: 4).

7.1 Making a Just Transition to sustainability

A Just Transition is an inclusive process that aims to engage all communities affected by restructuring towards sustainability in dialogue and collaboration, rather than in conflict.

Embracing the possibility of change entails opening up new thinking, new energies and new possibilities while resistance to change could lock communities into an unsustainable situation with crisis leading to collapse. Thus a Just Transition aims to transform fear and inertia into trust and movement towards a shared vision of a mutually agreed desirable future.

The CLC describes the scale of structural changes in economic and social relationships involved in achieving sustainability and responding to climate change as comparable "to the Industrial Revolution" (CLC, 2000: 4). The CLC notes that:

> There will be a cost to all this structural change. Just Transition will ensure that the costs of environmental change will be shared fairly (CLC, 2000: 4).

The CLC identified Green Job creation as the flip side of a Just Transition and a critical element of moving to "a sustainable economy, sustainable communities and a sustainable environment" (CLC, 2000: 1). The CLC sees the role of government as crucial in creating the regulatory and market environment for Green Job creation, and called on the Canadian Government as part of its response to the global financial crisis to:

> Launch a major, multi-year public investment program to save and create jobs, including support for public infrastructure development, expanded public services, energy conservation and renewable energy projects, and support for industrial restructuring (CLC, 20090: 2)

A Just Transition is a human adaptive response to pressures within a socio-ecological system. A community, industry or workplace with adaptive capacity anticipates and plans for the future. It builds genuine resilience by responding to the feedback that indicates that the structure and functioning of the socio-ecological system is reaching critical thresholds, and it takes action to minimise exposure to risks from external and internal threats (Walker & Salt, 2006; Adger, 2006).

7.2 Blue–Green alliances

The Just Transition concept emerged from small, voluntary collaborations by activists within the organised labour and the environment movements in the USA and Canada in the 1990s, and has now become a policy idea that is increasingly embraced by wider audiences, including United Nations agencies, governments, trade unions and major environmental organisations.

In 2006, the Sierra Club and the United Steel Workers of America established what they called a Blue–Green Alliance to fight global warming and create new jobs (Sierra Club, 2006). By 2009, the Alliance collaboration had grown to unite more than 6,000,000 people "in pursuit of good jobs, a clean environment and a green economy" (Blue Green Alliance, 2009), other unions and environmental organisations including Working America, the community affiliate of the AFL-CIO, the advocacy organisation Green For All, which campaigns for job creation, job training, and entrepreneurial opportunities in the emerging green economy for people from disadvantaged communities, and the progressive think-tank the Center for American Progress. The Alliance established the

Labor-Climate Project, a partnership with Al Gore's Alliance for Climate Protection. The Blue Green Alliance has commissioned the *2009 Good Jobs, Green Jobs National Conference* and research reports focused in renewable energy and "green chemistry" (Blue Green Alliance, 2009).

The formation of the Blue Green Alliance built on decades of cross-sectoral collaborations between unions and environmental organisations. As early as 1973, the Sierra Club had supported the Oil, Chemical and Atomic Workers' Union strikes against Shell over health and environmental issues, and health issues have been one of the main issues where unionists and environmentalists have found common ground and shared campaigns (Senier, 2007). Unions and environmental organisations have also collaborated in campaigns against the environmental and employment impacts of neo-liberal policies promoting globalisation and free trade, including against the North American Free Trade Agreement, and at the World Trade Organisation protests in Seattle in 1999 (Barry, 2002).

Unions and environmentalists had been collaborating on climate change issues well before 2006. In February 2002, for example, unions representing more than 3,000,000 workers and environmentalists (including the Union of Concerned Scientists, Natural Resources Defense Council and Sierra Club) released a joint plan, *A Worker-Friendly Approach to Combating Global Warming*, which aimed to reduce CO_2 emissions and increase jobs by 660,000 above projected levels by 2010. Launching the plan, Dan Becker, director of the Sierra Club's Global Warming and Energy Campaign, proposed that promoting efficiency and renewable energy was a "win–win" scenario because more new jobs would be created than lost, but noted that burning less coal to produce electricity meant some coal miners could lose their jobs. The plan recognised that, while it is not possible to protect every worker's job, Just Transition plans can protect their livelihoods. The plan included Just Transition provisions that proposed providing full income replacement for up to five years for displaced workers (Barry, 2002)

In 2002, Canada's largest union of energy workers and the Canadian Labour Congress backed its government signing of the Kyoto protocol and commitment to target reductions in $CO_{2,}$ on the condition that there were provisions made for a Just Transition for displaced workers (Young, 2003).

International environment, health and labour agencies such as the United Nations Environment Programme (UNEP), the World Health Organisation (WHO) and the International Labour Organisation (ILO) emphasised that workers affected by change have to be consulted and fully engaged in environmental, employment and economic policy development and restructuring from unsustainable to sustainable industries s that their needs and experiences are fully taken into account, and their cooperation is secured (UNEP, WHO and ILO, 2007).

The UN agencies noted that the Just Transition process targeting global warming offers scope for transforming the traditional agenda of trade unions, bringing them into collaborations with environmental organisations, governments and other civil society organisations campaigns that link workplaces and communities into collective social action on issues of ecological sustainability and related social development (UNEP, WHO and ILO, 2007).

The British Trades Union Council identifies that Just Transition measures are not just one-way traffic in terms of the flow of money and support from the wider economy to those at risk from environmental transition, but actually benefit the economy through timely research and strategic development and investments in green industries (TUC, 2008a).

Australian Blue–Green Alliances

The Green Bans imposed by the NSW Builders Labourers Federation (BLF) during the 1970s pioneered transformational union-environmental activism in Australia. The Green Ban movement stopped billions of dollars worth of undesirable development and saved large areas of the city of Sydney's inner working class suburbs and parks from demolition and degradation, with construction workers refusing to work on projects they regarded as socially and environmentally harmful, following requests and with the active support of local residents and environment organisations. Jack Mundey, the Secretary of the BLF asked:

> What is the use of higher wages alone, if we have to live in cities devoid of parks, denuded of trees, in an atmosphere poisoned by pollution and vibrating with the noise of hundreds of thousands of units of private transport? (Mundey, 1981: 143).

Burgmann and Burgmann described the hegemonic challenge to the power of governments and corporations posed by the ecologically aware and politically organised working class movement that the BLF represented:

> To many, the NSW Builders Labourers Federation represented the hideous spectre of working-class power maliciously halting progress, and restraining the liberty of property owners to undertake development … To many others the green union articulated the general interest of all but the greediest developers in preserving the built and natural environment from wanton destruction.
>
> The union's guiding principle, which underpinned this action, was the concept of the social responsibility of labour that workers had a right to insist that their labour not be used in harmful ways (Burgmann & Burgmann, 1998: 3)

Australian unions have been involved in leading the highly successful community unionism campaigns before and since the days of the NSW BLF and Green Bans. More recent campaigns include defending public education, public health and Medicare, and the *Your Rights at Work* campaign (Spies-Butcher & Wilson, 2008).

Trade union–community collaborations for a Just Transition and Green job creation, in response to climate change, are beginning to emerge and targeting the Australian Labor Party (ALP) national government which was elected to office following the ousting of the Howard Government.

The climate change policy of the Australian Council of Trade Unions (ACTU), Australia's peak trade union organisation, recognises the need for a Just Transition to a clean energy economy and defines its objective as "to meet the needs of the communities and workers affected by the moves to minimise the environmental impacts of industry" (ACTU, 2008: 12). In July 2008, the ACTU formed a cross-sectoral alliance, known as the Southern Cross Climate Coalition (SCCC), with other civil society organisations the Australian Conservation Foundation and the Australian Council of Social Service and The Climate Institute, which aims to "advance a constructive and long-term agenda to unlock the substantial economic, social welfare and environmental opportunities that will emerge from Australia's response to climate change" (ACTU, 2008: 1).

The SCCC identified key features of a Just Transition process, namely that responding to climate change demands major economic transformation, that all Australians should participate in the solutions and share the economic costs and benefits of change, and that working Australians should not be abandoned and put at risk by potential job and income losses (ACF, ACOSS, ACTU, Climate Institute, 2008).

7.3 Creating a basin of attraction for a Just Transition to an ecological economy

The potential for a Just Transition of the Hunter Valley from its current *Carbon Valley* status to a *Future Beyond Coal* will predominantly be influenced by attractors operating outside the region, including climate change, and political and economic actors at global scales, such as international policy and regulatory agencies, and markets in Australia's major trading partners in Asia and the wider world. There are, however, also regional attractors which will influence the potential for regional transition. A Just Transition requires creating an alternative basin of attraction by utilising global and regional attractors to drive change.

The following section discusses possibilities and precedents for a shift to an alternative basin of attraction through a Just Transition process.

Policy drivers for renewable energy

According to the Renewable Energy Network for the 21st Century (REN 21), Australia has the highest potential for renewable energy meeting projected demand by 2050, than any of the world's major economic powers, when environmental resources, technology availability and costs are considered (REN 21, 2008b). A mix of two policy drivers is needed to realize the potential of renewable energy:

- *technology push*, which includes research and development, capacity building, public awareness and education
- *market pull*, which includes policy frameworks that support market transition to clean technologies, infrastructure development, and financial incentives that

allow renewable energy to cross the threshold between pre-commercialisation and commercialisation (REN21, 2008b).

International climate change agreements, such as the Copenhagen successor to Kyoto Protocol, which will be adopted in late 2009, will be powerful cross-scale drivers for the development (or hindrance) of renewable energy markets in the Hunter Valley, by setting global targets for the reduction of greenhouse gas emissions, establishing regulatory and market mechanisms and prices for carbon, and increasing collaboration for transfer and adoption of clean energy technologies.

Civil society organisations and industry have been a significant influence on global policy development, and on the type and size of incentives provided to the renewable energy sector. The sector has grown rapidly since 2004, with global electric generating capacity doubling between 2004 and 2007 to 240 gigawatts and accounting for 2.4 million jobs globally (REN 21, 2008a: 17). More than 65 countries now have national goals for renewable energy, including Australia. In 2007 the Australian Government committed to ensuring that 20% of Australia's electricity supply comes from renewable energy sources by 2020 (Department of Climate Change, 2009).

Clearly, the basin of attraction for renewable energy is changing. The IPCC reports are among many that see great potential in the deployment of renewable energy. For example, estimations for concentrating solar thermal plants project that 5% coverage of world electricity demand by 2040 is possible (Sims et al., 2007).

International cooperation is an important factor influencing the basin of attraction in which global energy markets are currently located, including creating an alternative basin in which renewable energy can thrive. Table 13 (below) summarises the barriers, the opportunities and the important stakeholders for renewable energy uptake (Kofoed-Wiuff *et al.,* 2006). The following section identifies how some of these barriers can be overcome and opportunities seized in the Australian context as fundamental elements of a Just Transition process.

Table 13: Summary of barriers to renewable energy and examples of opportunities and important stakeholders

(Kofoed-Wiuff et al., 2006:10)

Barriers	Opportunities	Important stakeholders
There is no level playing field for renewable energy technologies	International cooperation on: - Phasing out subsidies for conventional technologies - Good practice for subsidies - Internalisation of external	National governments and international forums for cooperation (UN, EU, IEA, G8)
The incentives for governments and private companies to support renewable energy development are insufficient	- International agreements committing governments to demonstrate and deploy renewable energy technologies - Multilateral funds for RE deployment and demonstration - Partnerships with the private sector	National, regional and local authorities, international forums for cooperation (IEA, G8), the RE industry, international financial institutions
Financing is unreasonably costly for renewable energy technologies	- Favourable loans for renewable energy projects through national or international institutions. Promote long-term power purchase agreements between consumers and RE generators - Initiatives to stimulate carbon financing of renewable energy projects; - Training and education of financiers	International/national financing institutions, national governments, CDM executive board, Asia Pacific Partnership for Clean Development and Climate, energy producers, private financing instituions
Technology standards are lacking for (some) renewable energy technologies and fuels	- Develop standards for renewable energy technologies, components and fuels - Develop test facilities for renewable energy technologies	National and international standardisation organisations, the RE industry, industry associations, international trade organisations (WTO, NAFTA etc.)
Import tariffs and technical barriers impede trade in renewables	- International cooperation on removing duties and technical barriers to trade in renewable energy products	International and regional trade organisations (WTO, NAFTA etc.), international forums for cooperation (IEA, G8), the RE industry
Permits for new renewable energy plants are difficult to obtain	- Cooperation on best practice between national and local authorities from different countries - Developing internationally harmonized standard forms and requirements (to help RE project developers working internationally)	National and local authorities, the RE industry needs to adapt its products to meet requirements of authorities

Barriers	Opportunities	Important stakeholders
Energy markets are not prepared for renewable energy	International cooperation on: - best practice for grid connection/access - removing market imperfections in relation to RE - new interconnectors - integration of intermittent RE sources - promoting demand response in energy markets	National authorities, transmission system operators, distributions system operators, energy regulators, energy traders
Renewable energy skills and awareness are insufficient	- Information and education on all educational levels at national level or through international programmes - Twinning between authorities and TSOs from countries with different experience and between operational personnel from different countries - International in-service training programmes - National and international awareness campaigns.	National and local authorities, NGOs, consumers, international forums for cooperation (IEA, G8), universities and technical colleges, operational personnel

7.4 The Green job potential in Australia

Two research reports released in mid-2008 identified the job-creation potential of a shift to a more ecological economy in Australia. These reports, *Growing the Green Collar Economy* and *Green Gold Rush* were produced by the CSIRO and the Dusseldorp Skills Forum, and by the Australian Council of Trade Unions (ACTU) and the Australian Conservation Foundation (ACF) respectively.

The *Growing the Green-Collar Economy* report identified that well designed policies can substantially decouple economic growth from environmental pressure. The report identified that living standards continue to increase at current rates and that Australia's national environmental footprint can also reduce over time. The report also found that achieving a rapid transition to sustainability would have little or no impact on national employment, with projected increases in employment of 2.5 to 3.3 million jobs over the next two decades (Hatfield-Dodds *et al*., 2008: 1-2).

According to the report, employment in sectors with high potential environmental impacts will grow strongly, with projected increases of more than 10% over 10 years. This will add 230,000 to 340,000 new jobs – in addition to normal employment turnover – in the transport, construction, and agriculture, manufacturing and mining sectors, with employment in construction and transport sectors is projected to grow significantly faster than the national average (Hatfield-Dodds *et al*., 2008: 1-2).

The report identified five key elements of a coherent and systematic response to the skills challenges associated with this transition:

- incentives and policy settings for environmental performance
- green skills and training
- performance assessment and accreditation to inform action
- access to appropriate business inputs and components
- promotion of a stronger innovation culture (Hatfield-Dodds *et al*., 2008: 1-2).

The *Green Gold Rush* report of the Australian Council of Trade Unions and the Australian Conservation Foundation, identified six green-collar industries with great potential for growth and development:

- Renewable energy
- Energy efficiency
- Sustainable water systems
- Biomaterials
- Green buildings
- Waste and recycling (ACF and ACTU, 2008).

The report noted that Australia could generate up to 850,000 green-collar jobs by 2030 and multi-billion dollar export opportunities (ACF & ACTU, 2008).

As Kofoed-Wiuff *et al.* (2006) above identified, achieving the transition to a low-carbon sustainable economy will require investment in skills and training – both to equip new workers and to enable appropriate changes in practices by the three million workers already employed in the key sectors influencing Australia's environmental footprint. The *Growing the Green-Collar Economy* report noted that current Australian approaches do not appear sufficient for meeting these challenges, and that a greater effort is needed if Australia is to realise the opportunities and not be left behind (Hatfield-Dodds *et al.*, 2008: 1-2).

Revitalising manufacturing

The Australian Manufacturing Workers Union (AMWU) is one of Australia's largest trade unions, having over 120,000 members, and has a direct interest in a Just Transition. The AMWU has members working in coalmines and coal-fired power stations, but also covers workers in the renewable energy manufacturing and energy efficiency industries where thousands of new Green jobs can be created.

The AMWU produced a policy booklet for delegates to its 2008 Annual Conference, held in Newcastle, entitled *Making our Future: Just Transitions for climate change mitigation.* The policy recognised the challenge and opportunities in a Just Transition process from an energy-intensive to a less energy-intensive economy. It recognises that the transition implies loss of employment opportunities in some sectors but that there are opportunities to generate tens of thousands of jobs in environmentally sustainable industries. The union policy also recognised that the new jobs should be located in those regions which will lose jobs in carbon intensive industries (AMWU, 2008).

The AMWU's policy emphasises that government intervention is critical to a Just Transition process:

> A Just Transitions program must be established to guarantee the movement of any displaced workers to jobs in the new sectors which will use their skills, maintain their pay and offer genuine job security. But it won't happen without adequate government support and intervention to foster renewable industries. (AMWU, 2008: 15)

Like Kofoed-Wiuff *et al.*(2006), the AMWU's policy identifies that income raised through carbon taxes, or auctioning of emissions permits under the Rudd Government's proposed Carbon Pollution Reduction Scheme (CPRS), needs to be invested in new, low-carbon manufacturing, along with funds released by the removal of subsidies to fossil fuels, and from venture capital and superannuation funds (AMWU, 2008).

The AMWU policy also noted that changes to industrial relations laws were necessary to provide the rights at work for employees to actively negotiate environmental improvements in the workplace and in the community. The policy calls for environmental clauses to be allowable content in enterprise collective bargaining agreements (consistent with ACTU policy adopted at its 1993 Congress), and also calls for:

- the establishment of workplace environment committees
- appointment of environment officers within workplaces of more than 500 employees
- development of environment plans, which should address, amongst other things: energy efficiency; waste minimisation and recycling, pollution and emission controls, and the workplace environment
- continuing education and training of workers in environmental management (AMWU, 2008: 17)

7.5 Boosting adaptive capacity for a shift to a clean energy economy

In economic systems, as in ecological systems, the feedback between survival, collapse and renewal reflects a process of disturbance, creative destruction and the influence of innovation. According to "creative destruction theory", a continually innovating economy generates new opportunities for businesses and workers to participate in more creative and productive enterprises attuned to a changing environment (Schumpeter, 1942).

Creative destruction is a process of collapse and renewal of complex adaptive socio-ecological systems which can cause severe hardship for workers and communities that cannot acquire the necessary knowledge, skills, networks and resources to thrive in the new environment. Disturbances posed by climate change may potentially drive a process of creative destruction to global energy systems as the viability of fossil fuels diminishes and new energy technologies, services and markets develop. This process would unleash both threats and opportunities to workers and communities in coal-dependent regions such as the Hunter Valley, challenging their resilience to deal with shocks, their adaptive capacity and capacity to seize the opportunities, or alternatively succumb to the threats.

Coal communities have historically lacked resilience and been subject to cycles of boom and bust which have left workers at the mercy of impulses from global markets and corporations. Even during the 2005–08 mining boom in the Hunter Valley, coalminers' job security was vulnerable, with hundreds of mineworkers being suddenly thrown out of work without notice. Threats to mineworkers' jobs have escalated as the global financial crisis has developed, initially mostly affecting coal mines exporting metallurgical coal for steelmaking, but by June 2009, beginning to also affect Hunter Valley thermal coal exporting mines (Kirkwood, 2009c).

The historic lack of company or government support for displaced miners and their communities leaves coal communities vulnerable to change and potentially locked into a pathological dependence on carbon-intensive industries. The resilience of coal communities and workers in these communities needs to be boosted to break this vulnerability, through, for example, creating alternative industries and protecting and enhancing ecological, social and economic diversity.

Adaptive management: Moving from being stuck by demonstrating some pluck

Schwartz (2006) reviewed factors contributing to successful late 20th century economies (particularly considering Australia, Ireland, Denmark and Netherlands), and noted the influence of policies that he described as driving an economy to demonstrate qualities of "pluck, luck or being stuck". A policy that reflects "pluck" entails adjustment of the regional economy to better fit the external environment and emergent opportunities. A policy reflecting "luck" entails minimal change to the regional economy but enjoying the good fortune that the external environment and opportunities change to be in alignment with local conditions and capacities. However, a policy that reflects "remaining stuck" occurs where there is no change to the structure of the regional economy and increasingly it becomes out of alignment with external environments and opportunities.

Schwartz's theory fits neatly with complex adaptive systems cycles theory and the potential evolution of coal-dependent regions such as the Hunter Valley. A coal-dependent socio-economic system may appear to be in a state of apparent health and dynamism, but as the external environments change, for example, as global energy systems move from fossil fuels to renewable energy, it may in fact find itself stuck in a state which the region or industry lacks the anticipatory and adaptive capacity to alter, or to develop the innovation, skills or infrastructure to thrive in a changed external environment. Alternatively, a region and its people might be lucky if the external environment shifts to favour its resources and capacities. This could occur in the Hunter Valley if the global energy system remains coal-dependent and carbon capture and storage technologies were to be widely operationalised. A pathway relying on luck involves a high level of risk and a possible lack of adaptive capacity. Given the disturbances posed by climate change, the finite nature of coal resources and the likely trend over the next few decades towards renewable energy, it is both prudent and necessary for coal communities to anticipate change, and to develop their adaptive capacity and apply adaptive management strategies that demonstrate "pluck", by beginning structural adjustment to bring their economies into better alignment with a changing global energy market, and with ecological sustainability.

Unfortunately, the history of many mining communities, including those of the Hunter Valley, suggests there is a strong likelihood that mining–dependent communities might get stuck, rather than enjoying the luck or having the pluck, to move into alternative opportunities, unless there is significant government intervention. Industry decline affecting the Lower Hunter coal communities of Maitland, Cessnock and Kurri Kurri during the 1970s and 1980s caused high levels of unemployment and other indicators of social disadvantage for many years as mines closed and the workforce was reduced (Hartig & Holmes, 2000; Holmes, Hartig & Bell, 2002). While sudden mass lay-offs can be particularly catastrophic in single-industry communities, the impact can be exacerbated in communities where other industries are also downsizing, as happened in the Hunter Valley during the 1980 and 1990s when the Newcastle steelworks and dockyard closed. This convergence of industry closures reduced the capacity of Hunter Valley communities to deal with the shock of industry shutdown, leading to widespread social disadvantage (Hartig & Holmes, 2000; O'Neill & Green, 2000).

The mining communities of the Hunter Valley are caught in a paradox: expansion of mining destroys the economic and social diversity of the region's ecosystems and non-mining rural industries, the very ecological and social resources needed to provide the foundations for resilience and adaptive capacity for life beyond mining. As these resources are lost the reliance on mining becomes greater because there are few alternatives.

Boosting adaptive capacity of coal communities and displaced workers

Historically, many workers in the mining industry have lacked capacity to adapt to a changing economy, in part because they lacked exposure to alternative occupations and because the skills and culture of mining do not necessarily lend themselves to other professions. The traditional anti-authoritarian culture of mining communities has assisted workers to defend their rights against exploitative employers but this culture can make it difficult for mining communities to adapt to industries, such as hospitality, that have a different culture (Metcalfe, 1988; Holmes, Hartig & Bell, 2002; Henderson & Shutt, 2004).

Moreover, the preferred alternative jobs for displaced workers may not be locally available. In the coalfields communities of the UK, for example, the preferred jobs of displaced miners were as drivers, plumbers and fitters in railway and vehicle maintenance, but these industries were not necessarily attracted to rural areas (Henderson & Shutt, 2004). Tony Maher acknowledged the difficulty of miners finding alternative employment and learning new skills (Maher, 2007b), though some mineworkers have rejected this belief as a false and patronising characterisation of mineworkers' capacity to learn new skills and adapt to new circumstances (Brown, 2007). Nonetheless, it is likely that some Hunter Valley mineworkers may have to leave the region to maintain employment in the mining industry and continue to earn the high wages the industry pays, relocating to other regions where there are mining jobs (in coal, iron ore or other minerals), such as the Pilbara Region in Western Australia.

Where industry closure has occurred evidence suggests the impacts are less traumatic in mature, diverse economies, and where there is active government policy intervention catering to the specific circumstances of the communities and individual workers affected by change. A 1999 Victorian Government Forestry Restructuring Program exemplifies the role of government in providing support and transition assistance for both displaced workers and for contractors. These forms of assistance boost resilience by proving a safety net for displaced workers through income support, providing skills development for alternative jobs, and fostering alternative employment opportunities. Support includes:

- funds for innovation and partnerships for new industries, research and development, tax relief, infrastructure investments
- training and alternative employment tailored to local and individual needs and opportunities
- relocation assistance

- cheap loans
- subsidies to new employers
- assistance for displaced workers, including income maintenance, redundancy entitlements and retraining allowances
- compensation and equipment buy-outs for contractors
- assistance programs for workers employed by contractors (Victorian Department of Natural Resources and the Environment, 2002).

Industry closure can cause large and sudden loss of income. Research in Canadian mining communities affected by closure showed that sudden closure caused average income losses of 20–30%, with loss of employment persisting for as long as five years, though the average duration of unemployment was between 25 and 30 weeks. One-third of displaced workers were re-employed in mining, while a third withdrew from the labour force (Robinson & Wilkinson, 1998). The Hunter Valley has a more mature, diverse economy than the mining communities studied in Canada, so trauma may be somewhat reduced.

Some significant barriers make it difficult for some displaced workers to gain new employment, and therefore support programs need to be targeted to their needs and support them until secure and satisfying new jobs can be found for those who want them. Less-educated, older workers and those who have disabilities are particularly vulnerable. Once they become unemployed, older workers tend to experience longer spells of unemployment before becoming re-employed. They experience lower earnings compared with their earning level prior to losing their job (Robinson & Wilkinson, 1998; Kuhn, 2002; Farber, 2005).

Workers in industries linked to coalmining, such as mine equipment manufacturing and maintenance, may also have difficulty adapting to economic structural adjustment. Research indicates that workers laid-off from manufacturing industry also experience significant hardship after being made redundant. The Australian Government's Productivity Commission found that the workers made redundant from manufacturing industries had lower than average re-employment probabilities, even lower than those of workers displaced in the mining, agriculture and service sectors (Productivity Commission, 2003: 43).

A study of workers made redundant at two automotive component manufacturers, one in Sydney and one in Albury, showed an unemployment rate amongst 48.2% after six months. Only 41.4% of the workers who had managed to find jobs were able to secure employment in the manufacturing sector. Thirty one per cent of the workers who found jobs were employed as casuals, while of those with jobs 89.7% had suffered a reduction in wages, with the average reduction being 28.3%. Exactly half of the workers who had been made redundant believed that their long-term financial security had suffered significantly from redundancy (AMWU, 2006).

The average age of Hunter Valley mineworkers is over 41 years, with workers in the Newcastle coalfield averaging 44.5 years, making them the oldest in NSW and potentially vulnerable if they were to be retrenched (NSW DPI, 2008: 280). However, most currently operating mines have an expected lifetime of around 15–20 years, when size of resource and volume of annual production are considered, so most workers currently employed in the industry could expect to see out their working lives in their existing jobs (NSW DPI, 2008). It may in fact be their children that need the support of a Just Transition program to ensure that there are local jobs for them in a post-mining economy.

Policies for a regional scale transition to a clean energy economy

Successful policies for regional-scale transitions to an ecological economy need to be driven from a mix of top-down and bottom-up initiatives. Kofoed-Wiuff *et al.* (2006) identified a mix of policies that could potentially drive a shift in the basin of attraction of energy systems that shift it towards renewable energy (described earlier).

Successful policies for regional economic transition towards sustainability, originally generated in European countries, also offer useful guidance to how a Just Transition to a clean energy economy and sustainability could occur in the Hunter Valley and other regions. These policies involve:

- clear environmental targets and technology standards
- a clear decision to end investment in the non-sustainable industry and phasing out of subsidies
- the availability of satisfactory technological alternatives to the technology being phased out
- a regulatory environment and market that encourages research, innovation and development investment
- a high degree of political integration among and within different government sectors across global, national and regional scales
- funding to facilitate research and investment in new industries and jobs in targeted sectors and areas (Binder, Jänicke & Petschow, 2001; Kofoed-Wiuff *et al.*, 2006).

Lessons from the Newcastle steelworks closure, 1999

The closure of the BHP steelworks in Newcastle in September, 1999 was a shock to the people and economy of Newcastle. The decision severed an 84 year connection between the company and city. It displaced some 2,300 direct employees and 1,400 contract or flow-on employees at the time of closure, which was a significant decline over more than 10 years from peak employment levels of 12,000 in the 1960s. Many affected workers were distressed and there were predictions of major disturbance and flow-on impacts in the Newcastle economy (New South Wales Legislative Assembly, 2007). Yet despite the trauma of the closure for some directly affected workers and their families, the closure exemplified features of a Just Transition process described above.

Early notice was a critical element of ensuring a measure of “justice” during the BHP Steelworks closure. BHP steelworkers were given two and a half years of prior notice of the proposed changes, and packages were put in place to ensure that workers received benefits during the transition from steelmaking. Workers, unions and management established a BHP

Workforce Transition Committee to ensure that the employer and workforce worked towards "orderly closure", including ensuring establishment of training for alternative employment tailored to individual needs and local opportunities. A major planning and adjustment program for affected individuals, known as "Pathways", was established involving employees, unions and management in designing and implementing programs that would assist displaced workers, including taking into consideration the needs of the "over 45's". The average age of workers retrenched during the closure was 42 years old (BHP, 1999).

A $10 million Hunter Advantage Fund was established by the NSW Government, which the Premier Bob Carr credited with generating about 1,280 full-time and 194 part-time jobs (NSW Legislative Assembly, various speakers, 1999; Jay, 1999).

Following the announcement of the BHP steelworks closure, a "Steel River" project was proposed as an eco-industrial park for advanced industrial and high-technology production with an innovative, streamlined approvals process. The eco-industrial park concept has proved to be largely government wishful thinking and "greenwash" as it lacked an integrated industrial ecology framework and has not lived up to its promise. Ten years after the BHP closure most of the Steel River site remains unoccupied, and the industries that have located there are mostly warehouses and transport businesses.

However, the one significant success in the project occurred in January 1999 when the CSIRO announced the relocation of a sustainable energy centre to the site. Since it was established the CSIRO Energy Centre has become a regional research hub for energy research, and is the national headquarters of the CSIRO Energy Technology and the Energy Transformed Flagship and the National Solar Energy Centre which includes a high concentration tower solar array that can generate 500 kW of energy, and a low-concentration linear array for solar thermal energy. Other research conducted at the Centre includes distributed energy generation, solar-fossil hybrid technology, carbon sequestration and low emissions coal-fired power generation.

Conclusion

The transition to an ecological and clean energy economy in Australian will be influenced by global and national attractors. The energy and climate change policies of the federal Rudd Labor Government demonstrate a "two-bob each-way" gamble that Australia will secure a future for coal in global energy markets by backing both the technological fix of carbon capture and storage and "clean coal" and backing a renewable energy industry. The policy reflects the dialectic and contestation between communities and civil society organisations pressing for an ecological economy, and industry attempting to maintain business-as-usual.

While some strategic initiatives towards promoting a clean energy economy have been made, the public and private investments in renewable energy and energy efficiency are dwarfed by the investment in coal, including investments to treble the Hunter Valley's coal exports. The investment in carbon capture and storage technologies reflects the lack of adaptive capacity of the government to fully embrace clean energy, preferring instead to stay "stuck" on coal despite the technological, environmental, safety, economic and political risks and doubts associated with the technology (Diesendorf, 2006; Wilkenfeld *et al*., 2007; Van Alphen *et al.*, 2007; Shackley *et al.*, 2007: De Coninck *et al.*, 2008; Kavouridis & Koukouzas, 2008; Hansson & Bryngelsson, 2009).

The massive difference in the scale of subsidies to coal relative to renewables seems to be an attempt to lock in the fossil fuel sector, in the hope that the problems confronting CCS can be overcome and the technology can be commercialized before renewable energy alternatives are given a chance to demonstrate their viability – arguably, the deliberate gambling of the health of the planet by stalling the widescale adoption of a proven solution to global warming by governments addicted to coal royalties, cheap electricity and unable or unwilling to stand up to a few powerful global corporations.

Rather than investing in 'business-as-usual' – thus sacrificing regional ecosystems and public health, and risking Australia being stuck in using fossil fuels when the rest of the world moves into renewable energy – it would be more prudent public policy to support a Just Transition to a clean energy economy in the Hunter Valley.

A Just Transition process offers a pathway forward that minimises risk, and builds broad-based community partnerships, anticipating and planning for change through dialogue and collaboration. The conversation can then switch from "Why change?" to "How can change happen?"

Australia's carbon-intensive industries have received billions of dollars of subsidies for business-as-usual, but, as the Canadian Labor Congress noted, structural change to deal with climate change involves challenging the priorities of governments, corporations and other social institutions, including some trade unions and environmental organisations:

> Considering the huge amount of financial assistance given to corporations, Just Transition is not an exorbitant demand; it merely redresses the balance in the form of fair treatment rather than welfare subsidies to corporations (CLC, 2000: 17).

Relatively small amounts of strategically allocated public funding could help drive powerful change. In May 2009, the Australian Manufacturing Workers' Union (AMWU), the NSW Nature Conservation Council (NSW NCC) and the University of Newcastle Business Studies Centre announced the establishment of a trade union/ environment organisation/university collaborative project to map out a *Blueprint for a Low-carbon Future for the Hunter Valley*, supported by $250,000 of NSW Government funds. The project is intended to identify opportunities for employment in lowering the Hunter Valley's emission profile through technological innovation and deployment of renewable energy and boosting local manufacturing capacity and Green work skills (Ayres, 2009).

However, it is necessary to remember that a Just Transition to sustainability in response to climate change is not a problem that can be solved with technological innovation and public investment. The social causes of climate change, including inequitable and over-consumption of natural resources in the Global North, make it necessary to ask hard questions about the sustainability of consumerist lifestyles and values, the inequities and growth addiction of capitalist economies, and ecological and environmental justice.

The following chapter investigates two potential scenarios for a *Future Beyond Coal*, based on some research at the University of Newcastle that this author assisted in writing, and which shows that Green job creation could be part of a Just Transition process in the Hunter Valley.

Chapter 8

Two Scenarios for a Just Transition from coal to Green jobs

In 2008, the Centre of Full Employment and Equity (CofFEE) at the University of Newcastle was commissioned by Greenpeace Australia Pacific to investigate the potential for *A Just Transition to a Clean Energy Future for the Hunter Valley*. This report will be referred to henceforth as the *CofFEE report*. The report plotted business-as-usual and energy efficiency-driven energy consumption scenarios for NSW to 2020. The report identified strategies for achieving energy efficiency, and identified potential renewable energy technologies that could be deployed in the Hunter Valley to replace current coal-fired power generation. The report also identified the number of jobs that might be lost and gained under two different energy production scenarios for the Hunter Valley (Bill *et al.,* 2008).

The *CofFEE report* was the first study done in Australia examining the potential technology pathway and related employment impacts of a regional transition to a clean-energy economy. The report examined phasing out of coal-fired power generation, but did not examine the consequences of phasing out of the region's coal export industry, which employs more workers directly and indirectly than the coal-fired power generation industry, and generates billions of dollars in mineral wealth. Thus the report examines only one aspect of a transition to a regional *Future Beyond Coal*.

Two regional energy scenarios

The two renewable energy scenarios for the Hunter in the *CofFEE report* are shown in the table below. One scenario sees the Hunter as a self-sufficient regional energy centre, and the other continues the Hunter's role as a net energy exporter to the rest of NSW. These scenarios are consistent with the two sub-scenarios of the larger *Future Beyond Coal* scenario discussed in Chapter 1; namely, the *Clean Energy Hub* and the *Energy Self-sufficiency* scenarios.

> **Scenario 1:** ***Energy Self-sufficiency:*** *The Hunter as a self-sufficient regional energy centre*
>
> In the *Energy Self-sufficiency* scenario 23% of NSW electricity would be generated within the Hunter Valley region from local renewable energy (wind, solar, geothermal, and bioenergy) or gas co-generation, sufficient to meet all current energy demand within the region. It includes electricity for the two large aluminium smelters located at Tomago and Kurri Kurri.
>
> **Scenario 2:** ***Clean Energy Hub:*** *The Hunter as a NSW energy exporting centre*
>
> The *Clean Energy Hub* scenario would involve 40% of the NSW electricity being generated in the Hunter, again from a mix of renewable (wind, solar, geothermal

and bioenergy) and gas co-generation, and retains the Hunter and Wyong region's historic role as a major energy exporter to the rest of NSW, although on a somewhat smaller scale than currently occurs.

Energy consumption scenarios

The *CofFEE report* worked from various energy consumption scenarios, including a business-as-usual scenario in which NSW electricity consumption is projected to increase by 27% by 2020, as outlined in the 2007 *Annual Planning Report* of Transgrid, the operators of the high-voltage electricity transmission network throughout NSW (Transgrid, 2007, Table A3.1: 81), which had electricity demand growing by 1.6% annually (Transgrid, 2007, cited in Bill *et al.*, 2008)

The CofFEE researchers then identified an alternative energy consumption scenario in which there was a significant commitment to energy efficiency, and therefore reduced demand compared to business-as-usual. The potential for reduction in the projected growth of NSW electricity consumption was explored using NFFE (2003), Energetix (2004), McNichol (2004), EMET (2004) and GWA (2004) data. Studies of the potential for energy efficiency in Australian buildings and industry by McKinsey (2008a) were also used, and international studies about how energy efficiency could reduce global energy growth by 25–35% more energy efficient in the next 20 years at no net cost (Goldemberg & Johannson 2004). Based on this data, the scenarios discussed in the *CofFEE report* assumed that energy efficiency measures sufficient to achieve a saving of 24% compared to business-as-usual could be put into place for NSW consumption, and therefore the renewable energy supply scenarios sufficient to meet this projected consumption were used to determined energy mix and subsequent effects on employment.

Applying these potential energy efficiencies to projected NSW electricity use the *CofFEE report* projected reduced electricity consumption of 4% compared to 2005, the equivalent to saving 20,700 GWh (gigawatt hours) in NSW, and 4,600 GWh in the Hunter region, compared to business-as-usual. Savings of 13% were projected in aluminium smelting relative to business-as-usual based on 6.1% growth in the industry's electricity demand growth between 2005 and 2020 (ABARE, 2007)

The *CofFEE report* authors proposed that their energy efficiency potential is consistent with targets adopted elsewhere, citing the state of Maryland in the USA as having adopted policies to reduce electricity consumption by 29% compared to business-as-usual by 2025 and the European Union policy to reduce energy use by 13% by 2020 (Bill *et al.*, 2008). Current NSW electricity consumption, business-as-usual at 2020, and business-as-usual with energy efficiency are shown in Figure 265 and Table 14 below.

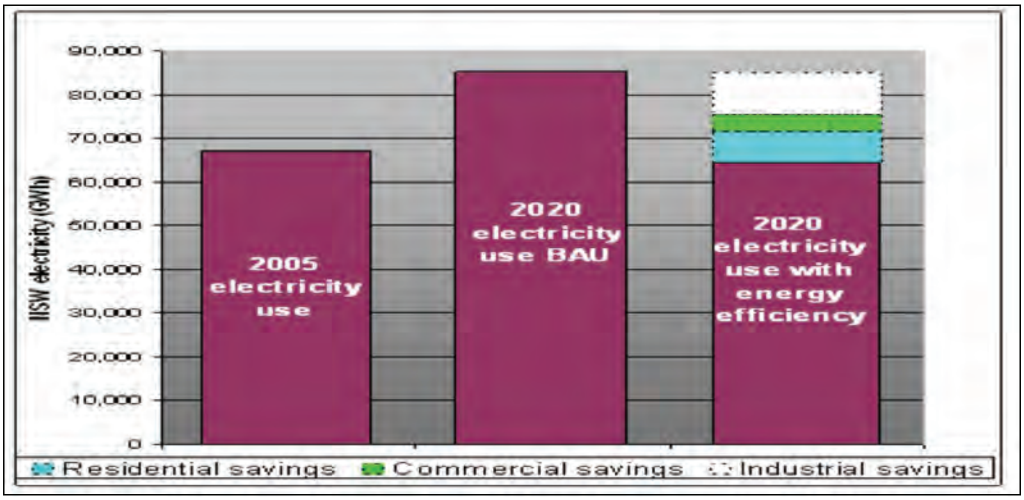


Figure 26: NSW electricity consumption 2005 and 2020

Consumption levels are calculated with and without energy efficiency measures (From Bill *et al.*, 2008)

Table 14: Electricity consumption in NSW and the Hunter 2005 and 2020, BAU and with energy efficiency measures

	GENERATION	CONSUMPTION			CONSUMPTION REDUCTION 2020 COMPARED TO			
	2005	2005	2020 BAU	2020 with EE	2020 BAU		2005 CONSUMPTION	
	GWh	GWh	GWh	GWh	%	GWh	%	GWh
NSW	-	67,200	85,300	64,600	24%	-20,700	4%	-2,600
Hunter	52,142	15,700	18,100	14,700	18%	-3,300	5%	-950
Hunter as a % of NSW	78%	23%	21%	23%		-		-

Note: Consumption for aluminium smelting is reduced by 8% compared to current levels. Hunter region coal generation as a percentage of NSW consumption

8.1 Energy mix for a clean energy future in the Hunter Valley

The *CofFEE report* shows that the Hunter Valley can continue to play an important role in NSW energy production under a transition to renewable energy, although it would be in the context of a radically transformed energy supply system. The energy technology mix identified in the *CofFEE report* sees a shift from centralised coal-fired power generation to a distributed energy supply system, a system that renewable energy technology is inherently more capable of supporting than a coal-fired-power-based system. Distributed energy systems demonstrate greater flexibility in the mix of technologies able to be deployed to suit local conditions and resources, have greater resilience than centralised systems to human or natural threats (such as earthquakes, terrorism), and require smaller capital outlays in single pieces of infrastructure which can be introduced through a staged investment process that is demand-driven rather than supply-driven (Saddler, 2008)

The scenarios identified in the *CofFEE report* use two emerging technologies: geothermal using hot, dry rocks; and solar thermal. While solar-thermal power generation is in use internationally it has not been fully commercialised. In the event that these technologies cannot be scaled up sufficiently, gas combined-cycle technology would need to be deployed as an interim measure. This would still bring a very substantial emission reduction compared to coal generation.

The *CofFEE report* noted that the aluminium industry accounts for 65% of the Hunter Valley's electricity consumption (15% of NSW), so therefore is a critical attractor within the regional energy system. The report uses energy efficiency measures equivalent to the potential identified in Energetix (2004), and assumed that aluminium smelters would install substantial levels of cogeneration.

The energy technology mix is shown in Tables 15 and 16 below. Energy efficiency is maximised in both scenarios, keeping NSW electricity consumption stable at current levels. This compares to the business-as-usual (BAU) growth in electricity use of 16% by 2020, which has electricity growth of 1.6% per annum.

Table 15: Scenario 1: *Energy Self-Sufficiency*

HUNTER REGION	MW	GWh	% of regional electricity	% of NSW electricity
WIND (Note 1)	1,400	3,679	25%	6%
BIOENERGY (Note 2)	250	1,752	12%	3%
GEOTHERMAL (Note 3)	200	1,489	10%	2.3%
PV – RESIDENTIAL (Note 4)	250	329	2%	0.5%
PV - BUSINESS (Note 5)	325	427	3%	0.7%
GAS COGENERATION (Note 6)	1,000	7,008	48%	11%
TOTAL	**3,425**	**14,684**	**100%**	**23%**
ELSEWHERE IN NSW				
WIND	3,500	9,198	-	14%
HYDRO	4,200	3,800	-	6%
BIOENERGY	1,300	9,110	-	14%
PV	3,000	3,942	-	6%
SOLAR THERMAL	2,000	6,132	-	10%
COGENERATION	2,500	17,520	-	27%
TOTAL	**16,500**	**49,702**		**77%**
ENERGY EFFICIENCY (Note 7)	-	-20,680	-	-

Notes

(1) Assumes that 3,500 MW of wind is developed elsewhere in NSW.
(2) 16% of identified currently available NSW bioenergy resource (Rutovitz & Passey,2004).
(3) Assumes development of the Geodynamics sites at Muswellbrook and Bulga.
(4) Assumes installation of 3kW systems on 37% of houses.
(5) Assumes business PV installation is 30% higher in total than residential.
(6) Assumes installation of gas-fired co-generation at industrial sites and large users within the region, initially at aluminium smelters.
(7) This is the total NSW saving compared to BAU electricity use.

Table 16: Scenario 2: *Clean Energy Hub*

HUNTER REGION	MW	GWh	% of regional electricity	% of NSW electricity
WIND (Note 1)	2,000	5,256	36%	8%
BIOENERGY (Note 2)	400	2,803	19%	4%
GEOTHERMAL (Note 3)	200	1,489	10%	2%
PV – RESIDENTIAL (Note 4)	467	614	4%	1.0%
PV - BUSINESS (Note 5)	934	1,228	8%	1.9%
GAS COGENERATION (Note 6)	1,600	11,213	76%	17%
SOLAR THERMAL	1,000	3,066	21%	5%
TOTAL	**6,601**	**25,669**	**174%**	**40%**
ELSEWHERE IN NSW				
WIND	2,900	7,621	-	12%
HYDRO	4,200	3,800	-	6%
BIOENERGY	1,200	8,410	-	13%
PV	2,200	2,891	-	4%
SOLAR THERMAL	1,000	3,066	-	5%
COGENERATION	1,900	13,315	-	21%
TOTAL	**13,400**	**39,103**		**61%**
ENERGY EFFICIENCY (Note 8)	-	-20,680	-	**-**

Notes

1) Assumes that 2,900 MW of wind is developed elsewhere in NSW.
2) 26% of identified currently available NSW bioenergy resource (Rutovitz & Passey 2004).
3) Assumes development of the Geodynamics sites at Muswellbrook and Bulga.
4) Assumes installation of 3kW systems on 70% of houses.
5) Assumes business installs double the total capacity of residential PV.
6) Assumes installation of gas-fired cogeneration at industrial sites and large users within the region, initially at the aluminium smelters.
7) Assumes major development of solar thermal, although power stations would not be located within the region

8.2 Green jobs in clean energy

Jobs in energy efficiency and renewable energy are potentially secure, well-paid, environmentally friendly and Green jobs; they may be found in manufacturing, installation, maintenance and servicing, operations, transport and delivery of goods, sales, research and design. Many of these jobs can utilise skills that are already in abundance in the Hunter, creating new jobs for local people. Skills development and training are critical parts of creating Green jobs through new training programs and apprenticeships.

A local renewable energy and energy efficiency industry has potential as a new export industry, supplying technology and expertise to other regions in NSW, Australia and to global markets.

The Figures 27 and 28 below show the range of jobs that make up the labour requirements involved in wind and solar photovoltaics, based on research by Singh and Fehrs (2001).

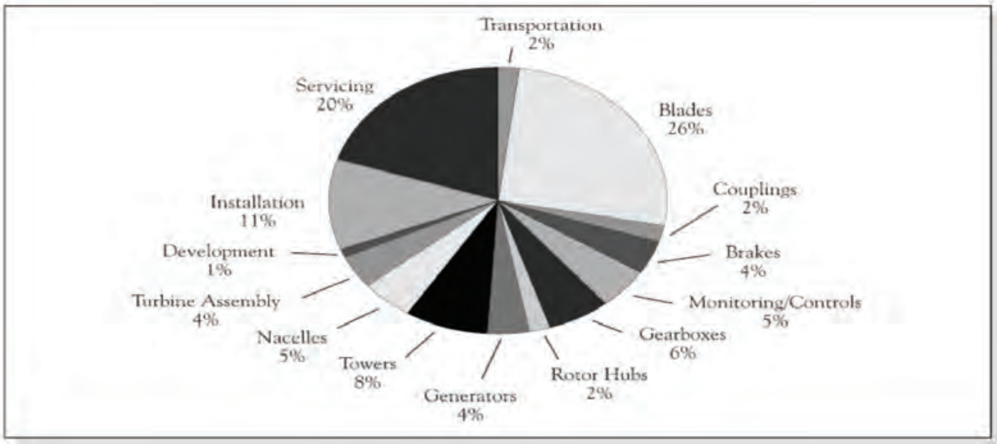


Figure 27: Labour requirements in wind by activity

(Source: Singh & Fehrs, 2001)

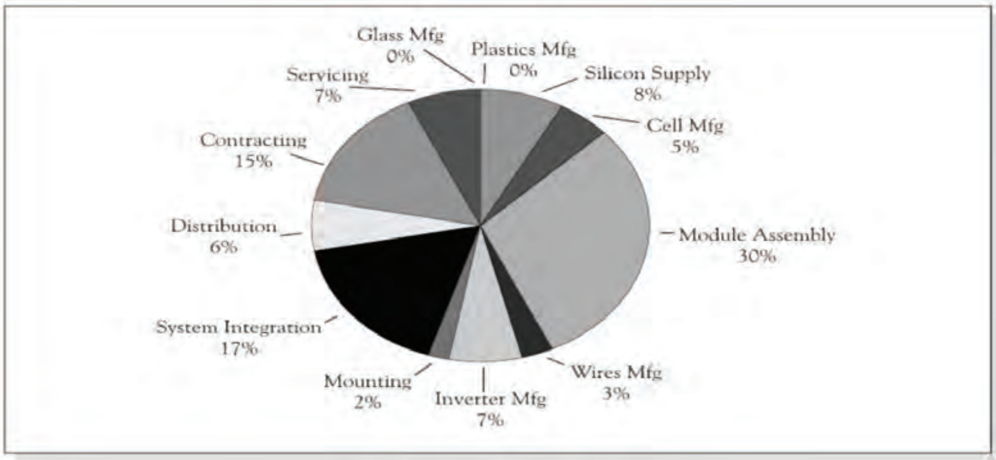


Figure 28: Labour requirements in solar photo-voltaics by activity

(Source: Singh & Fehrs, 2001)

Table 17 below shows the net employment gains from a switch to clean energy in the Hunter Valley region, using data from the *CofFEE report* based on employment factors in renewable energy identified by researchers including Kammen *et al.* (2004), Bedzek (2007), MacGill *et al.* (2002).

The table shows that *Scenario 1: Hunter as a Self-Sufficient Regional Energy Centre* models 4,700 jobs being directly created, and the same number indirectly – a total of 9,400 jobs. Assuming the loss of 3,600 jobs if the local coal-fired power stations were phased out, establishing the *Hunter as a Self-Sufficient Regional Energy Centre* would create a net gain of 5,800 jobs.

Scenario 2: Clean Energy Hub models 7,350 direct jobs being created and 6,950 jobs indirectly, a total of 14,300 jobs. Assuming the loss of 3,600 jobs if the local coal-fired power stations were phased out, establishing the Hunter as a *Clean Energy Hub* would create a net gain of 10,700 jobs (Bill *et al.,* 2008).

Table 17: Net employment gains from a switch to clean energy in the Hunter region

(Bill *et al.*, 2008)

	Renewable energy	Energy efficiency	Total Direct jobs	Total Indirect jobs	Total Jobs
Employment gains					
Scenario 1: Energy self-sufficiency	3,680	1,020	4,700	4,700	**9,400**
Scenario 2: Clean Energy Hub	6,320	1,020	7,340	6,950	**14,290**
Employment losses					
Phase out of coal-fired generation			1,300	2,340	**3,640**
Net effect					
Scenario 1: Energy self-sufficiency			3,400	2,360	**5,760**
Scenario 2: Clean Energy Hub			6,040	4,610	**10,650**

Notes:

- Employment gains are an average of low and high-energy efficiency estimates for Scenario 1 and Scenario 2, and assume renewable manufacturing for all of NSW occurs within the Hunter.
- Energy efficiency uses the average values for job creation.
- Jobs losses in the phase out of coal-fired power generation are based on input/output analysis of ABS data, as are indirect jobs created under employment gains for the renewable energy sector. (Bill *et al.*, 2008)

8.3 Local manufacturing

The full range of new jobs that could be created in the Hunter Valley region would vary according to a range of local manufacturing scenarios (see table below). The scenarios assumed a range from no renewable sector manufacturing in the region; renewable sector manufacturing for the Hunter Valley region only; and renewable sector manufacturing for all of NSW. The scenarios assumed also that it was most realistic that the renewable energy technologies that would be most likely to be manufactured locally or in NSW were 36% of wind energy equipment, 20% of solar photovoltaics (PV), and 100% of solar thermal.

This scenario of local manufacturing may be optimistic (especially given the closure of the BP Solar factory in Sydney in December 2008), but nonetheless, based on various scenarios, the *CofFEE report* showed that there is significant potential for a new export industry to be created in the Hunter Valley supplying renewable energy and energy efficiency technology and expertise to other regions in NSW, Australia and to global markets. While the potential export industry was not included in the CofFEE analysis, the report noted that scale disadvantages could be overcome by adopting an export strategy.

Table 18 below shows that thousands of renewable energy and energy efficiency jobs could be created in the Hunter Valley and around NSW under the *Energy Self-sufficiency* and the *Clean Energy Hub* scenarios, with various mixes of local manufacturing. The table also shows that thousands of additional Green jobs could be created in other NSW localities, recognising that renewable energy and energy efficiency technologies are inherently decentralised technologies.

Table 18: Job creation in renewable energy, energy efficiency and co-generation with domestic manufacturing

Hunter region	RE direct jobs	EE direct jobs	Indirect jobs	Total Jobs
Scenario 1: Energy self-sufficiency Assume region generates 100% of electricity for local use (23% of NSW electricity)				
No Australian manufacturing in RE	2,760	690-1,340	3,500-4,000	6,950-8,100
Assumes renewable sector manufacturing for Hunter region only	2,940	690-1,340	3,700-4,200	7,300-8,500
Assumes renewable sector manufacturing for all of NSW	3,680	690-1,340	4,400-5,000	8,800-10,000
Scenario 2: Clean Energy Hub Assumes region generates 40% of NSW electricity				
No Australian manufacturing in RE	5,400	690-1,340	5,700-6,300	11,800-13,000
Assumes renewable sector manufacturing for Hunter region only	5,780	690-1,340	6,100-6,700	12,600-13,800
Assumes renewable sector manufacturing for all of NSW	6,320	690-1,340	6,700-7,200	13,700-14,900

Notes:
1) Manufacturing: when onshore manufacturing is included, 100% of solar thermal, 36% of wind, and 20% of PV manufacturing is assumed to occur in Australia.
2) Solar thermal (Hunter region): 70% of construction work and all of the O&M is assumed to occur outside the Hunter. Jobs are included in "rest of NSW".
3) Co-generation: all fuel collection and distribution employment is assumed to occur outside the Hunter. These jobs are included in "all of NSW". (Bill *et al.*, 2008)

8.4 Intervention and investment for a clean energy economy

It is estimated that $12 billion would need to be invested in the Hunter Valley by 2020 to build the renewable energy, co-generation and energy efficiency infrastructure to enable *Scenario 1*: *Energy Self-sufficiency* to come into fruition (Bill *et al.,* and 2008: 43). These costs are shown in Table 19 below. Extrapolating from these calculations (and energy mix) the capital costs for realising *Scenario 2: Clean Energy Hub*, in which 40% of NSW electricity was generated in the Hunter Valley, would be likely to double.

Table 19: Estimated capital cost of renewable energy, cogeneration and energy efficiency measures for Scenario 1 (Hunter region only)

		INVESTMENT	CAPITAL COST
ENERGY EFFICIENCY INVESTMENT	**GWh savings**	**$million per GWh**	**A$ million**
Residential	590	$0.73	$429
Commercial	320	$0.39	$124
Industrial	975	$0.89	$869
RENEWABLE ENERGY INVESTMENT	**MW installed**	**$million per MW**	
Wind	1,400	$1.7	$2,380
Bioenergy	250	$2	$500
Geothermal	200	$4	$800
PV	575	$10	$5,750
Solar thermal	0	$3.5	$0
Cogeneration	1,000	$1.2	$1,200
TOTAL			**$12,052**

Note: Does not take account of technology cost decline over the period. All investment will not occur in the Hunter, as capital costs include imported technology

A Green job creation program for the Hunter Valley region to facilitate a transformation of the region's energy generation technology, to develop the necessary skills base in the region's workforce, and to protect livelihoods during transition, would require government intervention and large capital investments either by governments (if electricity generation remained in public ownership) or through public partnerships in a more mixed ownerships structure.

As well, billions of dollars of investment that are currently sunk in five existing coal-fired power stations would have to be amortised. Clearly, this is a cost that government could bear better than private investors (unless fully compensated by government) and thus is a strong argument for retaining public ownership of the Hunter Valley's power generation infrastructure.

The commitment by the Rudd Labor Government to invest A$50 million for the Australian Solar Institute at the CSIRO Centre in Newcastle would be a boost to a renewable energy research and industry development in the Hunter Valley, as would other policy commitments made by the federal government that are not specific to the Hunter Valley but are national programs that would assist a transition. These include a Mandatory Renewable Energy Target of 20% by 2020; use of government procurement to support innovative Australian firms (including firms involved in renewable energy and energy efficiency) and other incentives to stimulate research and development (ALP, 2007b, c). The Rudd Government's 2007 election commitment to invest $500 million into a Renewable Energy Fund to develop, commercialise and deploy renewable energy in Australia is intended to generate $1.5 billion worth of investment in renewable energy technologies by the private sector. Included in the fund were commitments for $50 million for photovoltaic research and development, $50 million for general clean energy research and development, including energy efficiency, energy storage technologies and hydrogen transport fuels (ALP, 2007c,e).

In its 2009 budget, as part of a Clean Energy Initiative (CEI), the federal government extended the funding commitment for the Renewable Energy Fund and committed $1.365 billion for a new Solar Flagships program and $465 million to establish Renewables Australia. The funding for Renewables Australia (comprising $100 million of new additional funds and $365 million of previously committed funds) is to establish a new government agency to support leading-edge technology research and bring it to market. The Solar Flagships program (comprising ($1.365 billion of new funds and $0.235 billion existing funds over six years) will support construction and demonstration of large-scale solar power stations in Australia, which including up to four individual generation plants on the national grid, generating using solar thermal, photovoltaic and energy storage technologies, with a target of 1000MW of electricity generation.

The Rudd Government also committed Australia to join the International Renewable Energy Agency (IRENA), an intergovernmental organisation, formed in January, 2009, for promoting the adoption of renewable energy worldwide through providing policy advice and facilitating capacity building and technology transfer.

Conclusion

The Rudd Government investment in renewable energy technologies is an important policy and financial commitment towards renewable energy based energy system for Australia, but they are not “game changers”. The government continues to emphasise that it also wants to maintain coal dependency, announcing an investment of $2.425 billion over nine years in so-called “clean coal” technologies in the 2009 budget (Australian Government, 2009).

However, the *CofFEE report* shows that there is potential for thousands of Green jobs to be created as part of a transition to a clean energy future for the Hunter Valley if some of the renewable energy funds are invested in the region, to achieve either of the two Hunter Valley scenarios: a *Clean Energy Hub* or the *Energy Self-Sufficiency* scenario. While there would be 1,300 direct jobs losses in the phasing out of coal-fired electricity generation in the Hunter Valley region and 2,300 indirect job losses (a total of 3,600 jobs), a switch from coal-fired power to renewable energy industry in the Hunter would create a net gain of between 3,900 and 10,700 jobs in scenarios where the Hunter generates 20–40% of NSW electricity from a mix of renewable energy, and natural gas as a transitional fuel.

The scenarios discussed in this chapter clearly indicate that the Hunter Valley could retain its historic role as an energy hub even in a more decentralised renewable energy technology-based system. With appropriate government policy and financial intervention, the region could potentially become a major centre of renewable energy generation and technology manufacture, creating thousands of new Green jobs.

Thousands of other jobs in the manufacture, installation, maintenance, sales and research into renewable energy and energy efficiency technologies could be created in other locations where that part of the NSW electricity demand not met from the Hunter Valley is generated.

Clearly there are multi-billion dollar costs involved in making a transition to a clean energy economy, including in writing off the value of existing coal-fired power generation infrastructure, and in building renewable energy and energy efficiency infrastructure needed to guarantee energy security as coal-fired power is phased out. Further research is needed to more accurately identify these costs, and identify how the necessary capital can be raised.

The *CofFEE report* exemplifies the importance of regional capacity to do research that responds to local concerns and seeks solutions that can influence the wider policy debate and identify sites of potential investment in Australia. Further research is also needed into the regional economic impact of closure of the region's coal export industry to get a full picture of the impact of a full transition from coal dependency.

However, this sort of research is only likely to get translated into government policies and investment if there is a strong community demand for an alternative sustainable future for the Hunter Valley, and the following chapter discusses the role of social learning processes to build awareness of the need to change, and to build a social movement that is effective enough to drive adaptive capacity for change.

Chapter 9

Social Learning for Resilience and Adaptive Capacity

A scan of the *Newcastle Herald*, the largest circulating newspaper in the Hunter Valley, over the last five years, shows a steady rise in articles, opinion pieces, cartoons and letters to the editor questioning the sustainability of the region's coal industry. A shift in public concern about the costs and benefits of coalmining and climate change is also reflected in surveys of environmental attitudes conducted by the Hunter Valley Research Foundation (HVRF, 2007; HVRF 2008).

The Hunter Valley Research Foundation's *Upper Hunter Environmental Attitudes Survey 2007* found that 30% of residents of the Upper Hunter heartland of the coal industry thought the costs of the coal industry for the region outweighed the benefits. Less than half the people who live in the region believe the benefits of coalmining outweigh the costs (HVRF, 2008: 7).

The region's young people (in the 18–24 years age group, and those most likely to consider seeking high-paid jobs in mining) were significantly more likely to think that the costs of coalmining outweigh the benefits, while 70% of Upper Hunter residents surveyed in 2006 indicated they believed that climate change would significantly affect their lives in the next 20 years (HVRF, 2007: 7; HVRF, 2008: 1).

Since 2006 there has been a small shift towards a somewhat less critical view of the costs and benefits of coalmining and the likely impacts of climate change. This shift in attitude may be attributable to two factors: the ending of the decade-long drought in 2007; and an intensive industry public relations campaign, entitled *Life. Brought to you by mining*.

The *Life. Brought to you by mining campaign* focused on the major mining regions of NSW (the Hunter Valley and Illawarra) using billboards, TV commercials, press advertising and a website to provide information "about the industry's contribution to modern life, from employment and the economy to electricity and consumer items" (NSW Minerals Council, 2007). Launching the campaign, the CEO of the NSW Minerals Council, Nikki Williams, stated:

> Unfortunately the public discussion on global warming has been railroaded by agenda-driven scaremongering, when what we desperately need is logic, innovation and collaboration (NSW Minerals Council, 2007).

Alarm about the threats that the region's coal dependency poses to environmental and social wellbeing has contributed to the emergence of a social movement opposing the expansion of coalmining and calling for a transition towards a *Future Beyond Coal*. This social movement is a new disturbance to the Hunter Valley's socio-ecological system being actively fostered through a political organising process. Like the NSW Minerals Council's campaign, the *Future Beyond Coal* social movement utilises mass media, the

Internet and popular education as part of a social learning process. Unlike NSW Minerals Council, the social movement also uses civil disobedience as a tool for alerting and mobilising the public.

The education and learning processes fostered by the *Future Beyond Coal* social movement combine different types of knowledge, layperson and scientific, and both experiential and academic learning to strengthen the role of regional, national and global attractors to build political power that challenges the political influence of powerholders. This combination builds the resilience and adaptive capacity of coal communities for creating an alternative economy, including what is known as a "diverse, community economy" that creates multiple ways in which people can make non-capitalist economies that, in the process, build new forms of community (Cameron & Gibson, 2001, 2005; Gibson-Graham & Roelvink, 2008). This chapter examines how social learning is linked to social movement building in the Hunter Valley for sustainability.

9.1 Education and learning for sustainability

Human activities are the most powerful influence on the health of ecosystems and their potential for sustainability. Social learning and education about the threats to sustainability, and the social values and behaviours needed to remove these threats are potentially powerful disturbances for transformation of socio-ecological systems.

The Millennium Ecosystem Assessment identified that the sustainable management of ecosystems "requires substantial changes in institutions and governance, economic policies and incentives, social and behavioural factors, technology, and knowledge" (Millennium Ecosystem Assessment, 2005: 17). Thus, education for sustainability, also referred to as "education for sustainable development" (UNESCO, UNEP, 1996) and "education for a sustainable future" (UNESCO, 1997), needs to alert people to the need for new institutional and governance arrangements that can promote sustainability, and the necessary social actions needed to create them.

Sustainability education theory and practice recognises that complex interactions link the economic, political, social, cultural, technological and environmental factors which influence human society's trajectory toward or away from sustainability. Arguably, Indigenous societies have for millennia educated their communities for sustainability, yet in contemporary capitalist societies addicted to growth, sustainability education needs to be reinvented. Tilbury *et al.* (2002) propose that achieving sustainability is a transdisciplinary issue and:

> Entails involving people in questions about the ownership of common property resources, issues of international and intergenerational equity, investigations into regional and national ecological footprints and, most importantly, engagement in debates about qualitative versus quantitative growth (Tilbury et al., 2002: 12).

Education for sustainability occurs within both formal and informal education settings, and draws insights from public health, ecology, political economy, disaster management and climate change, integrating systems thinking, participation, and action research linked to network building, dialogue, strategic mapping, adaptive management, evaluation and reflection (Keen *et al.,* 2005; Allen, 2008).

Social learning is seen by practitioners as a useful analytical and facilitative framework for building the capacity of communities to work together to solve complex environmental and social problems where there are multiple perspectives, constraints on available resources, and where decisions and actions need to be taken at different scales. The process builds capacity for adaptive management – learning by doing – and, as a collaborative process, builds social capital (Buck et *al.,* 2001; Pahl-Wostl & Hare, 2004; Keen *et al*. 2005; Pahl-Wostl, 2006; Kilvington, 2006; Fernandez-Gimenez *et al.*, 2008).

According to Keen *et al.* (2005), social learning for environmental management involves creating new learning partnerships, learning platforms, and social values that support collective action for sustainability. The new social learning partnerships bring people together across cultural and social divides, across knowledge systems and across institutional structures. New social learning platforms include new institutions and places of learning in which collaborative learning, values clarification and action for achieving sustainability occurs.

It will be vital to develop social learning for boosting the resilience of communities experiencing sustainability challenges and shocks from ecosystem health collapse, economic crises, Peak Oil/Coal and climate change. Communities and social movements with a strong culture of social learning around building capacity to anticipate and prepare for shocks are likely to lead the social transformation towards sustainability. The building of a culture and networks for social learning is exactly what the Hunter Valley's social movement for a *Future Beyond Coal* is attempting to do.

According to Whelan (2002), learning has not been recognised as a critical part of social change movement culture and strategy. Its significance as a tool for change has been neglected relative to other social movement activities, such as lobbying, electoral politics, protests, and media exposure. Yet Whelan (2002) identifies that linked learning, action, reflection and evaluation are vital components for effective campaigning for change. Effective social movement learning involves ensuring strategies have clearly identified audiences and purposes, and that they are critically evaluated to assess the long-term outcomes (Whelan, 2002: 9).

9.2 Social learning and popular education

Education and learning have a long tradition of social change movements with roots in the anarchist and socialist movements of Europe and North America of the 19th and 20th century, and in the revolutionary and social justice movements of Latin America, Africa and Asia (Holst, 2002). The tradition informed, and was developed by, the work of activist educators such as Antonio Gramsci, Paolo Freire, Rosa Luxemburg, John Dewey, George Counts, Henry Giroux, Ira Shor, Angela Davis, Howard Zinn, and many others (Torres, 1990; Foley, 1999; Kane, 2001; Taylor *et al.*, 2006; Walters & Manicom, 1997).

Radical adult education has a specific social change and community development agenda that seeks to build the power of communities so that they can challenge powerholders and change exploitative social relationships.

Popular education is a form of radical adult education that uses a participatory and conversational pedagogy. It emphasises collaborative learning and reflection on real-life experiences and on the politico-economic relationships in which participants find themselves living, and which they want to change (Newman, 1994; Schapiro, 1995; Wagner, 1998; Foley, 1999; Boughton *et al.*, 2004; Branagan & Boughton, 2003; Taylor *et al.*, 2006).

The popular education pedagogy espoused by Freire (and others) places a strong emphasis on assisting the learner to critically examine their *lived experience*, and for the learner to:

> Make oppression and its causes the objects of reflection by the oppressed, and from that reflection will come their necessary engagement in the struggle for liberation (Freire, 1993: 30).

Gramsci wrote of the important roles of intellectuals in the struggle of ideas about society, and in framing what is seen as "common sense" and therefore worth fighting for (Gramsci, 1971). Gramsci recognised what he called "traditional" and "organic" intellectuals as "articulators of meaning" in societies, and saw them as important participants in a struggle of ideas about current circumstances and potential futures. In his *Prison Notebooks*, Gramsci wrote that while all people are intellectuals, not all function in society as intellectuals whose "traditional" role in society is to give meaning to socio-economic relationships and events. For Gramsci, intellectuals such as managers, civil servants, the clergy, teachers, technicians, scientists, lawyers and doctors are often paid to prop up the dominant paradigm, even though they might argue they are actually independent and autonomous from it.

Organic intellectuals, in contrast to traditional intellectuals, do not necessarily work "officially" as intellectuals, but are produced "organically" by the educational system, and they also perform thinking and organising for the dominant social group in society. Gramsci wrote that:

> [E]very social group, coming into existence … [creates] organically one or more strata of intellectuals which give it homogeneity and an awareness of its own function not only in the economic but also in the social and political fields (Gramsci, 1971: 5).

Gramsci proposed that to be effective in the contest of ideas, to change social attitudes and behaviour, and to effectively engage in the project of democratising politics and society through effective political action, progressive social change movements need the active support of a significant number of "traditional" intellectuals, but they also need to produce their own "organic" intellectuals (Gramsci, 1971; Boggs, 1976; Allman, 1988; Sassoon, 2000).

Popular education attempts to create the "organic" intellectual that Gramsci identified as necessary for democratic social change. Popular education reflects the Gramscian view that education relationships are "hegemonic" struggles in which social actors engage in a contest of values, meanings of reality, and visions of alternative futures, and in doing so, create traditional and organic intellectuals that can advance their "causes" (Gramsci, 1971; Coben, 1998; Mayo 1999; Allman, 1999).

The potential of popular education is to challenge assumptions and beliefs of individuals and societies, and thereby be transformative of social relationships. Practitioners of transformative popular education consciously seek to bring about new ways of seeing the world, redefining it and acting in it in new ways that are emancipatory and liberating for themselves and others (Mezirow, 1991, 1997). Popular education therefore can be applied to understanding and transforming human-ecological relationships and enable humans to regain symbiotic relationships with nature that is recognised as the basis for sustainability by Bookchin, Rapport and others.

9.3 A socio-ecological focus in popular education

The Highlander Research and Education Center in Grundy County, Tennessee, is one of the most enduring and influential popular education centres in the social change movement of the US, and an inspiring example of how popular education in a developed country can educate and support generations of activists on social justice and ecological campaigns.

The Highlander Center was founded in 1932 by Don West and Myles Horton, a collaborator in popular education theory and practice with Paulo Freire and other practitioners. The Highlander Center played a key role in supporting and educating labour movement activists during the Great Depression years of the 1930s, and civil rights activists in the 1940, 50s and 60s (including Rosa Parks, who led the Montgomery action for the right of blacks to sit wherever they liked on buses).

The Highlander Center describes its purpose as:

> A catalyst for grassroots organizing and movement building in Appalachia and the South. We work with people fighting for justice, equality and sustainability, supporting their efforts to take collective action to shape their own destiny.
>
> Through popular education, participatory research, and cultural work, we help create spaces – at Highlander and in local communities – where people gain knowledge, hope and courage, expanding their ideas of what is possible.
>
> We develop leadership and help create and support strong, democratic organisations that work for justice, equality and sustainability in their own communities and that join with others to build broad movements for social, economic and restorative environmental change (Highlander Center, 2008).

Currently the Highlander Center is supporting Appalachian people's movements for economic and environmental justice, including groups such as the Save Our Cumberland Mountains, a non-profit Tennessee grassroots organisation working for social, environmental and economic justice in areas affected by strip mining and mountain top removal for coal (Highlander Center, 2008). The Save Our Cumberland Mountains organisation also campaigns on sustainable forestry, toxic issues, aerial spraying, tax reform, dismantling racism and voter rights (SOCM, 2008).

Like the Highlander Center, many popular education theorists recognise the need for the realm of theory and practice to extend beyond social justice issues into the ecological domain, and to shift the focus of popular education from what they regarded as an anthropocentric orientation towards an eco-centric orientation (Van Matre, 1990; Thomashow, 1995;,Suzuki & McConnell, 1997; O'Sullivan, 1999; Foley, 1999; Clover *et al.*, 2000).

O'Sullivan, for example, challenged the narrow, anthropocentric orientation of so-called "critical" popular educators (such as Freire), stating that:

> Their pre-eminent emphasis on inter-human problems [is] frequently to the detriment of the relations of humans to the wider biotic community and the natural world. The general direction of critical perspectives is towards anthropocentrism. The criticism of anthropocentrism is by no means a reason for dismissal of the vital concerns that critical perspectives pose for contemporary education. These issues must be taken forward and fused into wider biocentric concerns (O'Sullivan, 1999: 63).

More recently, the Instituto Paulo Freire, Sao Paulo, Brazil, has, in fact, established a program in ecopedagogy which promotes ecological literacy and the construction of a planetary citizenship, and (with many other organisations) worked on the creation of the Earth Charter, a declaration of global environment action based on the Universal Declaration of Human Rights (Gadotti, 2000).

Ecopedagogy theorist, Richard Kahn (2004, 2008) has questioned whether the concept of education for sustainability, as embraced by governments and some academic institutions may just be "a seductive pedagogical "greenwash" developed by and for big business-as-usual in the name of combating social and ecological disasters" (2008:7) He asserts that the values of ecopedagogy were espoused by Freire (2004) when he stated:

> It is urgent that we assume the duty of fighting for the fundamental ethical principles, like respect for the life of human beings, the life of other animals, the life of birds, the life of rivers and forests. I do not believe in love between men and women, between human beings, if we are not able to love the world (2004: 47).

Popular education in Australia

Australia also has a tradition of popular education for social change in the anti-war, women's liberation, Aboriginal rights, trade union, migrant rights, gay rights and environment social movements. Activist learning and training institutions, with similar roles and pedagogy to the Highlander Center, have existed in Australia, including the "Marx Schools" of the former Communist Party of Australia, trade union training centres, women's movement organisations (such as consciousness raising groups and Women's Health Centres) and Indigenous learning centres (such as Tranby Cooperative College in

Sydney and the Institute for Aboriginal Development in Alice Springs) (Boughton, 1996; Whelan, 2002; Branaghan & Boughton, 2003; Burgmann, 2003; Ollis, 2008).

Popular education organisations, such as The Change Agency in Australia, have developed popular education programs grounded in both ecological justice and social justice values (Whelan, 2002), and work with community, student and environment activists. The annual Australian Students Environment Network's (ASEN) *Students of Sustainability* conferences, as well as other environment movement initiatives, such as the Climate Action Network Australia annual conferences, also provide popular education forums linking ecological and social sustainability.

Shifting opinions about the impacts of coalmining and climate change among people in the Hunter Valley are, to some extent, a product of many years of informal, popular education undertaken in the region that have linked ecological and social justice thinking. In the case of the Hunter Valley, the perverse resilience of coal dependency and the hegemony of coal corporations over development trajectories, represent the "oppression" that is "the object of reflection" referred to by Freire (1993), and which becomes the focus of popular education and social learning.

Hunter Valley coal and climate campaigns and popular education

In the 1980s, the Newcastle Trades Hall Council-sponsored Ecology Centre played a major role organising and giving a voice to community concerns that the Hunter Valley's environment and community health were being sacrificed to global energy markets, organising community forums, protests and information booklets (Ross & Phillips, 1980). More recently, during the 1990s and 2000s, local environmental activists such as Wendy Bowman, Gail Collins, Christine Phelps, Bev Smiles – through the regional organisation Minewatch – organised local awareness and advocacy campaigns opposing a new wave of coal industry expansion (Hunter Environment Lobby, 2003, 2005; personal interviews 2004 –07).

In August 2005, the Hunter Environment Lobby organised an annual forum (that this author was involved in organising) on the theme *Building A Shared Vision and Partnerships for Justice and Sustainability in the Hunter*, with speakers from unions, Indigenous, environmental, student, farmers, health and welfare organisations, and clean-energy businesses.

The president of Minewatch, Wendy Bowman, noted that popular education can begin as a very low-key affair from household and small community meetings:

> We [at Minewatch] realised we could offer our services [to people affected by new mining proposals]. We'd ring and say who we are and "Would you like us to come and tell you what your rights are, and how a mine progresses from when they are given their first area to when the EIS comes out?" We very rarely have to ring anybody now. We seem to be known everywhere and are rung and asked "Please will you come over and talk to us and tell us what goes on? How do we deal with this?" And it was rather nice. (Bowman, personal communication, August 2004)

Regional organisations, such as the Hunter Environment Lobby, the Hunter Community Environment Centre, Rising Tide, and local groups, such as Jerry Plains Minewatch, Caroona Coal Action Group, and the Anvil Hill Project Watch, have organised cottage meetings and larger public meetings in the Lower and Upper Hunter Valley, and in the Central Coast, Gloucester and Liverpool Plains regions. These meetings have engaged communities in public awareness-raising followed by submissions to government inquiries and local governments, articles for print and electronic media, public protests and lobbying of politicians for environmental protection and a transition to a *Future Beyond Coal*.

Leading by example

Wendy Bowman is a farmer who founded the Upper Hunter residents' environment group Minewatch in 1992. Bowman, a "matriarch" of one of the Hunter Valley's most prominent "pastoral pioneer" families (Jameson, 2009), has seen historic homesteads and cattle properties owned by her family, and others, disappear into the bowels of open-cut coalmines over the last 20 years. In 2007, she was forced to sell the historic home *Gran Galang*, that her family had owned since 1893, after it became surrounded by open-cut mines, and then acquired by Rix's Creek mine operations. Bowman then moved to the nearby village of Camberwell, and there has again been under pressure to sell as that village is also becoming surrounded by mines.

In March 2009, Bowman declared that she would stay put, and not sell to Ashton Coal unless the NSW Government committed to a comprehensive study of the cumulative environmental and public health impacts of mining and coal-fired power generation on Hunter Valley residents (Harris, 2009; Jameson, 2009). Bowman's leadership and stoicism is graphically depicted below (Figure 29) by cartoonist, Peter Lewis.

Figure 29: Wendy Bowman, fighter for the health of the Hunter Valley

(Courtesy: Lewis, *Newcastle Herald*, 9/3/2009)

Importantly, Bowman, Minewatch, and other regional activists and organisations campaigning against coal dependency in the Hunter Valley, have recognised the importance of learning as part of the social change process, and acknowledge that residents and academics can work together as organic intellectuals in the Gramscian sense. Bowman describes the importance of social learning as part of the struggle for regional sustainability:

> Our work is bringing people together. Knowing that what you say is correct – you can't say something that isn't right otherwise you will be picked up immediately. So you have got to do your homework and know that what you say is absolutely correct. That is very important. Then once you bring people together and you can get strength in what you are doing. You have got to learn to talk to people, and to use media. As we were saying last night, if we can get something happening every week somewhere and keep it in the eye the government – it is being niggled at. Keep niggling them, keep going at it and show it to everybody. A lot of the researchers, like the fellow that was on television the other night and on ABC radio, from Sydney University, are important for our work (Bowman, 2004, interview with the author).

Rising Tide, which describes itself as "a grassroots Newcastle group taking action against the causes of anthropogenic climate change and for equitable, just, effective, and sustainable solutions to the crisis" (Rising Tide, 2006), has organised more than 12 direct actions involving (mostly) young residents of the Hunter Valley in civil disobedience, with actions including occupations of coal company offices, the headquarters of the state Labor party, and blockading the NSW Premier's motorcade in Newcastle. In 2007, 2008 and 2009, Rising Tide organised a flotilla blockade of the port of Newcastle, which stalled ship movements in and out of the port (Figure30 below).

Figure 30: The People's Blockade of the World's Biggest Coal Port

(Courtesy: Rising Tide, 2009)

In July 2008, Rising Tide (with other groups) organised a National Climate Camp in Newcastle that attracted 1,000 activists. Activities included popular education forums on the links between coal and climate change, renewable energy, skill sharing on political organising, and strategies for a Just Transition. The Climate Camp forums were followed by a blockade of the railway line to the world's largest coal export port, stopping movements of coal trains for a day.

It is not just "radical Greenies" that are taking direct action to oppose the expansion of the Hunter Valley's coal industry. Even conservative farmers have engaged in blockades against coalmines. Farmers at Caroona on the Liverpool Plains have blockaded the Duddy farm since August 2008 (Figure 31 below).

Figure 31: Farmers blockade coalmine developments in the Liverpool Plains

(Photo: Caroona Coal Action Group, 2009a)

The Caroona Coal Action Group (CCAG) campaign call is:

> We ask people to consider that food production from rural communities is a National Security Asset. If push comes to shove, we cannot eat coal. We need to be able to produce our own food and for that we need fresh water, living land and clean air. We are fed up with platitudes and lies. We want to know why cancer rates are so high in the Hunter Valley area. We want to know what heavy metals will get into our water tanks and how they will affect our children and their children's health. (CCAG, 2009b)

In June 2009, more than 200 farmers from the Liverpool Plains rallied outside the NSW Parliament in Sydney, to support of a Greens Party amendment to the *Mining Act 1992* to prevent any mining or exploration anywhere in areas designated as prime agricultural lands (CCAFG, 2009c). The amendment was lost due to the Shooters Party and the Christian Democrat parliamentarians voting in opposition to it, with the Labor Party.

The Hunter Valley's social learning and popular education networks have linked farmers, academics, environmental organisations, mineworkers, Indigenous people and unionists to share experiences and concerns about the ecological and human health impacts of coalmining, coal-fired power generation and climate change, to develop common policies to change their situation, and to engage in mutual support and joint advocacy. The processes are rendering obsolete historical political alliances, and bringing traditional conservatives and Greens together.

There is a growing body of critical analysis of learning and organising in the contemporary Australian climate movement, including investigating links with other sectors of society (Hall & Taplin, 2005; Lansbury-Hall & Taplin, 2006, 2007; Whelan & La Rocca, 2003; Evans, 2008b; Whelan *et al.*, 2009). This reflective work builds on earlier work examining the history and effectiveness of the Australian environment movement's engagement with other issues (Doyle, 1995, 2000; Hutton & Connors, 1999), and of the practices and impact of the global environment movement (Rucht, 1999; Dryzek *et al.*, 2003; Dryzek, 2005: Doyle, 2005).

Learning-by-doing is part of education for sustainability. It is a complex and challenging process. Learning about coal dependency and climate change requires transdisciplinary learning that integrates knowledge from many people, disciplines, places and experiences. The complexity of the challenge was recognised by the facilitators of the first National Grassroots Climate Movement conference, held in Canberra in 2009, when they asked participants to consider that:

> Across the climate movement, approaches to strategy are very diverse. People are putting energy into trying to shift 100 different levers. Some climate action groups are focused on raising community awareness and encouraging individual action, while others are seeking legislative remedies. Some focus on influencing local government decisions while others target state or national government and others focus primarily on influencing the coal and energy industries.
>
> Everyone, it seems, has their own answer to the climate problem, and everyone is sure their answer is right. Some even endorse so-called clean coal, while others are certain this isn't part of the solution. Many of the hundreds of community action groups that have formed in the last few years have found it almost impossible to know just what to focus their energy on and experience "action paralysis". Finding people in your community who share your concern about climate change is the easy part. Working out just what to do together (movement strategy) is much harder (Whelan et al., 2009: online).

9.4 New partnerships, platforms, and values

Social learning and popular education share common features, but also have some distinguishing features. Popular education and social learning practices are both ongoing social processes of collective learning, primarily through informal rather than structured activities, and each has a strong emphasis on learning being linked to dialogue, network building and social action (Foley, 1999; Keen *et al*., 2005; Taylor *et al.*, 2006; Wals and van der Leij, 2007; Allen, 2007; Tilbury, 2007; Bawden 2007).

While popular education practitioners have an explicit social change agenda on which they focus education and learning, social learning is not necessarily initiated as a social transformation process, or as oppositional to powerholders and oppressive social structures and practices. Indeed, social learning often engages participants from government and business in the learning process, in collaboration with individuals and organisations from civil society, on issues such as community improvement or environmental management (Wildemeersch, *et al.*, 1998; Breit *et al.*, 2003; Keen *et al*., 2005; Percy-Smith, 2006).

In the Hunter Valley, social learning and popular education have contributed to the negotiation of new values about sustainability, environmental justice and citizens' rights. Both social learning and popular education processes encourage a shift from a hierarchical expert/learner model of learning to a more collaborative learning among equals. Through these processes local residents have become experts on the issues affecting them and have learnt to assert their right to be heard by powerholders in government and industry, and in the general community. They have established new popular education platforms, such as Minewatch, the Anvil Hill Alliance, and less formal networks such as community meetings, media, and street conversations, through which they have taught residents about the impacts of mining and their rights as citizens, and trained people in advocacy skills.

Local residents have drawn attention to a dialectic that has emerged in the struggle for sustainability in the Hunter Valley. Residents have noted that while, on one hand, the threat of coal mines jeopardises the health and integrity of communities and drives people away from communities, creating marked gaps between 'haves' and 'have-nots' with respect to high incomes, it has also brought people together as collaborative learners and activists.

Residents have noted the divisions mining can cause in affected communities:

> When mine comes in it is able to offer huge money and I think it's caused a lot of greed to a certain extent in people, they don't think along the lines of how much trouble that huge money is causing, not necessarily just their direct neighbour, but every neighbouring town. Once big money comes into an area it changes the lifestyle in a huge area. Where you might have been able to buy certain things fairly cheap, all of a sudden there's money in the area and it goes dearer. But there are still those low income families in the area as well and it makes life difficult for lower income people, like your everyday farmhand, who isn't anywhere near getting the money that a miner is getting (Campbell, interview with author, 19/9/2004).

Residents have also noted that affected communities are learning to work together through the formation of local organisations:

> People learn about sustainability from, groups like Minewatch that are becoming more and more active, because people are starting to get onboard with them. As

> they're being affected, they're starting to get onboard. And so the actual community's learning from those people (Brown, interview with author, 29/7/2004).

Patrice Newell, a farmer, author and environmental activist opposing the proposed Bickham mine in the Upper Hunter, noted the emergence of a new ethic of cooperation and community-building emerging among farmers as a result of them learning about the impacts of coalmining on their water sources that brought them together to resist new mines:

> Neighbours who have fought over fences can join forces to fight for something like the saving of a river/ the protection of a water course/a catchment, an aquifer, a region's water security. People who wouldn't talk to each other because of socio-economic or religious differences, or some scandal in the dim past, join forces to fight for an issue that is way bigger than themselves (Newell, 2006: 4).

9.5 Social learning for resilience and adaptive capacity

There is a strong notion that ecological and social crises are becoming more complex in nature, increasingly transboundary and interconnected. Deep instability in socio-ecological systems will generate repeated crises with sudden crystallisation, occurrence and (in some cases) disappearance in a seemingly incomprehensible and random fashion. Problems that emerge are likely to be increasingly resistant to conventional treatment and, according to Boin and Lagadec (2000), who research the field of crisis and contingency management, crises of the future are likely to entail a post-breakdown state in which the change is irreversible. Fundamental problems will resonate with each other, with simultaneous collapse of systems of such a scale that sequential treatment that can be ordered in time, space and by category is impossible (Boin & Lagadec, 2000: 187). The current collapse in biodiversity and ecosystem health around the planet, the global financial crisis, and the emergent crises of climate change and Peak Oil reflect these patterns.

Boin and Lagadec's views are consistent with research into cascading collapse of ecosystems and linked social systems as failure in one dimension of the system drives collapse in other dimensions of the system, and collapse of systems at different scales (Scheffer *et al.,*2000; Gunderson & Holling, 2002; Kinzig *et al.*, 2006).

Building capacity for resilience and adaptation management capacity to deal effectively with the emergence of more complex and intractable future crises requires both resilient-oriented strategies and anticipation-based strategies:

> It is necessary, in turn, to organise for resilience to facilitate a rapid, flexible, innovative and effective response when a future crisis presents itself (Boin & Lagadec, 2000: 188).

There is plenty of evidence that suggests the crises are already occurring, so it is necessary to consider whether contemporary social institutions and organisations are capable of effectively maintaining the health and integrity of local, regional, and global ecosystems, and whether or not they have the capacity to sustain societal development in the context of uncertainty, surprise, and vulnerability (Folke *et al*., 2003: 353).

An anticipatory approach develops the capacities of institutions to prevent disturbances that jeopardise sustainability. It attempts to transform non-sustainable socio-ecological systems in a more desirable trajectory before crises hit, and develops strategies to adapt to changes that cannot be avoided. The reports of Stern (2007) and Garnaut (2008) identified that, in relation to climate change, an anticipatory approach is more cost-effective than doing nothing.

Managing for resilience and adaptive capacity requires fostering institutions and networks that can learn from experience, store knowledge, and encourage flexibility and innovation in problem solving (Berkes & Folke, 2002; Resilience Alliance 2005). In the Hunter Valley these institutions include national state and local governments, industry, trade unions, the University of Newcastle and other research organisations, technical colleges and educational institutions, and networks among farmers, environmental organisations and Indigenous organisations.

Informal or "shadow" networks among human actors in the socio-ecological system play a crucial role in transforming socio-ecological systems (Olsson, Gunderson *et al.*, 2006) as promulgators of knowledge, facilitators of information flows, identifiers of knowledge gaps, and creators of nodes of expertise that can be drawn upon at critical times. These networks foster the emergence of Gramsci's organic intellectuals and community leaders. Social learning plays a crucial role in building shadow networks in the Hunter Valley, as they organise within and across government, industry, academic institutions, trade unions, environment organisations and communities independent of, and often in conflict with, formal processes.

The ultimate test of effective social learning in relation to non-sustainability is the ability of social actors in the socio-ecological system to anticipate threats and foster the institutions and networks that can learn from experience, store knowledge, and organise to effectively challenge and create alternatives to the ecological hegemony of non-sustainable social and economic relationships, and the institutions that foster these relationships.

Some institutions, such as trade unions, have a strong critique of capitalist exploitation but do not necessarily foster critical thinking about ecological issues, in part because the workers they represent are often involved in processes that damage environments. These workers also lack the power to renegotiate the nature of their work. Furthermore, even where there is a critical analysis of ecological impacts of work, many institutions lack the flexibility to act because of limits on their scope for intervention in the workplace to protect and represent the interests of their constituents around a narrow set of issues. Constraints on the coverage rights of unions beyond particular industries limit the scope of some unions, such as the mineworkers' union (the CFMEU M&E) for thinking innovatively about alternatives to the current economy in which they are significant powerholders. In a non-fossil fuel economy the union would not be a major player unless its right of coverage could expand to include the new workforce, and this constraint limits the union embracing a *Future Beyond Coal*,; indeed the union is a powerful ally of governments and corporations promoting expansion of the coal industry.

Industries and governments that have large investments sunk in infrastructure, such as centralised the coal-fired power generators, also lack flexibility. Innovation is limited to technologies that can utilise existing infrastructure (such as carbon capture and storage, or solar-thermal installations attached to coal-fired power stations), rather than significant development of alternatives, such as renewable energy. Resident groups, and Indigenous and environmental organisations are constrained by lack of resources, including power to intervene in decision-making processes.

Therefore, while the previous chapter identified alternative scenarios for a Green jobs and energy transition for the Hunter Valley, based on regional-level work of organic intellectuals, the other critical area of learning is about how to pressure governments and industry to change to their policies and investments, to make a transition possible.

The *Blueprint for a Low-carbon Future for the Hunter Valley* research collaboration has the potential to link social learning and advocacy for investment in institutional change, capacity building, and information-sharing regarding local resources, skills and opportunities.

9.6 Turning uncertainty to opportunity

According to Folke, Colding *et al.* (2003) learning to enhance resilience and adaptive capacity within a socio-ecological system demands attention to four factors, namely:

- learning to live with change and uncertainty
- nurturing diversity for reorganisation and renewal
- combining different types of knowledge for learning
- creating opportunity for self-organisation towards social-ecological sustainability (Folke, Colding *et al*., 2003: 354).

Some of the social learning activities and strategies needed to build genuine resilience and adaptive capacity in the Hunter Valley are identified in Table 20 (below), using features of the four factors for boosting these system characteristics described by Folke, Colding *et al.* (2003).

Strategies to encourage capacity to live with change include evoking disturbance. Protests designed to alert the public and decision-makers in government, industry and civil society organisations (e.g. trade unions) are part of this process. People and institutions learn from crises, and industry closures (such as the closure of mines in the region in earlier times and the closure of the BHP steelworks) provide lessons for surviving current and emerging crises such as regional ecosystem-human health distress, global economic crises, and climate change.

Ecological and cultural diversity are foundations for renewal and the retention (and strengthening) of ecological and social memories and health (for example, restoring river health and protecting remnant biodiversity) as well as traditional rural industries (such as dairying, wine growing and horse breeding) are essential for sustainability in the Hunter Valley. These ecosystem services and cultural institutions represent old sources of order and stability and provide ecological and cultural resources for renewal and reorganisation. Efforts to secure these memories include pressuring governments to implement ecological and social sustainability principles such as the precautionary principle and intra-generational and inter-generational equity principles, in planning and development approvals.

Different types of learning and knowledge are combined through engagement in various processes including public forums, community meetings, government inquiries and “field days” (such as those organised on climate change by the NSW Department of Primary Industries) which to various degrees bring together both experiential and experimental knowledge. The shift in focus from knowledge of structure to knowledge of function is reflected in campaign priorities recognising that the imperative for coal dependency is primarily to generate income and meet energy security needs. Therefore campaigners have used research which identifies that both these functional needs can be met by creating Green jobs in renewable energy. These strategies also reflect the use of complementary knowledge systems and knowledge of processes (such as how to build trust through negotiation and collaboration between environmentalists, farmers and trade unionists).

Table 20: Social learning strategies to boost resilience and adaptive capacity
(Based on Folke, Colding *et al*, 2003 and Keen *et al* 2005)

<table>
<tr>
<td>Learning to live with change and uncertainty:
• Evoking disturbance: Protest rallies and civil disobedience creates tensions and provoke action by decision-makers
• Learning from crisis: Experiences from the closure of many mines, and manufacturing industries (including the BHP steelworks) in the past promoted, leading to ‘Just Transition’ thinking to foreground protecting affected workers and communities. Sharing strategies for living with mining and climate change impacts such as heat and water stress
• Expecting the unexpected: Climate change science is disseminated to highlight current and anticipated impacts and risks, and prepare for potential surprises</td>
<td>Nurturing diversity for reorganisation and renewal:
• Nurturing ecological memory: Advocacy for retaining river health and biodiversity as foundations for ecological recovery
• Sustaining social memory: Nurturing the maintenance of traditional rural (dairying, winegrowing) and manufacturing industries as foundations for social and economic diversity
• Enhancing socio-ecological memory: Advocacy for entrenchment of ecologically sustainable development principles in planning and land-use decisions</td>
</tr>
<tr>
<td colspan="2">Social learning processes:
• Partnerships: farmers, trade unions, environmentalists, academics, local governments
• Platforms: community networks and organisations, government inquiries, court cases
• Values: ecological sustainability, social justice</td>
</tr>
<tr>
<td>Combining different types of knowledge for learning:
• Combining experiential and experimental knowledge: Learning through engagement in diverse processes – public inquiries, public protest, court actions, personal observations, academic research, etc
• Expanding from knowledge of structure to knowledge of function: Shifting focus of policy and investment options from coal to alternative energy systems
• Building process knowledge into institutions: Advocacy for strengthening participatory culture and inclusiveness into community networks and in government decision-making
• Fostering complementarities of different knowledge systems: Integrating Indigenous knowledge and history and citizen science with workplace, academic social movement and institutional knowledge</td>
<td>Creating opportunity for self-organisation towards social-ecological sustainability:
• Recognising the interplay between diversity and disturbance: Encouraging a diversity of political approaches (radical → moderate) to stimulate multiple types of disturbances for self-organisation by inter-linked participants in the system and the system as a whole
• Dealing with cross-scale dynamics: Building local, national and global networks that link energy producer and consumer communities and policy advocates
• Matching scales of ecosystems and governance: Building activist community, policy and governance networks from local, state, national and global scales
• Accounting for external drivers: Factoring in global ecological, social and economic impacts (particularly climate change impacts) in local research and campaign messages</td>
</tr>
</table>

Opportunities for self-organisation are created by interaction and integration of a wide variety of political approaches to destabilise the status quo, ranging from radical civil disobedience and social change propositions to more moderate lobbying and traditional “rural” values. Cross-scale dynamics are used to integrate information and political action at regional, national, and global scales and managing networks across these scales, including lobbying and advocacy for appropriate alignment of ecological and governance structures. These range from the global-scale initiatives, such as the agreement that will be negotiated in Copenhagen in December 2009 through the UN, to regional–scale environment management plans of local and state governments.

9.7 Social learning and the adaptive cycle

Social learning can inform each of the four different phases of Holling's adaptive cycle of complex adaptive systems: *conservatio*n or climax, *release* or collapse, *reorganisation* or renewal and *exploitation* or consolidation.

Social learning can particularly inform the back-loop phases of the adaptive cycle (the *release* and *renewal* phases), but may also influence the front-loop phases (*exploitation* and *conservation* phases). Social learning can influence the trajectory of the backloop phase of *release* of a human social system by, for example, influencing whether the *release* stage is slow or rapid, chaotic or controlled, violent or peaceful, consensual or imposed. Social learning can inform social awareness, attitudes and knowledge about the need and possibilities of change or release from an unsustainable condition. It can stimulate awareness of the need to change, awareness of the risks and opportunities of alternative change pathways, and model the confidence and process of change.

The potential of social learning at different phases of the adaptive cycle of the Hunter Valley is shown in the diagram below (Figure 32). The boxes on the side of the diagram describe how social learning linked to social action (advocacy, policy implementation, research, investment, etc.) could mobilise particular attractors that might shift the system through the phases of the adaptive cycle to have the character that consolidates a transition to a regional *Future Beyond Coal*.

In the frontloop, social learning and social action about impacts of coal and climate change destabilise the current hegemony of the coal industry – which locks the system into its current *conservation* phase, and the system could then move into the *release* phase. Social learning about the desirability of particular development pathways for both regional and global sustainability could inform the character of the *reorganisation* phase by, for example, encouraging research and investment into renewable energy systems and ecosystem health restoration. In the back loop, social learning and linked social action could entrench the hegemony of particular development options and be a counter-hegemonic influence on undesirable options. For example, the desirability of investment in renewable energy technologies and environmental or social health restoration programs could prevail over a nuclear power-based energy system. Social learning and social action could then play critical roles in consolidating the preferred option during the *exploitation* phase so it becomes dominant in the system's new *conservation* phase.

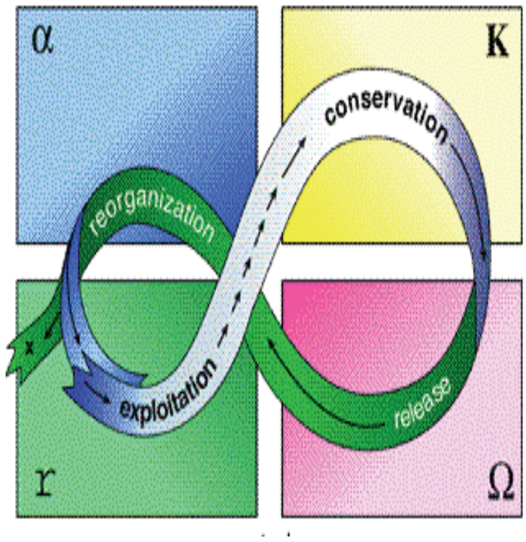
<table>
<tr>
<td>Social learning informs the back-loop: Learning and social action about impacts of coal and climate change destabilise the hegemony of the coal industry - the current conservation phase, and the system moves into the release phase, and informs the character of the reorganisation phase (for example encouraging research and investment into renewable energy systems and ecosystem health restoration).</td>
<td>
</td>
<td>Social learning informs the front-loop: Learning and linked social action entrench the hegemony of particular development options (for example the desirability of investment in renewable energy technologies and environmental or social health restoration programs) which are consolidated in the exploitation phase to become the dominant characteristics of the system in the new conservation phase</td>
</tr>
</table>

Figure 32: Social learning and the Hunter Valley's evolution to sustainability

(Following Holling, 1986)

It could be argued that a lack of social learning about the impacts of coal dependence and climate change on ecosystem and human health, about links between the regional economy and global climate change, about credible alternatives to coal dependency, or about how to challenge the hegemonic influence of the coal industry on government policy and investments is delaying a shift from the *conservation* business-as-usual phase to a *release* phase.

Social learning may have a significant impact on the rate and character of different phases of the adaptive cycle. The presence or lack of social learning and linked social action may mean transition is rapid or slow, conflict-ridden or harmonious, predictable or chaotic. Social learning may also play an important role in influencing the character of human/ecological and human/human relations that might emerge as the system evolves, influencing the values put on ecological services (e.g. the priority given to protecting biodiversity) and the character of communities (e.g. the extent to which the wellbeing of vulnerable communities is protected) as well as the particular economy or technologies that might be fostered (e.g. whether the economy is more local or global in its orientation).

The process and outcomes of social learning for a *Future Beyond Coal* being fostered by activists involved in community campaigns are discussed further in this chapter.

9.8 Social learning within a panarchy

Social learning can span socio-ecological systems at different spatial and temporal scales: that is across the panarchy in which the Hunter Valley is situated. Social learning across scales involves developing and sharing knowledge among people and institutions across national and global borders, and over different timeframes. Indigenous, traditional/local and scientific knowledge can inform awareness of problems (such as changes in ecosystems over time) and help frame solutions such as the values and practices which might help brings social systems back into a symbiotic rather than parasitic relationships with ecosystems (see Berkes & Folke, 1998; Rose, 1998; Baker, Davies & Young, 2001; Horstman & Wightman, 2001; Howitt, 2001; Berkes, Colding & Folke, 2003; Adams & Mulligan, 2003; Rose, 2004)

Ecological, cultural, political and financial knowledge can inform strategies. Knowledge of the adverse impacts of climate change and coal dependency, for example, is being shared across spatial systems by major environmental organisations such as Greenpeace, WWF and Friends of the Earth (Pozon & Mench, 2006; WWF, 2007a, 2007b; Friends of the Earth International, 2007; Rochon *et al.*, 2008; Yushi *et al.*, 2008; Bjureby *et al.*, 2008), and people to people contacts via travellers, conferences, popular media and academic journals and internet networks.

In the Hunter Valley and the global energy systems it is linked with, social learning and action promoting strategies for a shift of investment from coal to renewable energy systems can inform a shift to a *Future Beyond Coal*. Sharing of skills and experience of political advocacy at different levels of governance can influence the pace and form of change, or lack of it. The products and processes of this cross-scale learning become new disturbances in the system, influencing all phases, but particularly the *release* and *reorganisation* phases of nested systems.

Within panarchies, social learning across systems at different scales influences the *remembering* and the *revolt* feedback links across systems. Some cross-scale social learning memory and revolt links between systems are shown in the diagram below (Figure 33).

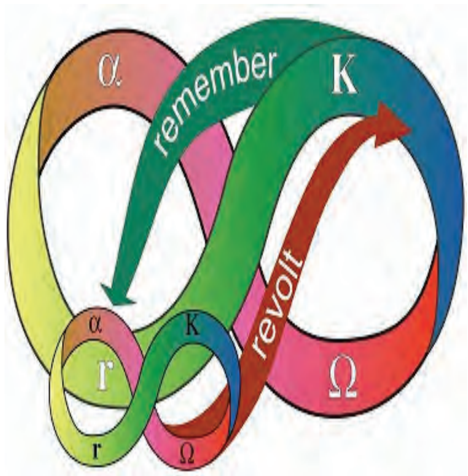
Memories and qualities within the larger system can be liberated by social learning and influence the evolution of the smaller system. For example, knowledge of renewable energy technologies from outside the Hunter Valley can be mobilised to inform the reorganisation of the region's energy system in a post-coal era. Awareness of Indigenous and 'traditional' knowledge of ecological and human health from larger systems and/or earlier times can inform new human-ecological relationships.	 	**Revolt between linked systems** can be stimulated by social learning and become a significant disturbance in larger systems. For example, awareness and social action about ecosystem and human health distress in many coal-affected communities may disturb the larger system (economic reliance on coal-fired power generation) sufficient to provoke a shift to a new evolutionary phase from coal dependency to a renewable energy-based economy.

Figure 33: Social learning-induced disturbances across the Hunter Valley panarchy

(Following Gunderson & Holling, 2002)

The *revolt* link can influence the evolution of larger systems, possibly from the *conservation* to the *release* phase. Knowledge and linked social action from many smaller systems, for example, about environmental and social impacts of mining and climate change in coal-affected communities around the world pressures the larger systems to change. Social learning (or memories) in larger systems can influence the evolution of smaller systems through the *remember* feedback link. For example, technologies, markets and environmental and social impacts of wind, solar and other renewable energy in a larger global system would influence the *reorganisation* of the smaller Hunter Valley system away from coal dependency towards a *Future Beyond Coal.* Similarly, awareness of the success or failure of a particular technology (such as carbon capture and storage) will influence whether it is deployed in the Hunter Valley in the *Carbon Valley* scenario.

It would be foolish to suggest that the social learning processes that have occurred among social movement activists for a *Future Beyond Coal* in the Hunter Valley have succeeded in achieving the goal of transforming the socio-ecological system towards sustainability. However, the results of surveys such as those conducted by the Hunter Valley Research Foundation (referred to in the introduction to this chapter), the frequency of media articles and letters, the high level of participation in community forums suggest that sufficient social learning has happened at the regional scale for the links between coal, energy and climate change to be widely understood by residents in the Hunter Valley.

Conclusion

Learning and knowledge are potentially powerful agents affecting socio-ecological systems. They can build adaptive capacity for a transition to sustainability as well as undermine the resilience of oppressive institutions and non-sustainable practices.

Social institutions that nurture and facilitate social learning about the impacts of coalmining and climate change, and political campaign strategies to deal with these impacts, have become powerful attractors in the Hunter Valley's stability landscape. Knowledge and social action generated from these processes become factors influencing the social licence of the coal industry to operate, and towards thresholds that may force the industry's social licence to operate to be withdrawn (in some places at least).

The influence of popular education and social learning can be difficult to determine, especially because it is often an informal process conducted through organisations staffed by volunteers who lack resources, and where formal evaluation is often neglected or not possible. Formal evaluation of the impact of social learning processes in the Hunter Valley would probably show a strong influence of both popular education and social learning initiatives on a wide range of community organisations and the wider community in raising awareness and attitudes to ecological damage, human health, environmental justice and social justice issues related to mining and coal-fired power generation in the region, between the combustion of coal and climate change, and about the role of governments, corporations and the socio-economic system in fostering the current ecological hegemony of fossil fuel dependency that is threatening the ecological and social sustainability of the region and the wider world.

Popular education and social learning processes are building a network of organic intellectuals among farmers, environmentalists, trade unionists, academics and others, whose knowledge is used by social change movements for building public awareness about regional and global issues, for developing strategies to put political pressure on powerholders to stop harmful practices, and for envisioning an alternative socio-ecological regime for the Hunter Valley and its place in the world.

Ultimately, this learning must come together as a compelling counter-hegemonic narrative to the one that currently dominates human-ecological and human-human relationships.

However, the social movements for a *Future Beyond Coal*, using popular education and social learning processes within the socio-ecological system, have shifted public opinion, mobilised the public to demand change, and are being heard by governments. The final chapter assesses to what extent they are beginning to destabilise the current socio-ecological system, and shift it into a new phase in the adaptive cycle towards reorganisation to restore genuine resilience and ecological and social sustainability.

Chapter 10

Synthesis and Conclusion: A transformation to sustainability

This final chapter provides a synthesis of the findings of this research, and makes some conclusions about the potential for replacing the perverse resilience of the Hunter Valley's current *Carbon Valley* status with a more genuinely resilient and sustainable *Future Beyond Coal*.

As discussed in earlier chapters, disturbances have a powerful influence on the trajectory of complex adaptive socio-ecological systems. Some powerful disturbances have emerged at regional and global scales that will significantly influence the potential trajectory of the Hunter Valley socio-ecological system, including the influence of the coal industry as a powerful attractor over the last 200 years. These include global influences such as climate change, Peak Coal and restructuring of the global economy. More national and regional scale threats to the resilience of the prevailing system include carbon-emission reduction programs, loss of social licence of carbon-intensive industries to operate, and the proximity to critical thresholds of key variables influencing ecosystem and human health, such as air quality, water security, biodiversity, and human manifestations of distress such as solastalgia (Albrecht, 2005).

10.1 The social movement for a Just Transition to a *Future Beyond Coal*

Human interventions, such as those described above, are the most influential disturbances affecting the evolution of socio-ecological systems, and their capacity to adapt to changes in their internal and external environments. While many anthropogenic disturbances, such as appropriation of natural resources, pollution, and landscape disturbances, are harmful to the health of ecosystems and the ecosphere, some anthropogenic disturbances have a potentially beneficial impact in that they expose, challenge and sometimes halt harmful practices. The social movement for environmental protection and sustainable human societies is one such disturbance.

Moyer describes social movements as:

> Collective actions in which the populace is alerted, educated, and mobilized, sometimes over years and decades, to challenge the powerholders and the whole society to redress social problems or grievances and restore critical social values (Moyer et al., 2001: 2).

The environment movement is one of many social movements, whose purpose is to restore human–ecological relationships from a parasitic to a symbiotic relationship in order to protect the health of ecosystems and human communities living in them.

It is beyond the scope of this thesis to analyse social movements in detail[10], but suffice to say there is great diversity in social movements. Some are progressive and seek to restore equity and wellbeing to all people and challenge the concentration of power and resources among a small group within society, while others, in contrast, attempt to maintain privilege and oppression around class, race, ethnic, gender and other socioeconomic relationships.

According to Doherty and Doyle (2006), the influence of the environmental social movement, including the climate justice and eco-equity elements of this diverse movement, has increased as the issues it confronts have expanded from local to global scales, as the movement's own networks for sharing ideas, information, tactics and strategies and campaigns have linked people across local and global scales.

It is clear that, like many large social movements, the politics of the environmental movement are complex and diverse. The movement, globally, but also regionally in places such as the Hunter Valley, reflects coalitions of diverse interest groups and alliances based on negotiated common interests. There are tensions within the movement that reflect its diversity, manifested as differences over whether transformative or incremental change is needed to achieve sustainability, and how struggles around class, gender, Indigenous and other issues link with environmental protection. Some of these differences are discussed below.

Transformative or reformist social change

Doyle and McEachern (1998) argue that most environment organisations' members come from relatively privileged or elite backgrounds, and, as beneficiaries of the socioeconomic status quo, and are not inclined to want to overthrow the established social order. Environment organisations therefore tend to work within the political and economic system rather than to reject it. Generally, they seek to reform the system rather than transform it. Many environment-movement activists and organisations, at least in liberal democracies such as Australia, believe that the agencies of government, and even corporations, will eventually "do the right thing" if appropriate pressure is put on them. This politics reflects reformist rather than revolutionary practice, and an "institutionalist" rather than "social green" worldview (Carter, 2001; Clapp & Dauvergne, 2005).

The interviews conducted during this research suggest that most people fighting coalmines and climate change in the Hunter Valley are challenging prevailing government and corporate priorities, but their concerns do not generally translate into a more fundamental critique of human–human and human–nature relationships. Indeed, many Hunter Valley residents have engaged in environmental issues because of a strong

[10] Social movement analysis is a vast area of intellectual endeavour and research by analysts such as Arrighi, Hopkins & Wallerstein, 1989; Klandermans, 1989; Rucht 1991; Dowie, 1992; Bagguley, 1992; Tarrow, 1994; Foweraker, 1995; Guigni, McAdam & Tilly, 1999; Brecher, Costello & Smith, 2000; Doyle, 2000; Bystydzienski & Schacht, 2001; Diani & McAdam, 2003; Bandy & Smith 2004; Snow, Soule & Kreisi, 2004; Morris & Staggenborg, 2004; Doyle, 2005; Doherty & Doyle, 2006; della Porta & Tarrow, 2005; della Porta & Diani, 2006.

yearning to maintain the rural status of the region and because they see mining as a threat to their rural idyll and traditional livelihoods and values. For some activists among the farming community, in particular, mining threatens to destroy prime agricultural land and vital aquifers on which their livelihoods directly depend.

These environmental protection values are arguably "progressive", but some activists' concerns about mining might also be linked to discomfort that a changing economy dominated by mining and heavy industry disrupts long-standing class-based privileges of the region's rural landowners, with which some felt quite comfortable. The proletarian ethic of class solidarity and egalitarianism traditionally inherent in mining communities, the larrikinism that is also an historic element of the Hunter Valley's mining communities, and the high incomes of mineworkers potentially disrupts the traditional pecking order and social relations of rural communities. In these cases, environmental activism targeting the Hunter Valley's coal industry is not necessarily seen by significant sections of the region's working class be an unqualified progressive social movement, and indeed may be seen as a movement that locks in traditional values as well as threatening the well-being of many workers. As Daniel Wallace, an official with the Australian manufacturing Workers' Union told the 2005 Hunter Environment Forum:

> With members in the mining power manufacture and fabrication industries, my union will continue to put the best interests of our members first, whether it's securing jobs, improvement in wages and conditions on the job or occupational health and safety. We've seen local manufacturing industry hardest hit by the lack of forward planning by all governments. If it was not for the recent high coal prices in this region driving jobs in the Hunter Valley, we'd be in all sorts of strife. Any transition to a clean energy future must create new jobs. There will continue to be opposition amongst some quarters until there is ownership of the issue amongst the wider community as well as big business and government (Daniel Wallace, speech to Hunter Environment Forum, Maitland, 19/8/ 2005).

Mining disrupts traditional farming practices, but historically farming has also contributed to the ecological non-sustainability of the Hunter Valley through land clearance and the use of chemicals, with significant impacts on biodiversity and water quality and general river and catchment health (see Brooks, 2003; Peake, 2006). Therefore, the attention of many activists in the Hunter Valley environment movement extends beyond mining and climate change to the non-sustainability of many of the region's land-use activities, and also to transforming contemporary socio-economic systems that drive non-sustainability, including consumer culture.

Some elements of the social movement for a *Future Beyond Coal*, for example the Rising Tide and Friends of the Earth organisations, reflect aspirations for a more fundamental social transformation, including challenging the consumer culture of contemporary society as a major driver of coal dependency and climate change. Engagement in militant and confrontational tactics, such as occupations and protest camps, reflect cynicism about the capacity of the prevailing political system to deliver sustainability. Protest actions have extended the scope of issues beyond land-use conflicts over mining or other rural land uses, to highlight the connections between the coal industry, climate change, non-sustainable consumer lifestyles and growth-oriented economic systems. On Fossil Fools' Day, April 1 2008, Rising Tide staged a banner hanging from the Westfield shopping complex in Kotara, Newcastle, and attempted to swap bucketloads of coal for imported consumer products at particular shops in the complex, as a way of highlighting the links between consumerism and climate change (see Figure 34 below).

Figure 34: Linking coal, climate change and consumerism. Rising Tide banner drop at Westfield shopping complex, Newcastle, April 2008.

(Rising Tide, 2008)

Rising Tide identified two key links between Hunter Valley coal industry expansion, climate change and consumerism: firstly, the huge cost of imported goods leaves Australia with a trade imbalance which is offset by expanding coal exports; and secondly, consumer demand for cheap goods from China and India accelerates the construction of new coal-fired power stations to provide the necessary energy (Rising Tide, 2008).

Regarding the need for civil disobedience and a grassroots social change movement, Steve Phillips of Rising Tide stated:

> Australia's economy, as many of the enemies of sustainability like to point out – is built on resource exploitation … Coalmining companies have governments and even unions wrapped around their finger, and anybody who dares call for a contraction of the coal industry is publicly caned as a dangerous extremist. It is in this economic and political climate that those of us who care for the ongoing sustainability of life on Earth must now demand swift and radical contractions of the fossil fuel industries – chiefly coal – leading to a total phase out … The idea that politicians will enforce this sort of action themselves is clearly silly … A strong grassroots movement, leading to broad public mobilisation, is our only hope of survival. This is especially the case if you believe, as I do, that your average Australian high-energy consumer lifestyle is part of the problem, and must change (Phillips, 2007; 2).

Rising Tide uses militant protest action to alert the community and governments to community concerns and the need for change. Its vision for society is for "equitable, just, effective, and sustainable solutions to the [climate] crisis" (Rising Tide, 2007a). However, its vision for the general society beyond climate change solutions is not clear. However, other environmental organisations that work closely with Rising Tide and other Hunter Valley environmental organisations on coal and climate change issues are more explicit. Friends of the Earth, for example, has a worldview that explicitly links human and environmental rights, biodiversity protection, and "repayment of the ecological debt owed by rich countries to those they have exploited for their own economic benefit" and campaigns for "a world where environmental protection, social justice and economic welfare for all people go hand in hand" (FoEA, 2007).

The bonds and trust, built by the diverse range of people and organisations in the social movement struggling together against the non-sustainability of climate change and coalmining in the Hunter Valley and beyond, create space for conversations about sustainability generally, including the sustainability of farming and rural communities, and the role of governments, trade unions and other sectors of society. The collaborations create space for negotiating a shared vision of an alternative society that is more ecologically and socially sustainable than that currently existing in the Hunter Valley.

Ecological "modernisation" or restructuring

The debate about the type of society that social movements strive to achieve in the Hunter Valley reflects negotiation between an ecological modernisation of the region's economy, or a more fundamental ecological restructuring. The framework of "weak ecological modernisation" offers an appealing solution for governments, industry and some trade unions (such as the CFMEU M&E) to the challenge of climate change. Ecological modernisation promotes the view that modernising and "greening" industry will solve environmental degradation, without challenging the fundamentals of the socio-economic system, or even the sectoral mix (Curran, 2009: 202).

Ecological restructuring, in contrast, promotes reorganising society and markets around ecological principles. While it also includes scope for industrial and technological modernisation, it goes beyond "cleaning" dirty industries through technological innovation (such as CCS, or even solar or wind technologies) by seeking significant change to the sectoral mix to reduce or phase out industries that are not compatible with ecological sustainability (Jänicke *et al*, 2004). Ecological restructuring is therefore more challenging to the status quo and the vested interests that benefit from it.

The demands of the Hunter Valley's environmental movement reflect aspirations aimed at both ecological restructuring and ecological modernisation. Environment and labour movement organisations, and researchers investigating potential pathways to a sustainable economy, have proposed a phasing out of the coalmining and coal-fired power generation. However, most commentators have suggested that the region's historic role as an energy exporter could be maintained through technological innovation and investment in renewable energy technologies for both domestic use and export (Bill *et al*, 2007; Evans, 2007; Greenpeace Australia Pacific, 2008b; Ayres, 2009).

10.2 Social movement development and the adaptive cycle

Moyer (2001) identified eight stages through which social movements develop, which he called a Movement Action Plan (MAP). The MAP is useful for social change advocates to identify where they are in their campaign, as there are particular features and challenges at different stages. For example, the tasks of the movement in the earliest stage when the problem is hidden from the general public and powerholders are different to those in the later stages when the campaign is gaining some success and perhaps debating alternative solutions to the problem.

Moyer's eight stages of social movement development fall into five broad groupings, as shown in Table 21 below.

Table 21: Eight stages of social movement development

(From Moyer, 2001)

Hidden Problem
Stage 1: Business-as-usual: A critical social problem exists that violates widely held values, but the general public is unaware of this problem.
Increasing Tensions
Stage 2: Normal Channels Fail: Official mechanisms used to address the problem: don't work, showing how entrenched the problem is and demonstrates the failure of institutions to solve it.
Stage 3: Conditions Ripen: The public begins to recognise the problem and awareness of its victims slowly grows. Pre-existing institutions and networks (churches, peace and justice organisations) lend their support. Tensions build. Upsetting events occur, including ones which "personify" the problem.
Take-off
Stage 4: Take-off: A catalytic (trigger) event occurs that starkly and clearly conveys the problem to the public (e.g. social or ecological disaster affecting society). The problem is finally put on 'society's agenda'. A new social movement rapidly takes off.
Waging the movement
Stage 5: Stalemate: There appears to be no progress forward. There is often hopelessness and burn-out. It seems that this is the end of the movement; in fact, it is now that the real work begins.
Stage 6: Winning Majority Public Opinion: The movement deepens and finds ways to involve citizens and institutions from a broad perspective to address this problem. Growing public opposition puts the problem on the political agenda. The consensus of the powerholders on this issue fractures, leading to proposals from the powerholders for change (often these proposals are for cosmetic change). The majority of the public is now more concerned about the problem and less concerned about the movement's proposed change.
Success
Stage 7: Campaign success, choosing alternatives: Majority now opposes current policies and no longer fears the alternative. Many powerholders split off and change positions. Powerholders try to make minimal reforms, while the movement demands real social change. The struggle shifts from opposing official policies to choosing alternatives. More "re-trigger" events occur.
Stage 8: Moving On: The struggle to achieve a more humane and democratic society continues indefinitely. This means defending the gains won as well as pursuing new ones. Building on this success, we return to Stage 1 and struggle for the next change.

A more detailed mapping of the movement's development is shown in Appendix 1. Achievements and goals, the tasks and responses of the movement, powerholders and the public, and the social learning challenges,of the Hunter Valley social movement for a *Future Beyond Coal* at the eight different stages of Moyer's MAP are shown. Some of these are shown in Table 22 below.

Table 22: Achievements and challenges of the Hunter Valley *Future Beyond Coal* social movement
(From Moyer, 2001)

Hidden Problem
Stage 1: Business-as-usual: issue of mine expansion lacked public profile beyond immediately affected communities until the late 1990s. The link between coalmining and climate change issue was not a prominent part of local campaigns.
Increasing Tensions
Stage 2: Normal Channels Fail: Minewatch and other resident groups formed in 1990s in response to threats from local mine proposals, and as community members sought support and advice from each other and develop local networks of support. o Locals began learning about the impacts of coalmines, and developed skills in local organising and organisation building. Locals develop expertise in researching and documenting the cumulative impacts of coalmining and participate in government processes (including court action and Commissions of Inquiry) to stop new mine proposals but find the 'dice is loaded': o The Hunter *No New Coal* campaign became a broad regional campaign, uniting many local campaigns against individual mines (Bickham, Glendonbrook, Wilpinjon). Links with global climate change issues become more to the foreground. New links made with larger national and global NGOs strengthen local capacities. o The Australian climate change movement forms and engages with international forums and processes, such as the Kyoto Protocol negotiations, and attempts to engage with domestic politicians (but with little impact). **Stage 3: Conditions Ripen:** Local campaigns link with larger scale regional and national networks as Hunter Valley mine-affected residents develop new partnerships beyond the region. Well resourced organisations (such as Greenpeace, the NSW Greens) help get regional concerns heard in the media and 'corridors of power' outside the region. • Cross-sectoral alliances (e.g. between farmers, unionists, environmentalists, local government leaders) are recognised as an essential tool for building local power. o Linkage of coalmining, climate change and renewable energy shift in campaign work and media commentary (Evans, 2006; Ray, 2006). Demand for investment shift to renewable energy becomes prominent in local campaign policy (Anvil Hill, 2005) and local government policies (Newcastle City Council, 2006).
Take-off
Stage 4: Take-off: On-going drought highlights potential collapse of the Hunter ecosystems and social dislocation, particularly to the politically powerful horse-breeding community. Proposed coalmining projects in the Gunnedah Basin draws hundreds of farmers into protest • The storms in June 2007 (including the grounding of the coal-ship the *Pasha Bulker* on Nobbys Beach, Newcastle) and the dramatic reduction in water allocations to farmers in 2007 were the two regional Trigger Events, while Cyclone Katrina was a global Trigger Event. The grounding of the *Pasha Bulker*, in particular, highlighted the linkage of catastrophic weather events, Hunter coal and climate change. • Debate in local media about energy pathway options increases, e.g. about viability of renewable energy shift or 'clean coal' and CCS technologies. • Election of Australian Labor Party (ALP) Government with climate change policy a significant issue: the world's first climate change election (Rootes, 2008).

Waging the movement
Stage 5: Stalemate: Massive industry expansion continues. Anvil Hill mine approved by NSW Government, approval of third coal loader in 2007, and funding to double coal export infrastructure in 2008-09 are setbacks (though not unexpected). • Miners' union (CFMEU M&E) and NSW Minerals Council declare "common cause" to oppose moratorium on mine expansion and make joint calls for expansion of Hunter Valley coal industry, and funding for CCS. Research on Green job creation (ACTU & ACF, 2007; Hatfield Dodds *et al*, 2007; Bill *et al*, 2008), shows potential for new Green jobs, to counter jobs v environment argument of powerholders. "Greenhouse Mafia" mounts successful PR scare campaign for strong Carbon Pollution Reduction Scheme.
Stage 6: Winning Majority Public Opinion: Coalmine expansion continues. Community health impacts become public. Community protest actions (e.g. Caroona Blockade, Gloucester Community Protest, demand for public health inquiry) grow in size and breadth of participation (e.g. involving grain farmers). • AMWU and other trade unions propose Just Transition policies including shift in investment to renewable energy. AMWU, NSW Nature Conservation Council and University of Newcastle research collaboration on *Blueprint for a Low-carbon Economy for the Hunter Valley.*

Arguably the movement has reached different stages in different facets of the campaign:

- No end in sight to coal exports and expansion of coal mines: Stage 5 – Stalemate.
- A shift to alternative energy technologies (renewable energy and energy efficiency) is slowly starting to occur: Stage 6 – Winning Majority Public Opinion.

Social movement development and system evolution

The eight stages of Moyer's social movement development can be correlated against Holling's (1986) schematic description of the four phases of the adaptive cycle, and this correlation is shown in Figure 35 below.

In this correlation, the earliest of Moyer's eight stages *Hidden Problem* and *Increasing Tensions* correspond with the *Conservation* (K) phase of Holling's adaptive cycle. Social movement disturbances (such as early awareness-raising, local discussions, participation in official forums, small-scale protests, etc.) are insufficient to disrupt or destabilise the system out of the *conservation* phase though they are signs that distress syndrome is present and pressures are building. Business-as-usual continues as incremental pressures steadily increase and powerbrokers ignore these pressures or attempt to engineer resilience in order to cope with them and to maintain the status quo, rather than changing the system's fundamentally non-sustainable characteristics.

Moyer's *Take-off* stage marks the point where incremental pressures have accumulated to the point where some critical ecological and/or social thresholds have been crossed. It marks a shifting from the *Conservation* phase into Holling's *Release* or *Collapse* (Ω) phase. In Moyer's *Take-off* stage the legitimacy of the prevailing value system begins to collapse, and with it the hegemony of the dominant values and institutions. *Take-off* is often in response to some critical "trigger events" or incident(s) which highlight the problem and the inadequacy of the values of the dominant society to deal with pressures building up in the system. The collapse in the legitimacy of the prevailing system may be rapid as the political, economic and public relations props (perverse subsidies) that have held the system in place begin to collapse (for example, the collapse of the social licence of carbon capture and storage technology as its financial viability erodes).

As social movement campaigns develop they correspond to Moyer's *Waging the Movement* stage and both Holling's *Release* and *Reorganisation* (□) phases. The legitimacy and subsidies supporting the prevailing system collapse, while at the same time the emergence of alternatives to the dominant paradigm builds the viability and commitment by the public and powerbrokers for a *Reorganisation* around new values and practices. The *Reorganisation* phase is a time of intense debate and political activity and risk-taking as values, institutions and practices advocated by the social movement contest for hegemony with the previously dominant system. Particular values, narratives and practices emerge from this contestation as hegemonic, and society reorganises around them. In the Hunter Valley context this may be energy efficiency and renewable-energy technologies and a more ecologically sustainable socio-economic system in which they play a part.

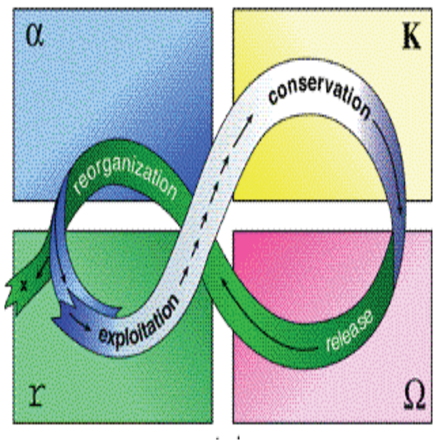
Movement activity (MAP Stages6 & 7): Alternative values and practices contest with those of the previously dominant system as society reorganises. Potentially, society reorganises around the values and practices of the social movement as they gain public and political hegemony **Success and moving on** (MAP Stages 7 & 8): Particular values and practices of the social movement become institutionalised in society. The socio-ecological system *consolidates* around these values and practices and eventually a new *conservation* phase emerges		**Hidden problem, increasing tensions, conditions ripen** (MAP stages 1, 2 & 3): The system is not sufficiently perturbed by events (distress and social movement disturbances) to move out of the *conservation* phase. Business continues as usual, though pressures may steadily increase **Take off** (MAP Stages 4, 5 & 6): The legitimacy of the prevailing value system begins to collapse as incremental pressures overwhelm controls. The system may be stuck in this stage for a long time (a stalemate situation), or alternatively it might collapse rapidly

Figure 35: Social movement development and the adaptive cycle

(Adapted from Moyer, 2002, and Holling, 1998)

Moyer's *Success* stage correlates with Holling's *Exploitation* or *Consolidation* (r) phase as the newly hegemonic values, institutions and practices advocated by the social movement become institutionalised. The socio-ecological system consolidates around them, and eventually a new *Conservation* phase emerges where new values and practices are dominant.

10.3 The *Future Beyond Coal* social movement builds adaptive governance for sustainability

Managing the future of human and biophysical systems for sustainability requires governance approaches that recognise, and are *adaptive to*, complexity, uncertainty and dynamics of change, namely *adaptive governance*. Adaptive governance is collaborative, flexible and based on learning-based issue management across different scales (Gunderson & Holling, 2002; Folke *et al*, 2003; Dietz *et al*, 2003, Olsson *et al*, 2006).

Olsson *et al.* (2006) propose that utilising emergent windows of opportunity in a timely and strategic way is an essential feature of adaptive governance, necessary for restoring, sustaining, and developing the capacity of ecosystems and social systems to provide essential services. They identify three phases in the adaptive governance of socio-ecological systems to achieve a transformation towards sustainability. These are:

- preparing for change
- making the transition
- building the resilience of the new direction.

According to Olsson *et al* (2006) preparing for change requires building knowledge, networks, and leadership. Leadership can be found in many localities, institutions, and sectors of society, including in social movements, and involves many functions, including trust-building, sense-making, conflict management, linking people, initiating partnerships, compiling and generating knowledge, developing and communicating vision, mobilising broad support for change navigating the transition, and institutionalising new approaches. Social movements play a vital role in all these functions.

Table 23 (below) shows the role being played by the Hunter Valley social movement for a *Future Beyond Coal* in the three phases in the transformation of the governance of the region's socio-ecological system. The social movement has been crucial to establishing the first phase of transformation – preparing for change – by educating the public and powerholders on the threat of climate change and the impacts of coal. It has raised awareness of technological alternatives to fossil fuels and promoted their strengths, and identified the institutional barriers to their adoption that need to be overcome. The movement has fostered new political values, visions, solutions to problems, and built community/ union/ research/ industry /government networks for change.

The movement has also facilitated the second phase – making the transition – by raising demands and political pressure for a Just Transition. The movement has succeeded in forcing governments to make some investment in new industry infrastructure, workforce skills development, and in setting regulatory targets, timetables and creating new markets for a renewable energy economy. There is still much to be done.

The social movement has made some progress in the third phase – boosting the resilience of the new direction – by creating partnerships for change and exposing and challenging the role of Big Coal in its efforts to maintain the perverse resilience of the status quo and to delay implementation of strong targets and viable markets for new renewable energy technologies.

Table 23: Social movement interventions in the adaptive governance of the Hunter Valley's socio-ecological system

(From Olsson, 2006)

Phase – *and stage of development*	**Tasks**	**What is happening in the Hunter Valley**
Preparing for change – *well developed*	Building knowledge, networking, Developing leadership	The threat of climate change and the impacts of coal are recognised, awareness of technological alternatives and their strengths and weaknesses promoted New political values, visions, solutions to problems, and community/ union/ research/ industry /government networks for change are articulated and fostered
Making the transition – *early development*		Demands and strategies made for a Just Transition to an alternative economy and energy technologies. Commitments by governments to protect vulnerable communities advocated – a Just Transition, with some investment in new industry infrastructure, workforce skills development, and business capacity, regulatory targets, timetables and creation of new markets beginning to occur.
Building the resilience of the new direction – *early development*		Regulations and partnerships for change begin to emerge. The influence of Big Coal to delay implementation of targets and new technologies is exposed and challenged

According to Kingdon (1995), significant changes in the governance of socio-ecological systems are most likely when three streams – problems, solutions and politics – that usually operate independently, come together. Kingdon proposed that:

> People recognize problems, they generate solutions for public policy changes, and they engage in such political activities as election campaigns and pressure group lobbying (Kingdon, 1995: 87).

Kingdon's analysis aligns neatly with Moyer's (2001) proposition that there were three critical moments in building successful social change:

- the public is engaged and convinced that there is a problem
- the public is convinced there is a solution to the problem that seems credible
- the public sees it can do things to make the solution happen, i.e. engages politically with powerholders and decision makers (Moyer *et al*, 2001: 84).

Hunter Valley communities have made significant progress towards identifying and documenting problems and bringing them to the attention of the public, governments and corporations. They have identified some solutions to these problems, such as a cap on new coalmines and a shift in investment to renewable energy. They have made some useful political alliances and partnerships with new leadership and vision for the region beginning to emerge. The trade union/environment movement and academic collaboration to develop a *Blueprint for a Low carbon Future for the Hunter Valley* (Ayres, 2009) is an example of this.

However, the social movement has been less successful at eliciting sufficient political action from the public to force key decision-makers and powerholders to actually renounce coal dependency and change human–ecological relationships to a moral economy that could sustain ecosystem services and healthy communities.

Indeed, it is arguable that while some shift in public opinion and public investment has been achieved, the views of climate sceptics and the carbon lobby (the Greenhouse Mafia) still hold a hegemonic influence over public policy and investments at regional, national and global scales. The perverse resilience of the fossil fuel industries continues, and thus the necessary drivers for adaptive governance for sustainability need to be strengthened for transition to occur.

10.4 Eradicating the perverse resilience of coal

As discussed in earlier chapters, the coal industry in Australia, and globally, recognises the challenge to maintain its social licence to operate because of growing public concern about climate change and the cumulative impacts of mining and coal-based power generation in mining regions. The capacity of the coal industry to maintain its social licence to operate is a test of its resilience.

Hegemony and the resilience of the coal industry

Walker *et al* (2004) identified four factors that influence the resilience of a complex adaptive system: their latitude or room to manoeuvre; the precariousness of key variables to critical thresholds; the capacity of key attractors to resist change; and the influence of cross-scale forces (panarchy) on the system.

Given that the coal industry is expanding despite the growing body of evidence that the industry, and its products, jeopardise the ecological and social health of coal regions and the whole planet (discussed above), the industry seems to have considerable resilience.

However, it is helpful to consider whether the industry's social licence to operate is in fact genuinely resilient, or simply explained by the strong hegemonic influence that the mining industry has over powerholders and decision-makers in Australia (and in other fossil fuel dependent regions).

Guy Pearse (2009), in his essay *Quarry Vision*, describes the hegemonic influence of the mining industry (including the coal industry). He argues that "quarry vision" is promoted by a political, business and media chorus that sees mining as our "natural competitive advantage endowed by providence", the "engine room of economic growth", and the "backbone of our economy" (Pearse, 2009: 1).

However, Pearse argues that this "vision" is not a reality and that Australia is not dependent on mining, or need be fossil-fuel dependent, but rather that the mining industry has manipulated political processes to entrench its interests within the policies of successive Australian national, state and local governments, dominant political parties, and key decision-makers in some powerful civil society organisations (including some environmental organisations and trade unions).

Mitch Hookes, CEO of the Minerals Council of Australia, for example, declared in December 2008 that:

> Coal exports will continue to be a mainstay of the Australian economy for the foreseeable future. Governments of all persuasions must fulfill their obligation to ensure Australia's coal export corridors are appropriately resourced and free of bottlenecks (Hookes, 2008).

Yet it is not the case that the minerals industry is the mainstay of the Australian economy. John Edwards, the chief economist of the HSBC Bank and advisor to former Prime Minister Paul Keating, noted:

> Mining is very valuable to Australia, but the entire industry accounted for only 5% of national GDP in 2006, little different to its share of national output 30 years earlier. It employs just 1% of the workforce — half the share it employed twenty years ago. It is highly profitable, but it is mostly overseas owned, so most of the after-tax profit is sent offshore (Edwards, 2006: 93).

Edwards went on to indicate that minerals exports are of similar value to exports from the more employment-intensive manufacturing and service sectors:

> Last year (2005) the total volume of metals ores and minerals, coal, minerals fuels and refined metals accounted for 30% of export volumes, compared to 36% of export volumes thirty years ago … Even though the value of minerals and energy exports has doubled since the end of the last decade, they are still just about matched by the total of manufacturing and service exports (Edwards, 2006: 94).

Mining accounted for less than 2% of national employment in 2005–06, while the manufacturing sector employed 11% of the workforce (ABS, 2008). Indeed, Pearse (2009) noted that twice as many Australians worked for McDonalds than worked in the coal industry, and that the hardware retailer Bunnings employed 50% more people than worked in the aluminium industry (Pearse, 2009).

In promoting itself as the economic pulse of Australia, the mining industry engages in a hegemonic contest over both class and ecological values, to win the compliance of key decision-makers in governments, trade unions and mining communities. Of course, the industry does provide significant income and material rewards through royalties, taxes, business and wages to these sectors of society. Consequently, the industry has enjoyed generous patronage from the NSW Government, exemplified by the former NSW Government Treasurer, Michael Costa, an unashamed climate sceptic, who declared his hostility to shifting energy investment from coal towards renewable energy, stating that:

> My problem with climate-change is that it's always existed. We wouldn't have a coal industry today if there hadn't been tropical rainforests in NSW. Britain wouldn't have had an industrial revolution without the forests that were once there, and became the coal industry. And Greenland is called “Greenland” for a reason.
>
> People are in here all the time looking for subsidies for renewables. But every time we allocate a dollar to some bogus scheme that will purportedly deal with climate change, that’s a dollar less we can allocate to the hospital system, to mental health, to some other cause that probably has more merit, on a cost–benefit analysis. (Costa, quoted in Salusinszky, 2008)

The industry maintains its hegemony by exploiting anxiety about economic catastrophe and unemployment, and uses divide and rule strategies to protect its interests. The industry has, for example, collaborated with the mineworkers’ union, the CFMEU M&E, to promote a myth that coalminers are being “demonised” by environmentalists, and that to curb the expansion of coalmining in the light of climate change is to perpetuate this demonisation (Maher, in NSW Minerals Council 2007b).

The CFMEU M&E goes so far as quote Mark O'Neill, the CEO of the representative organisation for employers, the Australian Coal Association, on its website:

> The image of the coalmining industry being actively promoted by some – of an evil empire counting its money while the planet melts – is a mere cardboard cut-out. It does not reflect attitudes towards climate change of the people in the industry, or their sense of responsibility for finding solutions.
>
> But the vilification is now causing distress to thousands of working families. It is already dividing communities and leading to a distorted public perception of the causes of climate change and its possible solutions.
>
> History is littered with morally vain political movements that have used selective vilification as a political tool, invariably with tragic consequences. History also tells us that it is dangerous for resource rich countries to withhold resources from those that are resource poor (O’Neill, 2007, quoted in CFMEU, 2007d)

The historic hegemony of the coal industry is currently dominant, but it is being challenged by ecological, social and economic realities, including climate change and the ecological and human health distress syndrome apparent in mining regions. It is also being challenged by the social movement for a *Future Beyond Coal*.

Interventions, led by government, that are crucial for regional economic transformation towards sustainability were identified by Binder, Jänicke & Petschow (2001), Kofoed-Wiuff *et al*, (2006) and others, and were discussed in Chapter 7. Ecologists, Walker, Abel *et al* (2009), identified similar interventions as essential for non-sustainable socio-ecological system transformation, namely:

- clear evidence that transformation is needed
- acceptance that change is necessary
- leadership, strong social networks, and trust
- a negotiation process
- strategic disinvestment in infrastructure, subsidies, or incentives that maintain the current regime
- support for those who will lose from the transformation
- political ability to implement structural changes
- strategic new investments in social and human capital, infrastructure, and technology (Walker, Abel *et al*, 2009: 21).

These interventions are critical to building the counter-hegemonic shift towards genuine resilience and system transformation so that maintenance of the current basin of attraction is neither feasible nor desirable.

"Trading sustainability for mere trinkets"

However, despite the many indicators that coal dependency is a major contributor to ecosystem and human health distress in the Hunter Valley and to climate change globally, the mining industry attempts to keep their licence to operate away from potential thresholds of community tolerance through deploying various political and community engagement strategies. In the Hunter Valley, mining companies sponsor local events: Xstrata and Bengalla sponsor the Denman Food and Wine Festival; Coal & Allied/Rio Tinto sponsor the Newcastle Knights rugby league team,; BHP Billiton sponsored the construction of the Muswellbrook Municipal Swimming Pool; in August 2009 Port Waratah Coal Services announced it would contribute $15,000 to solar heating the Mayfield Swimming Pool in Newcastle. The industry has established scholarships (for example, the Xstrata scholarship offered to some undergraduate students at the University of Newcastle) and community trust funds (such as the Coal & Allied Community Trust Fund). The NSW Minerals Council claimed that in 2008 it was investing $10 million annually in NSW communities (NSW Minerals Council, 2008).

However, as Albrecht cautioned in an article in the *Newcastle Herald*:

> To trade clean air, a healthy river, a healthy ecosystem and a community with a history, for a swimming pool and a fist full of dollars is indeed a big issue. The colonising of Australia was accompanied in some areas by offering trinkets for land

> to people who were not in a good position to assess the merits of the deal. It seems once again that we are about to give up our heritage for trinkets (Albrecht, 2002).

"Industry capture" arguably reflects hegemonic domination, and is not just an issue for communities and governments (discussed earlier), but also for environmental organisations and universities. Some analysts believe that some environmental organisations and universities have been captured and silenced in their criticism of the coal industry because of dependence on income from corporations, including the coal industry (Hamilton & Downie, 2006; Hamilton & Macintosh, 2004). The Australia Institute has documented what it calls "the increasingly close relationships between Australian universities and the fossil fuel industries" and asked whether fossil fuel companies are gaining an inappropriate level of influence over the teaching and research priorities of universities, and in so doing jeopardising academic freedom. (Hamilton & Downie, 2007: 1). The Institute also questioned whether WWF was taking a quiescent and uncritical role towards the policies of the Howard Government, in response to receipt of funds (Hamilton & Macintosh, 2004).

Efforts by the minerals industry to buy community compliance are viewed with cynicism by many. In 2009 the NSW Minerals Council sponsored the Dungog Film Festival in the Hunter Valley, but members of the community raised concerns that the event was being dominated by coal interests with heavy propaganda promoting the so-called sustainability of the industry. Some filmmakers staged a fringe festival, with art works and screening of environmental documentaries that highlighted the effects of long-wall coalmining in surrounding communities. With mining references so blatant throughout the festival many residents were concerned about the level of control the Council seemed to have over the event, with one filmmaker saying:

> It would be nice if they could just sponsor us instead of trying to brainwash us as well (Coal Mining, 2009).

10.5 Linking global and regional drivers for a shift to sustainability

The increased impacts of climate change, biodiversity loss, the global financial crisis and Peak Oil are powerful disturbances in the global socio-ecological system that are cascading across ecological, social, economic and political domains, and threaten to overwhelm the perverse resilience of the current system, as sustainability is jeopardised at regional and global scales.

There are significant uncertainties in predicting the future evolution of complex adaptive systems. It is unclear how the global financial crisis will evolve, and how it will link with other drivers of non-sustainability, such as over-consumption and climate change. Furthermore, it would be foolish to put too high expectations on the capacity of the American politico-economic system to fundamentally transform itself towards sustainability, yet the election of the Obama Administration potentially represents a break from previous climate sceptic and denialist policies in the world's dominant economy, and creates some political institutional momentum for change.

Green New Deal

Policies and public investment initiatives that have emerged in response to climate change and the global financial crisis have been described as the *Green New Deal* (Elliott *et al.*, 2008). *Green New Deal* policies emulate features of the Roosevelt-era New Deal policy in the US, which employed Keynesian economic policies to overcome the Great Depression, reform business and financial practices, provide relief and welfare to vulnerable communities, and stimulate economic activity through investment in public works. *Green New Deal* policies have been promoted in the US, UK and Australia, and have been taken up to varying degrees by governments as they attempt to link short-term stabilisation with longer-term reform of financial, employment and energy systems.

Regarding global policy, advocates of *Green New Deal* policies include setting a formal international target for atmospheric greenhouse gas concentrations that keep future temperature increases as far below 2° C as possible, a policy adopted at the Group of Eight meeting of economically powerful nations, held in Italy in July 2009. Other policies, such as delivering a fair and equitable international climate agreement to succeed the Kyoto Protocol, assisting poorer countries to escape poverty without fuelling global warming by massive investment in climate-change adaptation and renewable energy, and supporting the free and unconstrained transfer of new energy technologies to developing countries (Elliot *et al.,* 2008) are yet to be resolved in the lead-up to Copenhagen.

Green New Deal policies promote labour market development and industry development through creating markets, and training a workforce with the knowledge and skills for environmental reconstruction programs. They internalise the real environmental and social costs of fossil fuel so that price signals drive a shift to alternative fuels and energy efficiency (Elliot *et al.,* 2008).

At the conference of the governing Australian Labor Party (ALP), held in Sydney in July 2009, the Prime Minister, Kevin Rudd announced Australia's version of the *Green New Deal*, promising that 50,000 new jobs in Green Skills would be created, supported by a $94 million investment in training. The program will target young or disadvantaged workers, and includes 30,000 apprenticeships for, electricians in smart heating and cooling technologies, plumbers in water recycling and water efficiency and mechanics in green car engines, as well as 4,000 training places for insulation installers. (Australian Labor Party, 2009)

As part of financial sector reform, *Green New Deal* policy proposes a package of financial innovations and incentives to assemble the funds needed to finance the development of new energy infrastructure and to reduce demand for energy, particularly among low-income groups (Elliott *et al*, 2008: 4).

In its May 2009 budget, which was crafted at the peak of the global financial crisis, the Rudd Government committed $4.5 billion to "clean energy" including:

- $2.4 billion in low-emission coal technologies over nine years, including $2 billion in funds for industrial-scale CCS projects under the *Carbon Capture and Storage Flagships* program
- $1.6 billion in solar technologies over six years, including funding of a $1.365 billion *Solar Flagships* program
- $465 million to establish *Renewables Australia*, a new body that will advise governments and the community on the implementation of renewable energy technologies, and which would support growth in skills and capacity for developing domestic and international markets (Garrett, 2009).

The *Solar Flagships* program will aim to develop up to four individual generation plants linked into the national grid. As the recently announced site of the National Solar Energy Centre and Australian Solar Institute, there is a possibility that some of the *Solar Flagship* program might be located in Newcastle, along with significant CCS research. Launching the proposal at the Liddell coal-fired power station in the Hunter Valley, the Prime Minister indicated the Australian Government aims to build a 1,000 MW solar generation plant that is three times the size of the largest solar energy project currently operating anywhere in the world (Kirkwood, 2009b). Ironically, the world's largest solar plant is a solar thermal plant built in the Mojave Desert, California by Ausra, a formerly Hunter Valley-based company that was forced to move to the US due to lack of government support in Australia.

The Copenhagen and global climate change agreements

The shape of the international climate change governance for the next few decades will be negotiated at the UN Climate Change Conference of the Parties to be held in Copenhagen, Denmark, in December 2009. Contentious issues include global emissions reduction targets, potential for "contraction and convergence" policies that aim for equitable per capita carbon footprints between developed and less-developed countries, technology transfer mechanisms, and the role of the "Clean Development Mechanism" (CDM) that allows developed countries to buy Certified Emissions Reduction certificates (CERs) from approved projects in developing countries. The eligibility of carbon capture and storage technologies to be approved as a CDM is one contentious issue in this debate.

As part of its *Carbon Pollution Reduction Scheme* (CPRS) the Rudd Government committed to reducing Australia's annual CO_2 emissions pollution by between 5–25% below 2000 levels by 2020, with any commitment to a 25% reduction being contingent on an ambitious global deal to stabilise levels of CO_2 equivalent at 450 parts per million or lower being negotiated at Copenhagen in December 2009 (Rudd, 2009b).

In May 2009, the Rudd Government announced that it would delay the start of the CPRS by one year to 1 July 2011, with a fixed price of carbon in the first year of $10 per tonne.

From 1 July 2012, businesses covered by the scheme will need to purchase permits at the prevailing market price. Carbon-intensive trade-exposed industry assistance was increased, giving an effective rate of assistance of almost 95% to the most highly emissions-intensive trade-exposed activities in the first year of the scheme. An *Australian Carbon Trust* was established, with $50 million in seed funding, to promote energy efficiency in the business sector. The Trust will cover upfront capital costs of undertaking energy efficiency investments and put in place arrangements for business to repay the capital costs at a commercial rate as energy cost savings flow through (Wong, 2009b).

In promoting the revised CPRS, Climate Change Minister Senator Penny Wong announced that Australia's domestic arrangements would be consistent with the modest policies that the government would take to the Copenhagen Conference (Wong, 2009d).

With respect to the Clean Development Mechanism, Australia and other carbon-intensive countries (Canada, Norway, EU, Japan as well as some North African and Middle Eastern countries) are advocating for CCS to be eligible technology. If CCS is accepted as a CDM it would be a huge boost to institutionalising the technology in Australia as well as globally. However, Brazil, supported by Jamaica, Venezuela and Micronesia, as well as many environmental NGOs, argues against this (World Coal Institute, 2009), with Brazil's chief climate change negotiator, Jose Miguez, accusing Australia of simply acting as a mouthpiece for its coal industry:

> This [CDM] is supposed to be about climate change, not making money for your own companies. Some people mix up climate change and money. The coal sector speaks on behalf of the Australian Government and we don't like this. Statoil [the Norwegian oil and gas giant] speaks on behalf of Norway and Saudi Arabia is only worried about its oil. But CDM is supposed to be about clean development, not about subsidising fossil fuels (Miguez, quoted in Wilson, 2008).

Peak Oil

The global impact of Peak Oil sometime in this or the next decade (ASPO, 2008) is likely to have a profound effect on the character and scale of world trade (Campbell, 1997, 2005; Campbell & Laherrère, 1998). The report, *Peaking of World Oil Production: Impacts, Mitigation, & Risk Management* (Hirsch *et al.*, 2005), highlighted the risks involved for global economies and the need for timely mitigation actions, stating that:

> As peaking is approached, liquid fuel prices and price volatility will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated more than a decade in advance of peaking (Hirsch et al., 2005: 4)

Hirsch *et al* (2005) say the same in relation to Peak Oil as others, such as Stern (2007) and Garnaut (2008) have said in relation to climate change, namely that "early mitigation will almost certainly be less expensive than delayed mitigation" (Hirsch et al, 2005: 6). They propose that production of vast quantities of alternative liquid fuels to replace oil is one option for dealing with Peak Oil. However, another way of mitigating the impacts of Peak Oil is to recognise limits to growth, and to curb the scale of consumption and global trade and, instead, to relocalise economies around principles of sufficiency (Daly, 1993; Heinberg, 2004; 2007a, 2007b; Princen, 2005; Hopkins, 2008). In the "relocalisation scenario" demand for Hunter Valley's coal would decline, irrespective of the separate pressures of Peak Coal (Energy Watch Group, 2007; Kavalov & Peteves, 2007; Mohr & Evans, 2009) as industries relying on fossil fuel for production and fossil-fuel-based transport decline.

10.6 Key regional drivers of change

The most powerful drivers of a transition in the Hunter Valley from the *Carbon Valley* scenario to a *Future Beyond Coal* are likely to come from global disturbances, but as discussed earlier, social movements are also influential in creating disturbances that both push the transition process and define the potential shape of a sustainable Hunter Valley region.

For most of the time that the Hunter Valley has been occupied by humans, the region's ecosystems and human social systems have co-evolved in a condition of relative harmony and symbiosis. The Indigenous economy operated within nature's limits, but the advent of British occupation in 1804 heralded a new phase in the adaptive cycle of the Hunter Valley's socio-ecological system. Profoundly different human–ecological relationships have significantly transformed most of the Hunter Valley's ecosystems over the last 200 years, with vegetation cleared, wild rivers rendered "tame" (Hillman, 2003) by dams and irrigation, air, land and waters degraded with loss of biodiversity and pollution combining to jeopardise ecological and social sustainability.

Climate change, directly linked to the dominant economic activity of the Hunter Valley, poses unprecedented threats to regional ecological, economic and social health. Climate scientists have found that the rate of change is increasing, and therefore the potential to shape a sustainable future in the Hunter Valley depends on applying mitigation and adaption strategies in the region, including reducing the harm to the region's ecosystems from mining and other harmful industrial activities.

As the region's sustainability crisis becomes more obvious, the hegemony currently enjoyed by the coal industry that has enabled it to engineer a perverse resilience is likely to be broken, and a rapid shift in investment towards energy efficiency and renewable energy and a Just Transition may occur.

A social movement that can successfully bring together powerful regional social actors with powerful national and global actors in collaboration will potentially drive transformation of the region's economic, social and political culture towards sustainability. The *Blueprint for a Low-carbon Future for the Hunter Valley* project (Ayres, 2009) that unites trade unions, the environment movement and research communities is an encouraging new development that exemplifies these potentially powerful collaborations that could move the system into a new phase of its evolution and towards sustainability.

10.7 Conclusion

The dialectic between sustainability and non-sustainability in the Hunter Valley is ongoing. This research identifies two contradictory trends being contested in ecological, social, economic, cultural and political domains: the push by governments, industry and some sectors of the community to lock the Hunter Valley indefinitely into the current *Carbon Valley* and fossil fuel dependency scenario; and the countervailing pressure from communities and social movements (including some trade unions) to invest in a clean energy *Future Beyond Coal*.

The research has identified how powerful political actors that influence the trajectory of the Hunter Valley's socio-ecological system, particularly the Australian and New South Wales Governments, coal companies, power generators, aluminium smelters, and media champions of Big Coal are failing to recognise the scale of the climate crisis facing the planet and the urgent need for a shift to a clean energy economy. Yet, natural and social scientists and economic experts such as the IPCC, Stern (2006) and Garnaut (2008) have told us that early action will be much less costly in the medium-long term than propping up business-as-usual with perverse subsidies.

Sadly, the analysis of literature and interviews conducted in the course of this research shows that powerful forces within the Hunter Valley, Australian and global society seem to be either ignorant about the real costs of inaction, are preoccupied with short-term economic gain over longer-term ecological and social well-being and global justice, or are paralysed by the difficulty of challenging current powerholders and changing current social and economic practices (including unsustainable levels of consumption).

There are significant challenges in shifting the Hunter Valley economy from greater coal dependency to sustainability. This research finds that the current trajectory is away from sustainability. Christine Phelps, a local resident, campaigner against the Anvil Hill (now Mangoola) coal mine, and Muswellbrook Shire Councillor, notes the scale of the threat:

> It appears that we're on a road to mining every last bit of coal out of the Hunter Valley, and that seems to go from Anvil Hill and Moolarben onto its Western boundary and Scone and Murrurundi at its most northern end at the upper reaches of the Hunter Valley, and then into the Liverpool Plains. So we seem to be going from wall to wall with coal mining. You wonder if there is going to be anything left to be sustainable. Can we turn a mine void into something else and make a living out of it? I don't think so! (Christine Phelps, 2004, interview with author)

However, despite the trends towards ecological and social distress syndromes at regional and global scale due to coal mining and climate change, this research also identifies that there also a countervailing movement towards a just transition to sustainability and a clean energy economy .

This research has addressed the question:

> How might it be possible to make a rapid transition to sustainability in the Hunter Valley from its current status as a climate change hot spot to an alternative *Future Beyond Coal*, in such a way that the wellbeing of vulnerable workers, communities, and the ecosystems they live in, are protected during the change process?

The findings indicate that a managed Just Transition process could build a shared commitment across the Hunter Valley's diverse communities to policies and actions that might achieve a sustainable socio-ecological system built on ecological health, environmental justice and a prosperous economy that would create thousands of new Green jobs.

The research identifies that effective policies and practices to achieve a just transition to sustainability need to acknowledge the needs of vulnerable communities, and support these communities during the transition process.

A successful transition of complex adaptive socio-ecological systems towards sustainability must work across linked social and ecological systems that span local and global scales. Thus transition in the Hunter valley from coal dependency, particularly coal mining and export is likely to be linked to a transition in other economies (such as China, India, USA, Japan, Korea) from coal dependency to clean, renewable energy, and from centralised energy systems to more distributed energy systems, thereby reducing demand for Hunter Valley coal in global energy markets.

Popular education and social learning are playing a vital role in building a social movement for a *Future Beyond Coal* in the Hunter Valley, and linking the Hunter Valley communities with the wider global community tackling climate change. The research identifies that effective social learning combines the experiences and knowledge across scales, including that of local residents with regional, national and global environmental organisations, labour unions, academic researchers, governments, investors and businesses.

The *CofFEE report*, referred to in this study, identified that there would be significant Green job gains in the power generation sector in a shift to clean energy (Bill *et al.*, 2008). Phasing out coal exports will be more challenging to the region because it will entail greater job loss impacts than the phasing out of coal-fired power generation. There is a need for more detailed research to identify the process for writing off and replacing the region's coal-fired power generation infrastructure, the timeframe and specific support required for phasing out of coal exports, including how the region (and the national economy) could cope with the loss of coal export income. However this research shows that there is a strong demand from coal communities for a cap on new mines and a managed phasing out of coal exports and coal-fired power stations to protect the region's ecosystem and human health and encourage economic diversification as reliance on coal mining diminishes.

The obstacles to a Just Transition are political rather than technological, as many of the technology 'solutions' are already developed. The research has identified that the closure of Newcastle 's BHP steelworks in the late 1990's embodied many of the essential features of a successful just transition process. While many of the Hunter Valley's ecological systems are stressed, and mine expansion and climate change pose significant threats, the region generally retains ecological and social health and has the resilience to cope with transition.

Loss of employment and income from the closure of major coal industries can be managed if adequate notice of change is given, appropriate support is given to vulnerable communities, and there is adequate investment in infrastructure, training and development of alternative industries. Governments at all levels have a critical role in developing appropriate regulations and policies, planning for change, supporting communities and the emergence of new industries.

The reluctance of governments to facilitate a rapid transition from coal dependency and the Hunter Valley current *Carbon Valley* status to an alternative *Future Beyond Coal* threatens to maker any eventual transition more difficult and costly.

This research is not specifically intended as a study where the findings can be necessarily be generalised to other regions. However, it has identified many issues and social policies and practices which could be applied to other contexts. These situations may relate to coal, energy and climate change, but they may also be applicable in relation to other industries, such as unsustainable forestry, fishing, toxic chemical production, armaments and military industries.

Australia's coal communities could demonstrate that there are viable pathways out of coal dependency to a clean energy economy. Countries currently importing Australian coal learn from our experiences, as well as teach us. Yet, Australian state and federal governments are reluctant to fully commit to a just transition to a clean energy economy by large-scale investment in the development of renewable energy technology and markets, and continue to provide generous support and subsidies to coal dependency (including carbon capture and storage technology). The ecological hegemony of harmful development practices is therefore still strong.

However, complex adaptive socio-ecological systems are characterised by surprise, and can move rapidly into unpredictable trajectories. Accelerating global climate change and strong global mitigation responses may drive a rapid collapse of global fossil fuel markets. The apparent stability of the landscape on which industry and governments are basing multi-billion dollar investment decisions is proving to be illusory, and it may take a crisis of ecological collapse at both regional and global scales to spark stronger social awareness of the need for transition from coal dependency, and political action to achieve an alternative, more sustainable paradigm.

Rather than allowing socio-ecological systems to continue in a non-sustainable trajectory and collapse into a non-recoverable, unhealthy and potentially barbaric state, it is prudent to anticipate the need to change and apply adaptive management approaches that boost resilience and capacity to move to a desirable trajectory. The Hunter Valley and global social movement for a moral economy is organising for this preferred pathway through alerting and mobilising the public and demanding new, democratic and transparent governance regimes that uphold ecological citizenship and strong sustainability principles.

James Lovelock, in his book, *The Revenge of Gaia* (2006), provides a grim warning that the planet's evolving ecosphere will continue with or without humans, just as it did for billions of years, and that, given the way humanity is travelling, the future may unfold without human civilisation. This is a rather bleak prognosis, and Gramsci's (1971) call for "a pessimism of the intellect, optimism of the will" offers a more hopeful belief that, although it may be difficult, a transition to a just and sustainable world is possible.

Bibliography

Australian Broadcasting Commission (ABC) (2006) *Coal & Allied records Hunter coal mines profit rise.* 3/5/2006 Online: http://www.abc.net.au/news/australia/nsw/newcastle/200605/s1629418.htm Accessed: 28/2/2009.

Australian Broadcasting Commission (ABC) (2008) *Coal & Allied profits drop 47pc.* 29/1/2008. Online: http://www.abc.net.au/news/stories/2008/01/29/2149344.htm . Accessed: 28/2/2009.

Australian Broadcasting Commission (ABC) (2009) *Anglo Coal has announced it is cutting 650 mining jobs in Queensland and New South Wales.* Online: http://www.abc.net.au/news/stories/2009/03/02/2504654.htm?site=upperhunter . Accessed: 3/3/2009.

Australian Broadcasting Commission (ABC) (2009b) *Farmers take on mining giants.* Online: http://www.abc.net.au/news/stories/2009/07/20/2630507.htm . Accessed: 21/7/2009.

Australian Broadcasting Commission (ABC) Canberra (2008) *Switch to Green - Solar Thermal Energy plans for NSW and the ACT*. 4/4/2008. Online: http://www.abc.net.au/local/stories/2008/04/04/2208296.htm . Accessed: 12/2/2009.

Aberley, D. (1999) Interpreting bioregionalism: a story from many voices. In M. McGinnis (ed.) *Bioregionalism*. London, UK: Routledge.

ACIL Tasman (2008) *The impacts of an ETS on the energy supply industry*, commissioned by the Energy Supply Association of Australia. Melbourne, Australia: ESAA. Online: http://www.esaa.com.au/images/stories/Report/20080723esaaatreport.pdf . Accessed 8/8/2008.

Adams, W. & Mulligan, M., (2003) *Decolonizing Nature: Strategies for conservation in a postcolonial era.* London, UK & Sterling, VA, USA: Earthscan.

Adams, W. M. & Jeanrenaud, S. J. (2008). *Transition to Sustainability: Towards a Humane and Diverse World.* Gland, Switzerland: IUCN. Online: http://www.iucn.org/about/union/secretariat/offices/usa/?1661/Transition-to-sustainability-towards-a-humane-and-diverse-world. Accessed: 2/1/2009.

Adger, N. (2000) Social and ecological resilience: Are they related? *Progress in Human Geography*, 24: 347-364.

Adger, N. (2003) Building resilience to promote sustainability - an agenda for coping with globalisation and promoting justice, *Newsletter of the International Human Dimensions Programme on Global Environmental Change.* Bonn, Germany: IDHP. Online: http://www.ihdp.uni-bonn.de/html/publications/update/update03_2003/IHDPUpdate02_2003_adger.htm. Accessed: 2/5/2007.

Adger, N. (2006) Vulnerability, *Global Environmental Change*, 16, 3: 268-281.

Adger, N., Brooks, N., Bentham, G., Agnew, M. & Eriksen, S. (2004) *New indicators of vulnerability and adaptive capacity*, Tyndall Centre for Climate Change Research Technical Report 7. Norwich, UK: Tyndall Centre for Climate Change.

Adger, N., Arnella, N. & Tompkins, E. (2005) Successful adaptation to climate change across scales, *Global Environmental Change*, 15: 77-86.

Agarwal, A. & Narain, S. (1991) *Global Warming in an Unequal World*. New Delhi, India: Centre for Science and Environment.

Aguilar, B. J.,(1999) Applications of ecosystem health for the sustainability of managed systems in Costa Rica. *Ecosystem Health* 5:36-48.

Agyeman, J., Bullard, R. & Evans, B. (2003) Joined-up Thinking: Bringing together Sustainability, Environmental Justice and Equity. In J. Agyeman, R. Bullard & B. Evans (eds.) *Just Sustainabilities: Development in an Unequal World.* London, UK: Earthscan.

Albanese, A. (2008) *Rudd Government Delivers Funding Boost to Road and Rail Infrastructure in New South Wales*. Media release from the office of the Minister for Infrastructure, Transport, Regional Development and Local Government, 12/12/2008. Online: http://www.minister.infrastructure.gov.au/aa/releases/2008/december/aa198_2008.htm . Accessed: 14/12/2008.

Albrecht, G. (1994) Ethics, Anarchy and Sustainable Development, *Anarchist Studies*, 2, 2: 95- 118.

Albrecht, G. (2000) *Rediscovering the Coquun: Towards an Environmental History of the Hunter River.* Hunter River Catchment Management Authority. Online: http://www.newcastle.edu.au/service/archives/chrp/albrecht.html. Accessed: 13/6/2008.

Albrecht, G. (2001) Applied Ethics in Human and Ecosystem Health: The Potential of Ethics and an Ethic of Potentiality, *Ecosystem Health,* 7, 4: 243-252.

Albrecht, G. (2002) Trading sustainability for mere trinkets, 1/6/2002, *Newcastle Herald.* Newcastle, Australia.

Albrecht, G. (2005) 'Solastagia': A new concept in health and identity, *Philosophy, Activism, Nature*, 3: 41-55.

Albrecht, G., Freeman, S. & Higginbotham, N. (1998) Complexity and Human Health: The Case for a Transdisciplinary Paradigm. *Culture, Medicine and Psychiatry* 22(1): 55-92.

Albrecht, G. & Gutberlet, J. (2000) Sustainability and the Hunter Region. In P. McManus, P. O'Neill & R. Loughran (eds.) *Journeys: The Making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

Albrecht, G. & Higginbotham, N. (2001a) Complexity and Human Health: Across the Health Hierarchy. In N. Higginbotham, G. Albrecht, G. & L. Connor (eds.) *Health Social Science: A Transdisciplinary and Complexity Perspective.* South Melbourne, Australia: Oxford University Press.

Albrecht, G., Higginbotham, N. & Freeman, S. (2001b) Transdisciplinary Thinking in Health Social Science Research: Definition, Rationale, and Procedures. In N.

Higginbotham, G. Albrecht, G. & L. Connor (eds.) *Health Social Science: A Transdisciplinary and Complexity Perspective.* South Melbourne, Australia: Oxford University Press.

Albrecht, G., Higginbotham, N., Connor, L. & Freeman, S. (2008) Human Health and Ecosystem Health: A Social Perspective. In K. Heggenhougen (ed.) *International Encyclopedia of Public Health.* SanDiego, USA: Elsevier.

Alcan (2002) *Alcan's journey towards sustainability: Sustainable Development Report, 2002.* Online: http://www.publications.alcan.com/sustainability/en/pdf/csr_journ_e.pdf. Accessed: 6/12/2008.

Alcoa (2009) *Alcoa and Gov. of Iceland to Begin Feasibility Studies on a New 250,000 mtpy Renewable Energy-Powered Smelter in North Iceland; Smelter Could Be One of the First Geothermal-Powered in the World*. 1/3/2006 Online: http://www.alcoa.com/global/en/news/news_detail.asp?pageID=20060301005646en&newsYear=2006. Accessed: 12/6/2009.

Alinsky, S. (1971) *Rules for Radicals: A Pragmatic Primer for Realistic Radicals.* New York, NY, USA: Random House.

Allen, W. (2007) Social learning and practice change: Supporting dialogue, collective action and reflection. *Learningforsustainability.net*. Online: http://www.learningforsustainability.net/social_learning/. Accessed: 12/2/2008.

Allen, W. (2008?) Learning for Sustainability (LfS) – Introduction. *Learningforsustainability.net*. Online: http://www.learningforsustainability.net. Accessed: 12/3/2009.

Allison, H. E. & Hobbs, R. J. (2004) Resilience, adaptive capacity, and the "Lock-in Trap" of the Western Australian agricultural region, *Ecology and Society*, 9, 1. Online: http://www.ecologyandsociety.org/vol9/iss1/art3/. Accessed: 12/6/2007.

Allman, P. (1988) Gramsci, Freire and Illich: Their Contributions to Education for Socialism. In T. Lovett, (ed) *Radical Approaches to Adult Education: A Reader.* London, UK: Routledge.

Allman, P. (1999) *Revolutionary Social Transformation: Democratic Hopes, Political Possibilities and Critical Education*. Westport, Conn., USA: Bergin & Garvey.

Alston, M. & Bowles, W. (2003) *Research for Social Workers: An Introduction to Methods.* Crows Nest, Australia: Allen & Unwin.

Altheide, D. & Johnson, J. (1998) Criteria for assessing interpretive validity in qualitative research. In N. Denzin & Y. Lincoln (eds.) *Collecting and Interpreting Qualitative Materials.* London, UK: SAGE.

Alvessoon, M. & Skoldberg, K. (2000) *Reflective Methodology: New Vistas for Qualitative Research.* London, UK: SAGE.

Ames, S. (1998) *Guide to Community Visioning*. Chicago, IL, USA: APA Planners Press.

Amin, A. & Thrift, N. (1994) Globalisation, institutional 'thickness' and the local economy. In P. Healey, S. Cameron, S. Davoudi, S. Graham & A. Madani-Pour (eds.) *Urban Management.* London, UK: Belhaven.

Ananthapadmanabhan, G., Srinivas K. & Vinuta G. (2007) *Hiding Behind the Poor: A report on climate injustice.* New Delhi, India: Greenpeace India Society. Online: http://www.greenpeace.org/raw/content/india/press/reports/hiding-behind-the-poor.pdf . Accessed: 2/2/2009.

Anderies, J. M., Walker, B. & Kinzig, A. (2006) Fifteen weddings and a funeral. Case studies and resilience-based management, *Ecology & Society* 11, 1. Online: http://www.ecologyandsociety.org/vol11/iss1/art21/. Accessed: 13/5/2006.

Andrews, B. (2004) *Coal, railways and mines: the story of the railways and collieries of J & A Brown.* Redfern, NSW, Australia: Iron Horse Press.

Anvil Hill Alliance (2005) *Anvil Hill Alliance Statement.* Newcastle, Australia: Anvil Hill Alliance. Online: http://www.anvilhill.org.au/statement. Accessed: 30/5/2008.

Apollo Alliance (2004) *New Energy for America: The Apollo Jobs Report: Good Jobs & Energy Independence*. Washington, DC, USA: The Apollo Alliance. Online: http://apolloalliance.org/downloads/jobs_ApolloReport_022404_122748.pdf . Accessed: 24/8/2006.

Apollo Alliance (2008) *The New Apollo Program*: *Energy, Good Jobs: An Economic Strategy for American Prosperity.* San Francisco, CA, USA. Online: http://apolloalliance.org/downloads/fullreportfinal.pdf*.* Accessed: 22/12/2008.

Apollo Alliance (2009a) Weekly Update: Recovery Act Core Principles, Good Jobs, Jones Appointed To White House, 16/3/2009. Online: http://apolloalliance.org/apollo-productions/weekly-updates/apollo-weekly-update-31309-recovery-act-core-principles-good-jobs-jones-appointed-to-white-house/ . Accessed: 16/3/2009.

Apollo Alliance (2009b),*Imagining Newark's Green Future: A Year Building The Green Economy.* San Francisco, CA, USA: Apollo Alliance.

Apollo Alliance (2009c),*High Road or Low Road.* San Francisco, CA, USA: Apollo Alliance.

Arezki, R. & van der Ploeg, F. (2007) *Can the natural resource curse be turned into a blessing? The role of trade policies and institutions*, IMF Working Paper WP/07/55. Washington, DC, USA: International Monetary Fund.

Argyris, C. & Schőn, D. A. (1996) *Organisational learning II: Theory, method, and practice.* Reading, MA, USA: Addison-Wesley

Armstrong, J. (1983) *Shaping the Hunter.* Newcastle, Australia: Institution of Engineers Australia (Newcastle Division).

Arrold, T. (2007) Flynn fights for his green valley. *The Australian.* 30/4/2007. Sydney, Australia.

Arthur, W. B. (1989) Competing Technologies, Increasing Returns, and Lock-In by Historical Events, *Economic Journal*, 97: 642-65.

Arrighi, G., Hopkins, T. & Wallerstein, I. (1989) *Antisystemic Movements*, London, UK: Verso.

Ashman, S. (2004) Resistance to Neoliberal Globalisation: A Case of 'Militant Particularism'?, *Politics*, 24, 2: 143–153.

Association for the Study of Peak Oil and Gas (ASPO) (2008) *Newsletter*, No. 85, January 2008. Online: http://www.aspo-ireland.org/contentFiles/newsletterPDFs/newsletter85_200801.pdf.Accessed: 22/9/2009.

Athanasiou, T. (1998) *Slow Reckoning: The Ecology of a Divided Planet*. London, UK: Vintage Books.

Athanasiou, T. & Baer, P. (2002) *Dead heat: global justice and global warming.* New York, NY, USA: Seven Stories Press.

Athens, L. (1984) Scientific criteria evaluating qualitative studies, *Studies in Symbolic Interaction,* 5: 226-259.

Asia Pacific Energy Research Centre (2006) *APEC Energy Demand and Supply Outlook 2006: Energy Demand and Supply by Source.* Tokyo, Japan: APERC.

Australia Asia Pacific Mining Network (AAPMN) (1998) *Principles for the Conduct of Company Operations Within the Minerals Industry, Sydney, Australia:* Mineral Policy Institute, CFMEU & others. Online: http://www.natural-resources.org/minerals/csr/docs/csr/principles_for_mining_companies_by_aust_ngos.doc . Accessed 5/5/2004.

Australian Bureau of Agricultural & Resource Economics (2008) *Australian Mineral Statistics: December Quarter 2007.* Canberra, Australia: ABARE Online: http://www.abareconomics.com/publications_html/ams/ams_08/ams_mar08.pdf. Accessed: 7/6/2008.

Australian Bureau of Agricultural & Resource Economics (2008b) *Employment in Australian Industry.* Canberra, Australia: ABARE Online: http://www.abs.gov.au/Ausstats/abs@.nsf/7d12b0f6763c78caca257061001cc588/f976bf4d0f15cc14ca2573d20010a3ca!OpenDocument. Accessed: 13/3/2009.

Australian Coal Association (2008a) *Coal Facts Australia 2008.* Online: http://www.australiancoal.com.au/Pubs/COAL%20FACTS%20AUSTRALIA%202008%20Feb08-4.pdf. Accessed: 7/6/2008.

Australian Coal Association (2008b) *Submission to Emissions Trading Scheme Green Paper,* September 2008. Online: http://www.australiancoal.com.au/resources.ashx/Publications/1/Publication/E455331C5FFC5AC7F80678BFCB0D17B6/ACA_submission_on_GP.pdf. Accessed: 7/1/2009.

Australian Coal Association (2008c) *COAL21 & Other Initiatives.* Online: http://www.australiancoal.com.au/coal21-and-other-initiatives.aspx. Accessed: 7/1/2009.

Australian Coal Association (2008d) *ACA Applauds Victorian Government Contribution to Low Emissions Future. Media*Statement 30/4/2008. Online: http://www.australiancoal.com.au/resources.ashx/MediaReleases/9/MediaRelease/060946E9FEF76BF39ADAC1AF07908A0F/Clean_Coal_Victoria_300408_.pdf. Accessed: 7/1/2009.

Australian Coal Association (ACA), CFMEU, The Climate Institute, World Wildlife Fund (WWF) (2008c) *Historic alliance calls for a national task force on carbon capture and storage*. Media release, 16/4/2008. Sydney, Australia. Online:

http://www.australiancoal.com.au/Pubs/ACA_Media_Release_160408.pdf. Accessed 12/08/2008.

Australian Coal Association Research Program (ACARP) (2001) Impacts of Mine Subsidence on the Strata & Hydrology of River Valleys - Management Guidelines for Undermining Cliffs, Gorges and River Systems. Final Report C8005 Stage 1. Brisbane, Australia: ACARP.

Australian Coal Association Research Program (ACARP) (2002) *Impacts of Mine Subsidence on the Strata & Hydrology of River Valleys - Management Guidelines for Undermining Cliffs, Gorges and River Systems.* Australian Coal Association Research Program Final Report C9067 Stage 2. Brisbane, Australia: ACARP.

Australian Conservation Foundation (ACF) (2008),*Households to foot the big polluters' carbon bill.* Media release, 19/12/2008. Online: http://www.acfonline.org.au/articles/news.asp?news_id=2102 . Accessed: 20/12/2008.

Australian Conservation Foundation (2009) *Australia improves target to cut greenhouse pollution*, 8/5/2009. Online: http://www.acfonline.org.au/articles/news.asp?news_id=2248. Accessed: 9/5/2009.

Australian Conservation Foundation (ACF), Australian Council of Social Service (ACOSS), Australian Council of Trade Unions (ACTU) & The Climate Institute (2008) *Towards an Effective and Fair Response to Climate Change.* Melbourne, Australia: ACF, ACTU, ACOSS & The Climate Institute. Online: http://www.acfonline.org.au/uploads/res/SXCC_statement_6-7-08.pdf. Accessed: 8/7/2008.

Australian Conservation Foundation (ACF) & Australian Council of Trade Unions (ACTU) (2008) *Green Gold Rush: How ambitious environmental policy can make Australia a leader in the global race for green jobs*. Melbourne, Australia: ACF & ACTU. Online: http://www.acfonline.org.au/uploads/res/Green_Gold_Rush_final.pdf . Accessed 1/11/2008.

Australian Council of Trade Unions (ACTU) (1992) *The Greenhouse Effect: Employment and development issues for Australians*. Melbourne, Australia: ACTU. Online: http://www.cfmeu.com.au/storage/documents/ACTU_GHG_bklt_1992.pdf Accessed 3/8/2008.

Australian Council of Trade Unions (2008) *Principles and Policy on Global Warming: ACTU Position Paper. March, 2008.* Melbourne, Australia: ACTU. Online: http://www.actu.asn.au/Images/Dynamic/attachments/5904/ACTU%20Global%20Warming%20Policy%20March%202008%20final.pdf. Accessed: 21/8/2008.

Australian Council of Trade Unions (2008) *Environmental Challenges, Climate Change, a Greener Economy and Jobs.* Melbourne, Australia: ACTU. Online: http://www.actu.asn.au/Campaigns/CurrentCampaigns/Climatechange.aspx Accessed 28/10/2008.

Australian Council of Trade Unions (2009) *Carbon reduction plan will be good for jobs and good for the environment*. Media release. 4/5/2009. Online: http://www.actu.asn.au/Media/Mediareleases/Carbonreductionplanwillbegoodforjobsandgoodfortheenvironment.aspx Accessed: 14/5/2009.

Australian Council of Trade Unions (2009) *A Fair Society: Environment and Climate Change Policy.* Online: http://www.actu.asn.au/Images/Dynamic/attachments/6562/Climate%20Change%20-%20final.pdf. Accessed: 7/7/2009.

Australian Government (2009) Budget 2009-2010. Online: http://www.budget.gov.au/200910/content/ministerial_statements/climate_change/html/ms_climate_change-05.htm. Accessed: 2/6/2009

Australian Government Department of the Environment Water Heritage & the Arts (2006) *Department of the Environment & Heritage Annual Report 2005–06.* Canberra, Australia: Australian Government. Online: http://www.environment.gov.au/about/publications/annual-report/05-06/glossary.html. Accessed: 1/5/2008.

Australian Government Department of Climate Change (2008a*) National Greenhouse Accounts (NGA) Factors.* Canberra, Australia: Australian Government. Online: http://www.climatechange.gov.au/workbook/pubs/workbook-oct2008.pdf Accessed: 24/11//2008.

Australian Government Department of Climate Change (2008b). *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future, White Paper.* Online: http://www.climatechange.gov.au/whitepaper/index.html . Accessed: 15/12/2008.

Australian Government Department of Infrastructure, Transport, Regional Development & Local Government (2008) *Nation Building: Rail, Road, Education and Research and Business* (with the Minister for Resources, Energy & Tourism, Martin Ferguson), 19/9/2008. Canberra, Australia: Office of the Prime Minister of Australia. Online: http://www.infrastructure.gov.au/department/publications/nation_building.aspx . Accessed: 15/12/2008.

Australian Government Department of Education, Employment & Workplace Relations (2008) *Australia's new Workplace Relations System.* Online: http://www.workplace.gov.au/workplace/InTheWorkplace/. Accessed: 22/12/2008.

Australian Greens (2009) Greens boost for local jobs and unemployed. Mediarelease, 12/2/2009. Online: http://bob-brown.greensmps.org.au/content/media-release/greens-boost-local-jobs-and-unemployed. Accessed: 25/2/2009.

Australian Industry Greenhouse Network (2008), *The Carbon Pollution Reduction Scheme Green Paper on Greenhouse Gas Emissions Trading Scheme Design: AIGN Submission*. Kingston, ACT, Australia: AIGN.

Australian Industry Group (2007) Submission to the Prime Minister's Task Group on Emissions Trading. Sydney, Australia: AIG. Online:

http://pdf.aigroup.asn.au/publications/reports/general_reports/Submission_to_Prime%20Minister_Task_Group_Emissions_Trading_March07.pdf. Accessed: 2/6/2008.

Australian Industry Group (2008), *Ai Group renews call for gentle start to emissions trading*, Newsletter, September 2008. Sydney, Australia: AIG. Online: http://www.aigroup.asn.au/scripts/cgiip.exe/WService=aigroup/ccms.r?Roxy=0x000a835aandPageId=4456. Accessed: 14/09/2008.

Australian Industry Group (2009) *Ai Group welcomes changes to CPRS*. Mediarelease, 4/5/2009. Online: http://www.aigroup.com.au/. Accessed: 14/5/2009.

Australian Labor Party (2007a) *New Directions For Australia's Coal Industry: The National Clean Coal Initiative*. Canberra, Australia: ALP.

Australian Labor Party (2007b) *Securing a sustainable energy supply for Australia's future.* Canberra, Australia: ALP.

Australian Labor Party (2009) *50,000 new green jobs and skills training. Media*release, 30/7/2009.. Online: http://www.alp.org.au/media/0709/mspm300.php. Accessed: 31/7/2009.

Australian Manufacturing Workers Union (2006a) *Climate Change: A Threat Presenting Opportunities for Australian Science, Engineering and Manufacturing*. Granville, Australia: AMWU National Office.

Australian Manufacturing Workers Union (2006b) *AMWU Submission to the House of Representatives Employment, Workplace Relations and Workforce Participation Committee Inquiry into Employment in Automotive Component Manufacturing.* Granville, Australia: AMWU National Office.

Australian Manufacturing Workers Union (2007) *Australian manufacturing: A vision for the future.* Granville, Australia: AMWU National Office.

Australian Manufacturing Workers Union (2008a) *Making our Future: Just Transitions for climate change mitigation.* Granville, Australia: AMWU National Office. Online: http://www.amwu.org.au/content/upload/files/report/making-our-future_0708.pdf. Accessed 1/8/2008.

Australian Manufacturing Workers Union (2008b) *Climate Change: A Threat Presenting Opportunities for Australian Science, Engineering and Manufacturing.* Policy adopted at 2008 Annual Conference, Newcastle, Australia. Granville Australia, AMWU National Office.

Australian Mining (2008) *Government wants more from NSW coal*, 7/11/ 2008 Online: http://www.miningaustralia.com.au/Article/Government-wants-more-from-NSW-coal/430145.aspx. Accessed: 12/6/2009.

Australian Workers Union (2008) *The national emissions trading scheme*

AWU Position Paper, July 2008. Sydney, Australia: AWU. Online: http://www.awu.net.au/emissions_trading_scheme_a1_22_july_2008.pdf Accessed: 20/10/2008.

Auty, R. (1993) *Sustaining Development in Resource Economies: The Resource Curse Thesis.* London & New York, USA: Routledge.

Auty, R. (1998) *Resource Abundance and Economic Development–Improving the Performance of Resource-Rich Countries*, Research for Action 44. Helsinki, Finland: United Nations University World Institute for Development Economics Research.

Auty, R. & Warhurst, A. (1993) Sustainable development in mineral exporting economies, *Resources Policy*, 19. 1: 14-29.

Ayres, R. & Ayres, L. (2002) *A handbook of industrial ecology.* Cheltenham, UK. Edward Elgar Publishing.

Ayres, R. Castaneda, B. Cleveland, C., Costanza, R., Daly, H., Folke, C., Hannon, B., Harris, J., Kaufmann, R., Lin, X., Norgaard, R., Ruth, M., Spreng, D., Stern, D. & van den Bergh, J. (1996) *Natural Capital, Human Capital, and Sustainable Economic Growth*. Paper prepared from a workshop on Assessing the Role of Human and Natural Capital in Economic Production, Center for Energy & Environmental Studies, August 2-3, 1996, Boston University. Boston, MA, USA. Online: http://www.bu.edu/cees/research/workingp/pdfs/9702.pdf . Accessed: 2/12/2008.

Azapagic, A. (2004) Developing a framework for sustainable development indicators for the mining and minerals industry, *Journal of Cleaner Production,* 12, 6 (August 2004): 639-662.

Baer, P., Athanasiou, T., Kartha, S. & Kemp-Benedict, E. (2008) *The Greenhouse Development Rights Framework: The right to development in a climate constrained world, 2nd edition.* Berlin, Germany: Heinrich Böll Foundation, Christian Aid, EcoEquity & the Stockholm Environment Institute. Online: http://www.sei-us.org/climate-and-energy/GDR-second-edition.pdf. Accessed: 2/12/2008.

Bagguley, P. (1992) Social Change, the Middle Class and the Emergence of "New Social Movements": A Critical Analysis, *Sociological Review*, 40: 26-48.

Bahn, A. & Gowdy, J. (2003) Economics Weak and Strong: Ecological Economics and Human Survival, *World Futures,* 59,3/4: 253–262.

Bahro, R. (1982) *Socialism and Survival*. London, UK: Heretic Books.

Bahro, R. (1986) *Building the Green Movement.* London, UK: Heretic Books.

Baker, R., Davies, J. & Young, E. (eds) (2001) *Working on country: Indigenous environmental management in Australia.* Melbourne, Australia: Oxford University Press.

Bandura, A. (1977) *Social learning theory*. Englewood Cliffs, NJ, Prentice Hall.

Bandy, J. & Smith, J. (eds) (2004) *Coalitions Across Borders: Negotiating Differences and Unity in Transnational Struggles Against Neoliberalism.* Lanham, MD, USA: Rowman & Littlefold.

Banks, A. (1992). The power and promise of Community Unionism. *Labor Research Review* 18: 16 ‐ 31.

Banville, M., Brady, A., LaCount, R. (2008) *Crossing the Divide: The Future of Clean Energy.* Cambridge, MA, USA: Cambridge Energy Research Associates.

Bar-Yam, Y. (2006) *Making Things Work: Solving Complex Problems in a Complex World.* Cambridge, MA, USA: Knowledge Press.

Barrett, G. (2001) Closing the Ecological Cycle: The Emergence of Integrative Science. *Ecosystem Health*, 7: 79-84.

Barry, J. (2002) Green + Blue = Powerful Alliance. *The Planet Newsletter,* Sierra Club, June 2002. Online: http://www.sierraclub.org/planet/200205/green.asp. Accessed: 2/12/2006.

Barry, J. & Eckersley, R. (eds) (2005) *The State and the Global Ecological Crisis*. Cambridge, MA, USA: MIT Press.

Basiago, A. (1995) Methods of Defining Sustainability, *Sustainable Development,* 13: 109-199.

Bastida, E., Waelde, T., Warden, J., Warden-Fernández, J. (2005) *International and comparative mineral law and policy: Trends and prospects*. Leiden, The Netherlands: Kluwer Law International.

Bawden, R., Guijt, I. & Woodhill, J. (2007) The critical role of civil society in fostering societal learning for a sustainable world. In A. Wals (ed.) *Social Learning Towards a Sustainable World: Principles, perspectives and praxis.* Wageningen, The Netherlands: Wageningen Academic.

Baxter, B. (2005) *A theory of ecological justice*. London, UK & New York, NY, USA: Routledge.

Beattie, P. (2007) *Queensland Government Invests In A Climate Smart Future*. MediaStatement from the Office of the Premier & Minister for Trade, 3/6/2007. Online: http://www.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=52184 Accessed: 30/8/2008.

Beck, U. (1992) *Risk Society, Towards a New Modernity,* (translated by M. Ritter). London, UK: SAGE.

Beder, H. (1996) Popular Education: An Appropriate Educational Strategy for Community-Based Organisations, *New Directions for Adult and Continuing Education*: 78-83.

Beder, S. (1996) *The Nature of Sustainable Development* (2nd ed). Melbourne, Australia: Scribe Publications.

Beder, S. (2000) *Global spin: The corporate assault on environmentalism*.,Carlton North, Vic, Australia: Scribe Publications.

Beder, S. (2006) *Environmental Policies and Principles: An Interdisciplinary Approach*. Sydney, Australia: University of New South Wales Press.

Beer, A., Maude, A. & Pritchard, B. (2003) *Developing Australia's Regions: Theory and Practice.* Sydney, Australia: University of NSW Press.

Benyus, J. (2002) *Biomimicry: Innovation Inspired by Nature*. New York, NY, USA: Harper Perennial.

Berg, P. (ed.) (1978) *Reinventing a Separate Country: A Bioregional Anthology of Northern California.* San Francisco, CA, USA: Planet Drum Foundation.

Bergevin, P. (2006) *Energy Resources: Boon or Curse for the Canadian Economy?*, Parliamentary Information & Research Service (PIRS) of the Canadian Library of

Parliament. Online: http://www.parl.gc.ca/information/library/PRBpubs/prb0586-e.htm#thediagnosis. Accessed: 10/6/2008.

Berkes, F. (1999) *Sacred ecology: traditional ecological knowledge and management systems*. Philadelphia, PA, USA & London, UK: Taylor & Francis.

Berkes, F. & Folke, C. (1992) A Systems Perspective on the Interrelations Between Nature, Human-Made and Cultural Capital, *Ecological Economics*, 5: 1-8.

Berkes F. & Folke, C. (eds) (1998) *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge, UK: Cambridge University Press.

Berkes, F. & Folke. C. (2002) Back to the future: ecosystem dynamics and local knowledge. In L. H. Gunderson & C. S. Holling (eds) *Panarchy: understanding transformations in human and natural systems.* Washington, D.C., USA: Island Press.

Berkes, F., Colding, J. & Folke, C. (2000) Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10: 1251–1262.

Berkes, F., Colding, J. & Folke, C. (eds) (2003) *Navigating social–ecological systems: Building resilience for complexity and change.* Cambridge, UK: Cambridge University Press.

Bezdek R. (2007) Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century. American Solar Energy Society.

BHP (1999) *Submission to the Australian House of Representatives Inquiry into issues specific to workers over 45 years of age seeking employment, or establishing a business, following unemployment.* Online: http://www.aph.gov.au/house/committee/ewr/Owk/subs/sub161.pdf. Accessed: 28/9/2009.

Biegler, T. (2009) *The Hidden Costs of Electricity: Externalities of Power Generation in Australia.* Parkville, Vic, Australia: Australian Academy of Technological Sciences & Engineering (ATSE).

Biermann, F. (2007) Earth system governance as a cross-cutting theme of global change research, *Global Environmental Change*, 17, 3-4: 326-337

Biermann, F. & Bauer, S. (eds) (2005) *A World Environment Organization*. Aldershot, UK: Ashgate.

Bill, A., Welters, R., Rutovitz, J., Evans, G. & Mitchell, W. (2008) *A Just Transition to a Renewable Energy Economy in the Hunter Region, Australia*. Newcastle, Australia: Centre of Full Employment & Equity (CofFEE), University of Newcastle.

Binder, M., Jänicke, M., & Petschow, U. (eds.). (2001). *Green Industrial Restructuring: International Case Studies and Theoretic Interpretations*. Berlin, Germany: Springer.

Birdsall, N., Pinckney, T. & Sabot, R. (2000) *Natural Resources, Human Capital, and Growth*, Carnegie Endowment Working Papers, Global Policy Program 9. Washington, DC, USA: Carnegie Endowment for International Peace.

Bjureby, E., Britten, M., Cheng, I., Kaźmierska, M., Mezak, E., Munnik, V. Nandi, J., Pennington, S., Rochon, E., Schulz, N., Shahab, N., Vincent, J. & Wei, M. (2008) *The True Cost Of Coal: How people and the planet are paying the price for the world's dirtiest* *fuel.* Amsterdam, The Netherlands: Greenpeace International. Online: http://www.greenpeace.org/raw/content/international/press/reports/cost-of-coal.pdf . Accessed: 1/1/2009.

Bladen, F. (ed.) (1896) Letter from Governor King to Sir Joseph Banks 28 September, 1800 (Banks Papers): Excerpts from Historical Records of New South Wales. Vol. IV. Hunter & King, 1800. Online: http://www.newcastle.edu.au/service/archives/coalriver/pdf/1800_28thseptb.pdf. Accessed: 12/6/2008.

Bligh, A. (Queensland Deputy Premier, Treasurer & Minister for Infrastructure) & Wilson, G. (Minister for Mines & Energy) (2007) *SEQ power supply secure in face of drought*. Media Statement, 08/03/2007. Online: http://statements.cabinet.qld.gov.au/MMS/StatementDisplaySingle.aspx?id=50758. Accessed: 20/6/2008.

Blue Green Alliance (2009) *About the Blue Green Alliance.* Online: http://www.bluegreenalliance.org/site/c.enKIITNpEiG/b.3416603/k.DD10/About_BGA.htm Accessed: 28/2/2009.

Blyton, G., Heitmeyer, D. & Maynard, J. (2004) *Wannin thanbarran: a history of Aboriginal and European contact in Muswellbrook and the Upper Hunter Valley.* Muswellbrook, Australia: Muswellbrook Shire Aboriginal Reconciliation Committee.

Boggs, C. (1976) *Gramsci's Marxism*. London: Pluto Press.

Boin, A. & Lagadec, P. (2000) Preparing for the Future: Critical Challenges in Crisis Management, *Journal of Contingencies and Crisis Management*, 8, 4: 185-191.

Bookchin, M. (1962) *Our Synthetic Environment*. New York, NY, USA: Alfred A. Knopf.

Bookchin, M. (1971) *Post-Scarcity Anarchism.* San Francisco, CA, USA: Ramparts Press.

Bookchin, M. (1980) *Towards an ecological society*. New York, NY, USA: Black Rose Books.

Bookchin, M. (1982) *The Ecology of Freedom: The Emergence and Dissolution of Hierarchy.* Palo Alto, CA, USA: Cheshire.

Bookchin, M. (1990) *Remaking Society: Pathways to a Green* Future. Boston, MA, USA: South End Press.

Bookchin, M. (1993) What is Social Ecology? In M. Zimmerman (ed*), Environmental Philosophy: From Animal Rights to Radical Ecology* (Englewood Cliffs, N.J., USA: Prentice Hall.

Booth, C.J. Spande, E.D. Pattee, C.T. Miller, J.D. & Bertsch L.P. (1998), Positive and negative effects of longwall mine subsidence on a sandstone aquifer, *Environmental Geology*, 34: 223-233.

Borland, J, Gregory, B. & Sheehan, P (eds) (2001) *Work rich, work poor: inequality and economic change in Australia*. Melbourne, Australia: Centre for Strategic Economic Studies, Victoria University.

Botterill, L. C. & Fisher, M. (2003) (eds) Melanie Fisher (2003) Beyond Drought: People, Policy and Perspectives. Canberra, Australia: CSIRO.

Boughton, B. (1997) Does Popular Education Have a Past? In B. Boughton, T. Brown & G. Foley (eds.), *New Directions in Australian Adult Education*. Sydney, Australia: University of Technology Sydney (UTS) Centre for Popular Education.

Boughton, B. (2005) 'The Workers' University': Australia's Marx Schools. In J. Crowther, V. Galloway & I. Martin (eds.) *Popular education: Engaging the academy: international perspectives*. Leicester, UK; National Institute of Adult Continuing Education (England & Wales).

Boughton, B., Taksa, T. & Welton, M. (eds.) (2004) *Histories of Adult Education and Training Australia*. St Leonards, Australia: Allen & Unwin.

Bowden B. & Russell, B. (2000) Benchmarking, Global Best Practice and Production Renorming in the Australian Coal Industry: The Impact of Globalisation. In S. McBride & J. Wiseman (eds), *Globalisation and Its Discontents.* Basingstoke, UK: Palgrave Macmillan.

Bradshaw, M. & Stratford, E. (2005) Qualitative Research Design and Rigour. In I. Hay (ed.) *Qualitative Methods in Human Geography.* South Melbourne, Australia: Oxford University Press.

Braithwaite, J., & Drahos, P. (2000) *Global Business Regulation*. Cambridge, UK: Cambridge University Press.

Branaghan, M. & Boughton, B. (2003) How do you learn to change the world? Learning and Teaching in Australian Protest Movements. *Australian Journal of Adult Learning,* 43, 3: 346-60.

Brayshaw, H. (1986) *Aborigines of the Hunter Valley: A Study of Colonial Records.* Scone, Australia: Scone & Upper Hunter Historical Society.

Brecher, J. & Costello, T. (1990) (eds) *Building Bridges: The merging grassroots coalition of labor and community.* New York, NY, USA: Monthly Review Press.

Brecher, J., Costello, T. & Smith, B. (2000) *Globalisation From Below: The Power of Solidarity*, Boston, MA, USA: South End Press.

Breit, H., Engels, A., Moss, T. & Troja M. (eds) (2003) *How Institutions Change: Perspectives on Social Learning in Global and Local Environmental Contexts*. Leverkusen, Germany: C.W. Leske Verlag + Budrich GmbH.

Brendow, K. (2004) Global and Regional Coal Demand Perspectives to 2030 and Beyond, in *Sustainable Global Energy Development: The case of coal*. London, UK: World Energy Council. Online: http://87.224.35.42:8190/wec-geis/publications/reports/coal04/perspectives/perspectives.asp . Accessed: 12/6/2008.

Brereton, D., Moran, C., McIlwain, G., McIntosh, J., Parkinson, K. (2008) *Assessing the Cumulative Impacts of Mining on Regional Communities: An Exploratory Study of Coal Mining in the Muswellbrook Area of NSW.* Brisbane, Australia: Centre for Social Responsibility in Mining, University of Queensland

Bridgman, H. (2000) Weather, Climate and Air Quality: The Hunter's Atmosphere. In P. McManus, P. O'Neill & R. Loughran (eds) *Journeys: The Making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

Broad, D. (1995) Globalization and the casual labor problem: History and prospects, *Social Justice*, 22,3/61: 67-91

Broad, J. (1999) Contraction and Convergence, *The Ecologist*, 29, 2: 141-142.

Brofenbrenner, K. & Juravich, T. (1998) It takes more than house calls: organizing to win with a comprehensive union building strategy. In K. Brofenbrenner, K. Friedman, R.W. Hurd, R.A. Oswald & R.L. Seeber (eds), *Organizing to Win: New Research on Labor Strategies*. Ithaca, NY, USA: ILR Press.

Bromley, D. (ed) (1992) *Making the commons work: Theory, practice, and policy*. San Francisco, CA, USA: Institute for Contemporary Studies.

Brooks, A.P. (2003) A conceptual model of geomorphic changes to catchments and river channels in south-eastern Australia since European settlement – causes and implications. In G. Albrecht (ed.) *Airs Waters Places Transdisciplinary Conference on Ecosystem Health in Australia*. Newcastle, Australia: University of Newcastle: 62–89.

Brown, G. (2007) Golden handcuffs have a hold on Hunter Valley mine workers: *Interview for PhD research.* 1/12/2007, Muswellbrook, Australia.

Brown, L. (2001) *Eco-Economy: Building an Economy for the Earth.* New York, NY, USA & London, UK: W. W. Norton.

Brown, L., Flavin, C., Postel, S. (1992) *Saving the Planet: How to Shape an Environmentally Sustainable Global Economy*. London, UK: Earthscan.

Brown, P. & Garver, G. (2009) *Right Relationship: Building a Whole Earth Economy*. San Francisco, CA, USA: Berrett-Koehler.

Brunckhorst, D. (2000) *Bioregional Planning: Resource Management Beyond the New Millennium.* Amsterdam, The Netherlands: Harwood Academic.

Bryant, B. (1995) *Environmental Justice: Issues, Policies and Solutions.* Washington DC, USA: Island Press.

Buck L, Wollenberg E, Edmunds D (2001) Social learning in the collaborative management of community forests: lessons from the field. In E.Wollenberg, D. Edmunds, L. Buck, J. Fox, S. Brodt (eds) *Social learning in community forests.* Desa Putera, Indonesia: SMK Grafika.

Buck, S.1998) *The Global Commons: An Introduction*. Washington DC, USA: Island Press.

Bullard, R. (1990) *Dumping in Dixie: Race, Class and Environmental Quality.* Boulder, CO, USA: Westview Press.

Bullard, R. (1999) Environmental justice challenges at home and abroad. In N. Low (ed.) *Global Ethics and Environment.* London, UK: Routledge.

Bullard, R. (ed) (1993) *Confronting Environmental Racism: Voices from the Grassroots*. Boston, MA, USA: South End Press.

Bullard, R.D., 2000, Climate Justice and People of Color, Environmental Justice Resource Centre, Clark Atlanta University, USA, Online: http: www.ejrc.cau.edu. Accessed 1/6/2004.

Bullard, R. (2005) Environmental Justice in the Twenty First Century. In R. Bullard (ed.) *The Quest for Environmental Justice: Human Rights and the Politics of Pollution.* San Francisco, CA, USA: Sierra Club Books.

Burgess, J, Mitchell, W & Preston, A. (2003) The Australian labour market in 2002, *The Journal of Industrial Relations*, 45, 2: 125-150.

Burgmann, M. & Burgmann, V. (1998) *Green bans, red union: environmental activism and the New South Wales Builders Labourers' Federation.* Sydney, Australia: UNSW Press.

Burgmann, V. (1995) *Revolutionary Industrial Unionism. The Industrial Workers of the World in Australia*. Melbourne, Australia: Cambridge University Press.

Burgmann, V. (2003) *Power, Profit and Protest, Australian Social Movements and Globalisation.* St Leonards, Australia: Allen & Unwin

Burgmann, V., McNaughton, C. & Penney, J. (2002),*Unions and the environment*. Fitzroy, Vic. Australia: Australian Conservation Foundation.

Burrows, M. (2001) Just Transition, *Alternatives*, 27, 1, Winter 2001: 29-32. Vancouver, BC, Canada: Labour Environmental Alliance Society. Online: http://leas.ca/Just-Transition.htm. Accessed: /7/6/2008

Business Week (2008) *Coal & Allied Industries Ltd*. 15/12/2008. Online: http://investing.businessweek.com/research/stocks/earnings/earnings.asp?symbol=CNA.AX Accessed: 15/12/2008.

Business Spectator (2008a) *Geodynamics wins $10m for Hunter Valley project,* 26/11/2008. Online: http://www.businessspectator.com.au/bs.nsf/Article/Geodynamics-wins-10m-for-Hunter-Valley-project-LR8WX?opendocument&src=rss Accessed: 13/3/2009.

Business Spectator (2008b) *Australia cuts thermal coal export growth forecast*, 15/12/2008. Online: http://www.businessspectator.com.au/bs.nsf/Article/Australia-cuts-thermal-coal-export-growth-forecast-MCB2Q?OpenDocument Accessed: 25/2/2009.

Butler, C.D., Oluoch-Kosura,W., Corvalan, C., Fobil, J., Koren, H., Pingali, P., Tancredi, E., & Hales, S. (2006) Human well-being across the scenarios. In: Scenarios Working Group (eds) *Millennium Ecosystem Assessment*. Washington DC, USA: Island Press.

Butler, C., Corvalen, C. & Koren, H., (2005) Human Health, Well-Being, and Global Ecological Scenarios, *Ecosystems*, 8: 153-162.

Button, J. (2008) Greenhouse mafia's scorching approach to climate change, *Eureka Street*, 18, 1: 1-3.

Bystydzienski, J. & Schacht, S. (eds) (2001) *Forging Radical Alliances Across Differences: Coalition Politics for the New Millenium*, New York, NY, USA: Rowman & Littlefold.

Cahill, D. (2005) Neo-liberalism and neo-liberal hegemony in Australia. Paper presented at *Hegemony: Explorations into Consensus, Coercion and Culture*, A workshop at the University of Wollongong, 14 &15 Feb 2005. Online: http://www.uow.edu.au/arts/research/hegemony/events/2005-workshop/damien-cahill.pdf . Accessed: 6/1/2009.

Cahill, D. (2007) The Contours of Neo-liberal Hegemony in Australia, *Rethinking Marxism: A Journal of Economics, Culture and Society*, 19, 2: 221-33.

Callicott, J. Baird (1985) Intrinsic Value, Quantum Theory, and Environmental Ethics. *Environmental Ethics* 7: 275-285.

Camacho, D. (1998) The environmental justice movement: A political framework. In D. Camacho (ed), *Environmental Injustices, Political Struggles: Race, Class and the Environment.* Durham & London, UK: Duke University Press.

Cameron J. & Gibson, K. (2001) Regional communities reinvent economy. In J. Dibden, M. Fletcher & C. Cocklin (eds), *All Change! Gippsland Perspectives on Regional Australia in Transition*, Melbourne, Australia: Monash Publications in Geography & Environmental Science.

Cameron J. & Gibson, K. (2005) Building community economies: A pathway to alternative 'economic' development in marginalised areas. In P. Smyth, T. Reddel & A. Jones (eds) *Community and Local Governance in Australia* Kensington, Australia: UNSW Press.

Cameron, J. & Gibson, K. (2005) Alternative Pathways to Community and Economic Development: The Latrobe Valley Community Partnering Project. *Geographical Research,* 43: 274-286.

Campbell, C. (1997) *The Coming Oil Crisis*. Brentwood, Essex, UK: Multi Science Publishing Co Ltd

Campbell, C. & Laherrère, J. (1998) The End of Cheap Oil*, Scientific American*, March 1998.

Campbell, C. (2005) *Oil Crisis*. Brentwood, UK: Multi Science Publishing Co Ltd

Canadian Auto Workers (2007) *Climate Change and our Jobs: Finding the Right Balance*. St Johns, Nfld, Canada: CLC. Online: http://caw.exmi.ca/whoweare/CAWpoliciesandstatements/pdfs/Environment_Paper_E.pdf. Accessed: 5/10/2008.

Canadian Labour Congress (2000) *Just Transition for Workers During Environmental Change*. Ottawa, ON, Canada: CLC. Online: http://canadianlabour.ca/index.php/just_transition. Accessed: 5/4/2008.

Canadian Labour Congress (2009) *Statement to the House of Commons Standing Committee on Finance Regarding the 2010 Federal Budget*. Online: http://uwfa.files.wordpress.com/2009/08/2010-federal-budget-en.pdf Accessed: 12/8/2009,

Caroona Coal Action Group (2008a) *Letter to Hon Ian Macdonald, MLC Minister for Primary Industries, Minister for Energy, Minister for Mineral Resources*, 25/7/2008. Online: http://www.ccag.org.au/images/stories/pdfs/macdonald25july.pdf . Accessed: 21/10/2008.

Caroona Coal Action Group (2008b) *Songwriters join the anti-mining push.* Online: http://www.ccag.org.au/index.php?option=com_content&task=view&id=72&Itemid=74. Accessed: 21/10/2008.

Caroona Coal Action Group (2009a) *Blockade Continuing.* Online: http://www.ccag.org.au/index.php?option=com_frontpage&Itemid=74. Accessed: 13/03/2009.

Caroona Coal Action Group (2009b) *SOS Action* Online: http://www.ccag.org.au/index.php?option=com_content&task=view&id=82&Itemid=81. Accessed: 13/03/2009.

Caroona Coal Action Group (2009c) *Water Study Welcomed As Farmers Rally Outside NSW Parliament To Protect Prime Farmland.* Online: http://www.ccag.org.au/ Accessed: 13/06/2009.

Carpenter, S. R., & K. L. Cottingham (1997) Resilience and restoration of lakes. *Conservation Ecology*, 1,1. Online: http://www.consecol.org/vol1/iss1/art2/

Carpenter, S. & Folke, C. (2006) Ecology for transformation, *Trends in ecology & evolution*, 21, 6: 309-315.

Carpenter, S., Walker, B., Anderies, J.M. & Abel, N. (2001) From Metaphor to Measurement: Resilience of What to What?, *Ecosystems*, 4: 765-781.

Carpenter, S. R. & Brock. W.A. (2004) Spatial complexity, resilience, and policy diversity: fishing on lake-rich landscapes. *Ecology & Society* 9, 1. Online: http://www.consecol.org/vol9/iss1/art8/.

Carr, Senator K. (2008) *Speech to AMWU National Conference*, 29/7/2008. Newcastle, Australia. Online: http://minister.industry.gov.au/SenatortheHonKimCarr/Pages/ADDRESSTOAMWUANNUAL.aspx. Accessed 6/8/2008

Carr, W. & Kemmis, S. (1986) *Becoming Critical: Education Knowledge and Action Research.* London, UK: Falmer Press.

Carson, L. & Gelber, K. (2001) *Ideas For Community Consultation: A Discussion Of Principles And Procedures For Making Consultation Work.* Sydney, Australia: NSW Government. Online: http://www.planning.nsw.gov.au/planfirst/pdf/principles_procedures_final.pdf. Accessed: 20/5/2006.

Carson, R. (1962) *Silent Spring*. Boston, MA, USA: Houghton Mifflin.

Carter, N. (2007) *The Politics of the Environment: Ideas, Activism, Policy*. New York, NY, USA: Cambridge University Press.

Castells, M. (1997) *The Power of Identity*. Oxford, UK: Blackwell.

Castells, M., Flecha, R., Freire, P., Giroux, H, Macedo, D. & Willis, P. (1999) *Critical Education in the New Information Age*. Oxford, UK: Rowman & Littlefield Publishers Inc.

Cavanagh, J. & Mander, J. (2004) *Alternatives to Economic Globalization: A Better World Is Possible*. San Francisco, CA, USA: Berrett-Koehler Publishers.

Caygill, M. (2002) Do the Labels Matter? Contested Categories and the Movement. Paper given to the 8th Alternative Futures & Popular Protest Conference, 2–4 April, Manchester Metropolitan University.

Centre for Science and Environment (2008) *The agenda for Poznan.* Online: http://www.cseindia.org/equitywatch/pdf/agenda.pdf. Accessed: 2/2/2009

Chain, M. (2005) Mining pains run deep: Community groups form coal alliance, *Newcastle Herald*, date unknown, Newcastle, Australia.

Chambers, N., Simmons, C., Wackernagel, M. (2000) *Sharing Nature's Interest: Ecological Footprints as an Indicator of Sustainability.* London, UK: Earthscan.

Charles, S. & Wood, W. (2008) *Bring it on: Song of solidarity for farmers*. Tamworth, Australia: self-published.

Charmaz, K. (2003) Grounded Theory: Objectivist and Constructivist Methods, in N. Denzin & Y. Lincoln (eds.) *Strategies of Qualitative Inquiry.* Thousand Oaks, CA, USA: SAGE.

Chatterjee, P. & Finger, M. (1994) *The Earth Brokers: Power, politics, and world development*, London, UK: Routledge.

Chatterton, P. (2002) Be Realistic: Demand the Impossible. Moving Towards 'Strong' Sustainable Development in an Old Industrial Region? *Regional Studies,* 36 (5): 552-561.

Chatterton, P. & Style, S. (2001) Putting Sustainable Development into Practice? The role of local policy partnerships networks, *Local Environment,* 6 (4): 439-452.

Choi, B.C.K. & Pak, A.W.P. (2006) Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1, Definitions, objectives, and evidence of effectiveness. *Clinical and Investigative Medicine* 29(6): 351- 364

Chu, S. (2007) *Steven Chu: Coal is my nightmare*, Speech at UC Berkeley in April 2007. Online: http://uk.youtube.com/watch?v=OSekZehD6rc Accessed: 9/1/2009

Christoff, P. (1996) Ecological citizens and ecologically guided democracy. In B. Doherty & M. de Geus (eds.), *Democracy and Green Political Thought. Sustainability, Rights and Citizenship*. London, UK: Routledge.

Christoff, P. (2002) *In Reverse*. Melbourne, Australia: University of Melbourne.

Clapp, J. (2005) Transnational corporations and global environmental governance. In P. Dauvergne (ed) *Handbook of Global Environmental Politics*. Cheltenham, UK: Edward Elgar.

Clapp J., Dauvergne P. (2005) *Paths to a Green World: The Political Economy of the Global Environment*, MIT Press.

Clark, & Dickson, (2003) Sustainability science: The emerging research program, *Proc.Nat.Acad. Sci.*, 100, 14: 8059–8061

Clawson, D. (2003). *The next upsurge: Labor and the new social movements*. Ithaca, NY: Cornell University Press.

Clayton, A. M. H. & Radcliffe, N. J. (1996) *Sustainability: A systems approach.* London, UK: Earthscan.

Climate Action Newcastle (CAN), (2006a) *CAN Action Plan*. Online: http://www.climateaction.org.au/campaigns. Accessed: 13/11/2006.

Climate Action Newcastle (2006b) *Postcard from Newcastle: International Day of Action on Climate Change.* Online: http://www.climateaction.org.au/image/tid/9. Accessed: 5/05/2008.

Climate Action Newcastle (2008) *About Climate Action Newcastle.* Online: http://www.climateaction.org.au/about. Accessed: 25/10/2008.

ClimateMovement.org.au (2008) *Connecting communities active on climate change.* Online: http://www.climatemovement.org.au/about/. Accessed: 24/11/2008.

Clover, D., Follen, S., & Hall, B. (2000). *The nature of transformation: Environmental adult education*. Toronto, ON, Canada: OISE Press.

Coal & Allied (2008) *Our Approach: Environment and Communities*, Online: http://www.coalandallied.com.au/ourapproach/33_environment_and_communities.asp. Accessed: 10/6/2008.

Coal Industry Advisory Board (CIAB) (2002) *Coal in Sustainable Development: Achieving balance in priorities,* Position paper for WSSD in Johannesburg, South Africa. London, UK: International Energy Agency (IEA)/OECD. Online: http://www.iea.org/textbase/papers/2002/coal.pdf. Accessed: 12/6/2004.

Coal Industry Advisory Board d (CIAB) (2006) *Case Studies in the Sustainable Development in the Coal Industry*. London, UK: International Energy Agency & OECD. Online: http://www.nswmin.com.au/__data/assets/pdf_file/6459/CIAB_Case_Studies_2006.pdf. Accessed: 4/6/2006.

Coal Mining (2009) *The mining industry fears it may not be able to bare the true cost of coal,* 11/2/2009. Online: http://www.miningcoal.com.au/Article/The-mining-industry-fears-it-may-not-be-able-to-bare-the-true-cost-of-coal/437774.aspx Accessed: 3/3/2009.

Coal Mining (2009a) *Coal interests dominate hunter film festival,* 9/6/2009. Online: http://www.miningcoal.com.au/article/coal-interests-dominate-hunter-film-festival/484461.aspx Accessed: 153/6/2009.

Coal River Working Party (2006) *Nobbys Coal River Heritage Park*. Newcastle, Australia: University of Newcastle. Online: http://www.newcastle.edu.au/service/archives/coalriver/ Accessed: 4/7/2008.

Cobb, C., Halstead, T. & Rowe, J. (1995) *The Genuine Progress Indicator*. San Francisco, CA, USA: Redefining Progress.

Coben, D. (1998) *Radical Heroes: Gramsci, Freire and the Politics of Adult Education*. New York, NY, USA: Garland.

Cohen, R. & S.M. Rai (eds) (2000) *Global Social Movements*. London, UK: Athlone.

Colley, P. (2002) Political Economy of Mining. In G. Evans, J. Goodman & N. Lansbury (eds.) *Moving Mountains: Communities confront mining and globalisation.* London, UK: Zed Books.

Colley, P. (2005) Australia's power future: coal, gas or what? *Common Cause,* 71**,** 4: 13-14.

Colley, P. (2008) Geoff Evans on climate change and coal, *InSight*, online journal of the, Centre for Policy Development, Sydney, Australia, 28/6/2008. Online: http://cpd.org.au/article/a-just-transition. Accessed: 1/1/2009.

Collins English Dictionary (2000) 5th edition. Online: http://dictionary.reverso.net/ justice Accessed: 25/11/2008.

Collins Essential English Dictionary (2006) Glasgow, UK: HarperCollins Publishers. Online: http://www.thefreedictionary.com/Hot+Spots Accessed: 28/10/2008

Collins, P. (1990) *Black Feminist Thought.* New York, NY, USA: Routledge.

Comerford, J. (1997) *Coal and Colonials: The Founding of the Australian Coal Mining Industry.* Aberdare, NSW, Australia: United Mineworkers of Australia (NSW Northern District Branch of the CFMEU Mining & Energy Division).

Comerford, J. (1979) The Mines. In W.S. Parkes, J. Comerford, J. & M. Lake, (eds.) *Mines, Wines and People: A History of the Greater Cessnock.* Cessnock, Australia: Council of the City of Cessnock.

Commission for Racial Justice. United Church of Christ (1987) Toxic Wastes and Race in the United States: A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites. New York, NY, USA: Public Data Access.

Committee on the Human Dimensions of Global Change (2002) The Drama of The Commons Washington, DC, USA: National Academy Press.

Common, M. & Stagl, S. (2005). *Ecological Economics: An Introduction*. New York, NY, USA: Cambridge University Press.

Commoner, B. (1972) *The closing circle: confronting the environmental crisis*. London, UK: Cape.

Commoner, B. (1990) *Making peace with the planet*.,New York, NY, USA: Pantheon Books.

Commonwealth of Australia (1997) *Nationally agreed criteria for the establishment of a comprehensive, adequate & representative reserve system for forest in Australia. A report by the Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee*. Canberra, Australia: Commonwealth of Australia.

Commonwealth of Australia (2001) *Stronger Regions, A Stronger Australia.* Canberra, Australia: Department of Transport & Regional Services.

Commonwealth Scientific & Industrial Research Organisation (CSIRO) (2006) *The Heat Is On: The Future of Energy in Australia*, A report by the Energy Futures Forum. Canberra, Australia: CSIRO

Commonwealth Scientific & Industrial Research Organisation (CSIRO) (2007a) *Climate Change in the Hunter-Central Rivers Catchment*. Canberra, Australia: NSW Government & CSIRO. Online: http://www.greenhouse.nsw.gov.au/__data/assets/pdf_file/0004/7825/Hunter-CentralRiversDetailedFinal.pdf. Accessed: 1/5/2008.

Commonwealth Scientific & Industrial Research Organisation (CSIRO) (2008a) *Technologies Embodied Energy.* Canberra, Australia: CSIRO. Online: http://www.cmmt.csiro.au/brochures/tech/embodied/index.cfm. Accessed: 13/6/2008.

Commonwealth Scientific & Industrial Research Organisation (CSIRO) (2008b) Newcastle, Australia: CSIRO Energy Centre,. Online: http://www.csiro.au/places/pps66.html Accessed 4/8/2008.

Commonwealth Scientific & Industrial Research Organisation (CSIRO) (2008c) National Solar Energy Centre. Online: http://www.csiro.au/multimedia/pfuq.html Accessed 4/8/2008.

Conca, K. & Dabelko, G. (eds) (2004) *Green Planet Blues: Environmental Politics from Stockholm to Johannesburg*. Boulder, CO, USA: Westview Press.

Connell, R. & Irving, T. (1980) *Class Structure in Australian History: Documents, Narrative and Argument*. Melbourne, Australia: Longman & Cheshire.

Connor, L., Albrecht, G., Higginbotham, N., Freeman, S. & Smith, W. (2004) Environmental Change and Human Health in Upper Hunter Communities of New South Wales, Australia, *EcoHealth*, 1 (Suppl. 2): 47-58.

Connor, L., Higginbotham, N., Freeman, S, & Albrecht, G. (2008) Watercourses and Discourses: Coalmining in the Upper Hunter Valley, New South Wales. *Oceania*, 78, 1: 76-90

Connor, R. & Dovers, S. (2004) *Institutional change for sustainable development.* Northampton, MA, USA: E. Elgar.

Construction, Forestry, Mining & Energy Union - Mining & Energy Division (2007a) *Climate Change Position Paper*. Sydney, Australia: CFMEU - Mining & Energy Division. Online: http://www.cfmeu.com.au/storage/documents/Climate_pol_sep07.pdf. Accessed: 10/6/2008.

Construction Forestry Mining & Energy Union - Mining & Energy Division (2007b) *Climate Change: Policy Backgrounder*. Sydney, Australia: CFMEU Mining & Energy Division. Online: http://www.cfmeu.com.au/index.cfm?section=29andCategory=61andviewmode=contentandContentID=252. Accessed: 10/6/2008.

Construction Forestry Mining & Energy Union - Mining & Energy Division (2007c) *Carbon Capture and Storage: making it happen, A CFMEU position paper*. Sydney, Australia: CFMEU Mining & Energy Division. Online: http://www.cfmeu.com.au/storage/documents/CCS_report_dec07.pdf Accessed: 10/6/2008.

Construction Forestry Mining & Energy Union - Mining & Energy Division (2007d) *Mark O'Neill, ACA, on the role of coal in Australia.* Sydney, Australia: CFMEU Mining & Energy Division. Online: http://www.cfmeu.com.au/index.cfm?section=29&Category=61&viewmode=content&contentid=264 Accessed: 8/1/2009.

Construction Forestry Mining & Energy Union - Mining & Energy Division (2008) Labor's new IR laws restore some fairness – but more still to be done, *Bulletin*, 11, 35. Sydney, Australia: CFMEU Mining & Energy Division. Online: http://www.cfmeu.com.au/index.cfm?section=5&Category=23&viewmode=content&contentid=372 Accessed: 10/12/2008.

Construction Forestry Mining & Energy Union - Mining & Energy Division (2008b) *Historic alliance calls for a national task force on carbon capture and storage.* Media release, 16/4/2008. Sydney, Australia: CFMEU Mining & Energy Division. Online: http://www.cfmeu.com.au/index.cfm?section=5&Category=42&viewmode=content&contentid=353 Accessed: 28/2/2009.

Construction Forestry Mining & Energy Union - Mining & Energy Division (2008c) *CFMEU Response CPRS Green Paper.* Sydney, Australia: CFMEU M & E. Online: http://www.climatechange.gov.au/greenpaper/consultation/pubs/0774-cfmeu.pdf Accessed: 5/5/2009

Corden, W.M. & Neary, J.P. (1982). Booming Sector and De-industrialisation in a Small Open Economy, *The Economic Journal*, 92 (December): 825-848.

Corvalen, C, Hales, S, & McMichael, A, (lead authors) (2005). *Ecosystems and Human-wellbeing Health Synthesis: A report of the Millennium Ecosystem Assessment.* Geneva, Switzerland: World Health Organisation Press.

Costanza R. (1989). What is ecological economics? *Ecological Economics,* 1:1-7.

Costanza, R. (ed.). (1991*) Ecological Economics: The Science and Management of Sustainability*. New York, NY, USA:. Columbia University Press.

Costanza, R. (1992) Toward an operational definition of ecosystem health. In R. Costanza, B.G. Norton & B.D. Haskell (eds) *Ecosystem Health: New Goals for Environmental Management*. Washington, DC, USA: Island Press.

Costanza, R., Norton, B. & Haskell, B. (eds.) (1992) *Ecosystem Health, New Goals for Environmental Management.* Washington DC, USA: Island Press.

Costanza, R. & Daly, H. (1992) Natural capital and sustainable development, *Conservation Biol*ogy, 6, 1: 1-10.

Costanza, R., Olman, S. & Martinez-Alier, J. (eds) (1996) *Getting Down to Earth: Practical Applications of Ecological Economics.* Washington DC, USA: Island Press.

Costanza, R. & Mageau, M. (1999) What is a healthy ecosystem, *Aquatic Ecology*, 33: 105-115.

Costanza, R., Low, B.S., Ostrom, Wilson, J. (eds) (2001) *Institutions*, Ecosystems and *Sustainability*. Boca Raton, FL, USA: Lewis Publishers.

Costanza, R., Graumlich, L. & Steffen, W. (2007) *Sustainability or collapse?An integrated history and future of people on earth.* Cambridge, MA, USA: MIT

Cotter, B. & Hannan, K. (Environs Australia) (1999) *Our Community Our Future: A Guide to Local Agenda 21*. Canberra, Australia: Commonwealth of Australia.

Cox, K. R. (ed.) (1997) *Spaces of Globalization. Reasserting the Power of the local*. New York/ London: The Guilford Press.

Coxhead, I. (2007) A new resource curse? Impacts of China's boom on comparative advantage and resource dependence in Southeast Asia, *World Development,* 35, 7: 1099-1119.

Creswell, J. (1998) *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA, USA: SAGE.

Cronshaw, D., (2006) The coalmine that swallowed a creek: Property owner left high and dry, *Newcastle Herald,* 20/5/2006*.* Newcastle, Australia.

Cronshaw D. & Thompson, F. (2006). Mines strike seam of growing protest, *Newcastle Herald*, 6/6/2006. Newcastle, Australia.

Cronshaw, D. (2008) New gas station in the pipeline, *Newcastle Herald,* 20/3/2008. Newcastle, Australia.

Cubby, B. (2008) Farmers block miner. *Sydney Morning Herald*, 23/7/2008. Sydney, Australia. Online: http://www.smh.com.au/news/national/farmers-block-miner/2008/07/22/1216492448203.html Accessed: 1/8/2008.

Curran G. (2009) Ecological modernization and climate change in Australia, *Environmental Politics*, 18, 2: 201-217.

Daily, G. (ed.) (1997) *Nature's Services: Societal Dependence on Natural Ecosystems*. Washington DC, USA: Island Press.

Daley, G. (1999) Satellite images show Valley scars, *Newcastle Herald*, 2/11/ 1999. Newcastle, Australia.

Daly, H. (1977) *Steady State Economics.* London, UK: Earthscan.

Daly, H. (1980) *Economics, Ecology, Ethics: Essays toward a steady-state economy*. New York, NY, USA: W.H.Freeman & Co

Daly, H. (1990) Towards some operating principles of sustainable development, *Ecological Economics*, 2: 1-6.

Daly, H. (1992) Allocation, distribution, and scale: towards an economics that is efficient, just and sustainable, *Ecological Economics*, 6: 185-193.

Daly, H (1993) The Steady State Economy: Towards a Political Econ0my of Biophysicial Equilibrium and Moral Growth. In H. Daly & K. N. Townsend *Valuing the Earth: Economics, Ecology, Ethics*. Cambridge, MA, USA: MIT Press: 325-363.

Daly, H. (1996) *Beyond Growth: The Economics of Sustainable Development*. Boston, MA, USA: Beacon Press.

Daly, H. (2008) *A Steady-State Economy: A failed growth economy and a steady-state economy are not the same thing; they are the very different alternatives we face.* Opinion piece commissioned by the Sustainable Development Commission, UK (April 24, 2008). Online: http://www.sd-commission.org.uk/publications/downloads/Herman_Daly_thinkpiece.pdf Accessed: 29/01/2009.

Daly, H. & Costanza, R (1992) *Natural Capital and Sustainable Development*, Conservation Biology, 6, 1: 37-46.

Daly, H. & Cobb J (1994) *For the Common Good*. Boston, MA, USA: Beacon Press

Daly, H. & Townsend, K. N. (1993) *Valuing the Earth: Economics, ecology, ethics*. Cambridge, MA, USA: MIT Press.

Daly, K. (1997) Re-placing theory in ethnography: A post-modern view, *Qualitative Inquiry*, 3: 343-366.

Dasgupta P., Heal, G. & Nisbet, J. (1979) *Economic theory and exhaustible resources*. Cambridge, UK: Cambridge University Press.

Davidson, D. J., & Freudenberg, W. R. (1996) Gender and environmental risk concerns: a review and analysis of available research. *Environment and Behavior, 28*, 302-339.

Davis, G. (1995) Learning to Love the Dutch Disease: Evidence from the Mineral Economies, *World Development* 23, 10: 1765-79.

de Blas, A. (2000) Newcastle: A World Leader in Energy Efficiency, *Earthbeat*, Radio National, 8/07/2000. Sydney, Australia: Australian Broadcasting Commission.

Online: http://www.abc.net.au/rn/science/earth/stories/s151155.htm Accessed 12/10/2007.

de Coninck H., Fischer C., Newell R.G., Ueno T. (2008) International technology-oriented agreements to address climate change, *Energy Policy*, 36: 335-356.

Deeg, R. (2001) *Institutional Change and the Uses and Limits of Path Dependency: The Case of German Finance*. Discussion Paper 01/6. Cologne, Germany: Max Planck Institute for the Study of Societies.

de Kruijf, H. & van Vuuren, D., (1998) Following Sustainable Development in Relation to the North-South Dialogue: Ecosystem Health and Sustainability Indicators, *Ecotoxicity and Environmental Safety*, 40: 4-14.

della Porta, D. & Tarrow, S. (2005) (eds) *Transnational Protest and Global Activism*. Lanham, MD, USA: Rowman & Littlefold.

della Porta, D. & Diani, M. (2006) *Social Movements: An Introduction.* Malden, MA, USA: Blackwell.

Dennison, W.C. & Abal, E.G. (1999) *Moreton Bay Study: a scientific basis for the Healthy Waterways Campaign*. Brisbane, Australia: SEQRWQMS.

Denniss, R. (2009) *State of denial: The impact of the CPRS on state government budgets*.,Policy Brief No. 2. Canberra, Australia: The Australia Institute.,

Denzin, N. & Lincoln, Y. (2003) The Discipline and Practice of Qualitative Research. In Denzin, N. & Lincoln, Y. (eds.) *Strategies of Qualitative Inquiry.* Thousand Oaks, CA, USA: SAGE.

Dernbach, J. (2008) *Agenda for a Sustainable America.* Washington, DC, USA: Environmental Law Institute.

de Sombre, E.. (2002) *The Environment and World Politics.* London, UK: Continuum.

Devall, B. & Sessions, G. (1985) *Deep Ecology*. Salt Lake City, UT, USA: Peregrine Smith Books.

Diamond, J. (2005) *Collapse: How Societies Choose to Fail or Succeed*. New York, NY, USA: Penguin.

Diani, M. & McAdam, D. (eds) (2003) *Social Movements and Networks*, Oxford, UK & New York, NY, USA: Oxford University Press.

Dicken, P. (2003) *Global Shift: Reshaping the Global Economic Map in the 21st Century.* London, UK: SAGE Publications.

Diesendorf, M. & Clive Hamilton, C. (eds) (1997) *Human Ecology, Human Economy: Ideas for an Ecologically Sustainable Future*. Sydney, Australia: Allen & Unwin.

Diesendorf, M. (2000) Sustainability and sustainable development. In Dunphy, D., Benveniste, J., Griffiths, A. & Sutton, P. (eds) *Sustainability: The corporate challenge of the 21st century*. St Leonards, NSW, Australia: Allen & Unwin.

Diesendorf, M. (2006) Can geosequestration save the coal industry? In J. Byrne, L. Glover & N. Toly (eds), *Transforming Power: Energy as a Social Project*, Vol. 9, Energy & Environmental Policy Series, Transaction Press.

Diesendorf, M. (2006) *The Base-Load Fallacy.* Canberra, Australia: Energy Science. Online: http://www.energyscience.org.au/FS16%20BaseLoad.pdf. Accessed 7/12/2007.

Diesendorf, M. (2007) *Greenhouse Solutions with Sustainable Energy.* Sydney, Australia: UNSW Press.

Dietz, T. Ostrom, E., Stern, P. (2003). The Struggle to Govern the Commons, *Science*, 302, 5652: 1907-1912.

Dobson, A. (1998) *Justice and the Environment: Conceptions of Environmental Sustainability and Dimensions of Social Justice.* Oxford, UK: Oxford University Press.

Dobson, A. (2003) Social Justice and Environmental Sustainability: Ne'er the Twain Shall Meet. In J. Agyeman, R. Bullard, & B. Evans (eds), *Just Sustainabilities: Development in an Unequal World.* London, UK: Earthscan.

Dobson, A. (2004) *Citizenship and the Environment.* Oxford, UK: Oxford University Press.

Dobson, A. (2005) Citizenship. In A. Dobson & R. Eckersley (eds.), *Political Theory and the Ecological Challenge.* Cambridge: Cambridge University Press.

Dobson, A. (2007) *Green Political Thought.* London, UK: Routledge.

Dobson, A. & Eckersley, R. (2006) *Political theory and the ecological challenge*. Cambridge, UK: Cambridge University Press.

Doherty, B. (2002) *Ideas and Actions in the Green Movement*. London, UK: Routledge.

Doherty, B. & de Geus, M. (eds) (1996) *Democracy and Green Political Thought*. London, UK: Routledge

Doherty, B. & Doyle, T. (2006) Beyond borders: Transnational politics, social movements and modern environmentalisms, *Environmental Politics*, 15, 5: 697 – 712.

Doherty, B. & Doyle, T. (2008) *Beyond Borders: Environmental Movements and Transnational Politics.* London, UK & New York, USA: Routledge.

Dowie, M. (1992) American Environmentalist: A Movement Courting Irrelevance, in *World Policy Journal,* Spring: 67-92.

Doyle, T. (1995) *Australian environmental politics and policy.* Macmillan.

Doyle, T. (2000) *Green Power: The Environment Movement in Australia*. Sydney, Australia: University of New South Wales Press.

Doyle, T. & McEachern, D. (2001) *Environment and Politics*. London, UK & New York, USA: Routledge.

Doyle, T. (2005) *Environmental Movements in Majority and Minority Worlds: A Global Perspective*. New Brunswick, Canada, New York, USA & London, UK: Rutgers University Press.

Drysdale, R., Shimeld, P. & Loughran, R. (2000) The physical landscape of the Hunter Valley. In P. McManus, P. O'Neill & R. Loughran, (eds.) *Journeys: The Making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

Dryzek, J. (1999) Global ecological democracy. In N. Low (ed) *Global Ethics and the Environment.* London, UK: Routledge.

Dryzek, J. (2005) *The Politics of the Earth: Environmental Discourse.* Oxford, UK: Oxford University Press.

Dryzek, J. & D. Schlosberg (eds.) (1998) *Debating the Earth: The Environmental Politics Reader*. Oxford, UK: Oxford University Press.

Dryzek, J., Downes, D., Hunold, C., & Schlosberg, D. (2003) *Green States and Social Movements: Environmentalism in the United States, United Kingdom, Germany and Norway.* Oxford, UK: Oxford University Press.

Duffy, M. (1994) *The Contribution of Mining to Australia's Development.* Ottawa, ON, Canada: International Council on Metals & the Environment.

Dyball, R., Brown, V. & Keen, M. (2007) Towards sustainability: Five strands of social learning. In A. Wals (ed.) *Social learning towards a sustainable world: Principles, perspectives, and praxis.* Wageningen, The Netherlands: Wageningen Academic.

Earsman, W.P. (1920) *The Proletariat and Education. The Necessity for Labor Colleges.* Melbourne, Australia: Andrades.

Earth Charter Initiative (2001) *The Earth Charter*, Stockholm Sweden & San Jose, Costa Rica. Online: http://www.earthcharterinaction.org/2000/10/the_earth_charter.html. Accessed: 12/6/2008.

Echavarría, C. (1999) Indigenous People and Mining: Core Issues – The case of the Wayúu People and the El Cerrejón Coal Development, MERN Working Paper 168. Warwick, UK: University of Warwick.

Echavarría, C. (2003) In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset and A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Eckersley, R. (1992) *Environmentalism and Political Theory: Towards an eco-centric approach.* London, UK: UCL Press.

Eckersley, R. (2004) *The Green State: Rethinking Democracy and Sovereignty.* Cambridge, MA, USA: MIT Press.

Eco Logical Australia (2004) The Impacts of Longwall Mining on the Upper Georges River Catchment: Report to Total Environment Centre. Sydney, Australia: TEC

Ecologically Sustainable Development Steering Committee (ESDSC) (1992) *National Strategy for Ecologically Sustainable Development.* Canberra, Australia: Council of Australian Governments. Online: http://www.deh.gov.au/esd/national/nsesd/strategy/intro.html#WIESD. Accessed: 5/9/2006.

Ecologically Sustainable Development Working Groups (1991) *Final Report – Mining,* Canberra, Australia: Commonwealth of Australia.

Edwards, J. (2006) *The Quiet Boom: How the long economic upswing is changing Australia and its place in the world,* Lowy Institute Paper 14. Sydney, Australia: Lowy Institute.

Eimer, S. (1999) From 'Business Unionism' to 'Social Movement Unionism': The Case of AFL-CIO Milwaukee County Labor Council, *Labor Studies Journal*, 24, 2: 63-81.

Ekins, P. & Max-Neef, M. (eds) (1992) *Real-life Economics.* London, UK: Routledge.

Ellis, L. (2005) *Energy in China Fact Sheet*. Washington DC, USA: China Environment Forum, 2005. Online: http://www.wilsoncenter.org/topics/docs/energy_factsheet.pdf Accessed: 12/12/2008.

Elliott, L. (2004) *The Global Politics of the Environment*. London, UK: Palgrave.

Elliott, L., Hines, C., Juniper, T., Leggett, J., Luca, C., Murphy, R., Pettifor, A., Secrett, C., & Simms, A. (2008) *A Green New Deal: Joined-up policies to solve the triple crunch of the credit crisis, climate change and high oil prices*, report of the Green New Deal Group. London, UK: new economics foundation.

EMET Consultants (2004) Energy efficiency improvement in the commercial sub-sectors. Sydney, Australia: EMET

Energetics. (2004) NFEE: Energy Efficiency Improvement Potential Case Studies – Industrial Sector March 2004.

Energy Supply Association of Australia (ESAA) (2008) *The Energy Industry: Facts in Brief*, Online: http://www.esaa.com.au/the_energy_industry:_facts_in_brief.html Accessed: 12/12/2008.

Environment Australia (2002) *Are We Sustaining Australia? Report Against Headline Sustainability Indicators.* Canberra, Australia: Environment Australia. Online: http://www.deh.gov.au/esd/national/indicators/report/summary.html Accessed: 5/9/2006.

Epstein, P. R. (1995) Emerging diseases and ecosystem instability: new threats to public health. *American Journal of Public Health,* 85: 168-172.

Estill, L. (2008) Small is Possible: Life in a Local Economy. Gabriola Island, BC, Canada: New Society Publishers.

Evans, G. & Smiles, B. (2004) *Challenging the Fossil-Fuel Dinosaur: Grassroots education and organising for 'No New Coal' in the Hunter Region of NSW. Paper* presented at the Popular Education & Social Action Conference, December 6 – 8, 2004. Sydney, Australia: University of Technology.

Evans, G. (2005a) *Hunter coal: Nobody knows what we are going through so this State can be rich.* Sydney, Australia: Mineral Policy Institute Online: http://www.mpi.org.au/campaigns/climate/hunter_coal/ Accessed: 2/3/2008.

Evans, G. (2005b) Now is time to begin cleaning up our act, *Newcastle Herald,* 2/8/2005, Newcastle, Australia.

Evans, G. (2007) A Just Transition from coal to renewable energy in the Hunter Valley, NSW, Australia, *International Journal of Environment, Workplace and Employment*, 3 (3/4): 175-194.

Evans, G. (2008a) Transformation from "Carbon Valley" to a "Post-Carbon Society" in a climate change hot spot: the coalfields of the Hunter Valley, New South Wales, Australia. *Ecology and Society,* 13(1): 39. Online: http://www.ecologyandsociety.org/vol13/iss1/art39/.

Evans, G. (2008b) A sustainable, closed-loop minerals industry, *Chain Reaction*, 103. Melbourne, Australia: Friends of the Earth Australia.

Evans, G., Russell, G. & Sullivan, R. (2002). An international regulatory framework? In G. Evans, J. Goodman & N. Lansbury, *Moving Mountains: Communities confront mining and globalisation.* London, UK: Zed Books.

Evans, M. (1988) Participant Observation: The Researcher as Research Tool. In J. Eyles & D.M. Smith (eds.) *Qualitative Methods in Human Geography*. Cambridge, UK: Polity Press.

Eyerman, R. & Jamison, A., (1991) *Social Movements: A Cognitive Approach*. Cambridge, UK: Polity Press.

Ezzy, D. (2002) *Qualitative Analysis: Practice and Innovation.* St Leonards, Australia: Allen & Unwin.

Faber, D., (ed) (1998) *The Struggle for Ecological Democracy: Environmental Justice Movements in the United States.* New York, NY, USA: The Guildford Press.

Faber, D. & McCarthy, D., 2003. Neo-Liberalism, Globalisation and the Struggle for Ecological Democracy: Linking Sustainability and Environmental Justice. In J. Agyeman, R. Bullard & B. Evans, (eds), *Just Sustainabilities: Development in an Unequal World.* London, UK: Earthscan.

Fairbrother, P. (2008). Social movement unionism or trade unions as social movements. *Employee Responsibilities and Rights Journal*, *20*, 213–220.

Fairclough, N. (2003) *Analysing Discourse: Textual Analysis for Social Research.* London, UK: Routledge.

Fairfax Digital (2009) *Coal & Allied expects grim 2009.* 29/1/2009. Online: http://www.businessday.com.au/business/coal--allied-expects-grim-2009-20090129-7st7.html. Virewed: 28/2/2009

Fals Borda, O. (2001) Participatory (Action) Research in Social Theory: Origins and Challenges. In P. Reason & H. Bradbury (eds.) *Handbook of Action Research: Participative Inquiry and Practice.* London, UK: SAGE.

Fals Borda, O. & Rahman, M. A. (1991) *Action and Knowledge: Breaking the Monopoly with Participatory Action Research.* London, UK: Intermediate Technology Publications.

Farber, H.S. (2005) What do we know about job loss in the United States? Evidence from the Displaced Workers Survey, 1984–2004, *Economic Perspectives*, 29, (2): 13–28.

Farrell, A. & Hart, M. (1998) What Does Sustainability Really Mean? The Search for Useful Indicators, *Environment* 40, 9:26-31.

Farrelly, E. (2008) Sins of emission, *Sydney Morning Herald*, 6/12/2008

Fernandez-Gimenez, M. E., H. L. Ballard & V. E. Sturtevant. 2008. Adaptive management and social learning in collaborative and community-based monitoring: a study of five community-based forestry organizations in the western USA. *Ecology & Society* 13(2): 4. Online: http://www.ecologyandsociety.org/vol13/iss2/art4/

Ferguson, M., Minister for Resources & Energy (2008) *Low Emission Coal Initiatives Announced*. Mediarelease, 28/7/2008. Canberra, Australia: Office of the Minister for Resources & Energy. Online: http://minister.ret.gov.au/TheHonMartinFergusonMP/Pages/lowemissioncoalinitiativesannounced.aspx. Accessed: 26/9/2008.

Ferris D. & Hahn-Baker, D. (1995) Environmentalists and Environmental Justice Policy. In B. Bryant, *Environmental Justice: Issues, Policies and Solutions.* Washington DC, USA: Island Press.

Fisher, W. & Ponniah, W. (2003) *Another World is Possible: Popular Alternatives to Globalization at the World Social Forum.* London, UK: Zed Books

Flannery, T. (2005) *The Weather Makers.* Melbourne, Australia: Text Publishing.

Foley, G. (1999) *Learning in Social Action: A contribution to Understanding informal education.* London, UK: Zed Books.

Foley, G. (2000) *Understanding Adult Education and Training.* St Leonards, Australia: Allen & Unwin.

Folke, C. (2006). Resilience: the emergence of a perspective for social-ecological systems analysis, *Global Environmental Change,* 16, 3: 253-267.

Folke, C., Jansson, A., Larsson, C. & Costanza, R. (1996) Ecosystem Appropriation by Cities. *Ambio*, 26: 167-172.

Folke C., Colding, J. & Berkes, F. (2003) Building resilience for adaptive capacity in social-ecological systems. In F. Berkes, J. Colding & C. Folke (eds). *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge, UK: Cambridge University Press.

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C.S, Walker, B., *et al* (2002) *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations.* Stockholm, Sweden: The Environmental Advisory Council to the Swedish Government. Online: www.unisdr.org/eng/risk-reduction/wssd/resilience-sd.pdf Accessed: 21/11/2008.

Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L. & Holling, C. S. (2004) Regime Shifts, Resilience, and Biodiversity in Ecosystem Management. *Annual Review in Ecology and Systematics,* 35**,** 557-581.

Folke, C., S. Carpenter, B. Walker, M. Scheffer, T. Elmqvist, L. Gunderson & C. S. Holling (2004) Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Evolutionary Systems* 35:557-581.

Folke, C., Hahn, T., Olsson, P. & Norberg, J. (2005) Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources* 30(November): 441-473.

Foran, B., Lenzen, M. & Dey, C. (2005) Balancing Act: A triple bottom line analysis of the 135 sectors of the Australian economy, CSIRO Technical Report. Canberra, Australia: CSIRO Sustainable Ecosystems.

Foweraker, J. (1995) *Theorizing social movements*. Boulder, Co, USA: Pluto Press.

Fowke, R. & Prasad, D. (1996) Sustainable development: Cities and local government. *Australian Planner,* 33**,** 61-66.

Frankel, B. (1987) *The Post-Industrial Utopians*. Cambridge, UK: Polity.

Franklin, M. (2008) Minister dubbed servant of labour movement, *The Australian*, 31/7/2008, Sydney, Australia.

Free Online Dictionary (2009) Online: http://www.thefreedictionary.com/perverse Accessed: 10/2/2009.

Freed, J. (2009) Miners should ride out falling coal demand, *Sydney Morning Herald*, 9/2/2009. Online: http://www.businessday.com.au/business/miners-should-ride-out-falling-coal-demand-20090208-80z8.html Accessed: 23/2/2009.

Freed, J. (2009b) *Hunter coalminer on Rio's sales list,* 13/1/ 2009. Online: http://business.smh.com.au/business/hunter-coalminer-on-rios-sales-list-20090112-7f7q.html Accessed: 28/2/2009.

Freire, P. (1993) *Pedagogy of the Oppressed.* New York, NY, USA: Continuum Publishing Company.

Freire, P. (2004) *Pedagogy of Indignation.* Boulder, CO, USA: Paradigm Publishers.

Frew, W. (2006a) Thirst for coal threatens water supplies. *Sydney Morning Herald,* 17/10/2006. Sydney, Australia.

Frew, W. (2006b). King coal under siege, *Sydney Morning Herald,* 2/12/2006. Sydney, Australia.

Frew, W. (2007). Mine coal dust a worry for locals, *Sydney Morning Herald,*11/12/2007. Sydney, Australia. Online: http://www.smh.com.au/news/environment/mine-coal-dust-a-worry-for-locals/2007/12/11/1197135463529.html. Accessed: 7/9/2008.

Friends of the Earth Australia (FoEA) (2004) *Australian communities demand a shift from coal dependency*. Mediarelease: 15/11/2004. Online: http://www.foe.org.au/media-releases/2004-media-releases/mr_15_11_04.htm Accessed: 12/6/2006.

Friends of the Earth Australia (FoEA) (2007) *Vision statement*. http://www.foe.org.au/about-us/vision-statement. Accessed: 2/7/2009.

Friends of the Earth International (FoEI) (2006a) *Climate justice and energy.* Online: http://www.foei.org/en/campaigns/climate Accessed: 2/1/2009.

Friends of the Earth International (FoEI) (2007) *Voices From Communities Affected By Climate Change.* Amsterdam, The Netherlands: FoEI. Online: http://www.foei.org/en/publications/pdfs/climate-testimonies Accessed: 2/1/2009.

Friends of the Earth International (FoEI) (2008) *Rich nations to blame for climate inaction and rejection of rights*. Media Statement, 12/12/2008 Online: http://www.foei.org/en/media/archive/2008/rich-nations-to-blame-for-climate-inaction-and Accessed: 9/1/2009.

Friends of the Earth International (FoEI) (2009) FoEI speech to the UN climate conference**.** Online: http://www.foei.org/en/blog/2008/12/15/foei-speech-to-the-un-climate-conference. Accessed: 9/2/2009.

Frisco Bay Mussel Group (1977) *Living Here.* San Francisco, CA, USA: Frisco Bay Mussel Group.

Fryer, D., Barraclough, M. & Crooks, R. (2008) *The impact of industry assistance measures under the Carbon Pollution Reduction Scheme, White Paper update*, Research Note: 18/12/2008. New York, NY, USA: Innovest Strategic Value Advisors. Online: http://www.acfonline.org.au/uploads/res/Innovest-Recipients-of-CPRS-assistance-Oct08.pdf. Accessed: 6/1/2009.

Gadgil, M., Olsson, P., Berkes, F. & Folke, C. (2003) Exploring the role of local ecological knowledge for ecosystem management: three case studies. In F. Berkes, J. Colding & C. Folke (eds) *Navigating social–ecological systems: building resilience for complexity and change.* Cambridge, UK: Cambridge University Press,.

Gadotti, M. (2000) *Pedagogy of the Earth and Culture of Sustainability.* Sao Paulo, Brazil: Instituto Paulo Freire.

Gallopín, G. (2002) Planning for resilience: Scenarios, Surprises and Branch Points. In L. H. Gunderson & C. S. Holling (editors) *Panarchy: Understanding transformations in human and natural systems.* Washington DC, USA: Island Press.

Gallopín, G. (2006) Linkages between vulnerability, resilience and adaptive capacity, *Global Environmental Change,* 16: 293-303.

Galvin & Associates (2005) A risk study and assessment of the impacts of longwall mining on Waratah Rivulet and surrounds at Metropolitan Colliery, Commissioned by NSW Department of Primary Industries. Report No: 0504/17-1c. NSW DPI.

Gardner, G. & Sampat, P. (1999) Forging a Sustainable Materials Economy. In *Worldwatch Institute State of the World 1999*. New York, NY, USA: Norton.

Garnaut, R. (2008). *Garnaut Climate Change Review: Interim Report to the Commonwealth, State and Territory Governments of Australia.* Melbourne, Australia. Online: http://www.garnautreview.org.au/CA25734E0016A131/WebObj/GarnautClimateChangeReviewInterimReport-Feb08/$File/Garnaut%20Climate%20Change%20Review%20Interim%20Report%20-%20Feb%2008.pdf. Accessed: 6/6/2008.

Galtung, J. (1994) *Human Rights in Another Key.* Cambridge, UK: Polity Press.

Garrett, P., Minister for the Environment, Heritage & the Arts (2009) *$4.5 Billion clean energy initiative*. Media release (jointly) with Ferguson, M., Minister for Resources & Energy Minister for Tourism, Wong, P., Minister for Climate Change & Water, Carr, K., Minister for Innovation, Industry, Science & Research, 12/5/2009. Online: http://www.environment.gov.au/minister/garrett/2009/budmr20090512i.html. Accessed: 14/5/2009.

Geary, P., Loughran, R. & Timms, B. (2000) Rivers, Lakes and Wetlands. In P. McManus, P. O'Neill & R. Loughran, (eds) *Journeys: The Making of the Hunter Region*. St Leonards, Australia: Allen & Unwin.

Gelb, Alan & Associates (1988) *Oil Windfalls: Blessing or Curse?* New York, NY, USA: Oxford University Press.

Gelbspan, R. (2004) *Boiling Point: How Politicians, Big Oil and Coal, Journalists, and Activists Have Fueled a Climate Crisis - And What We Can Do to Avert Disaster*. New York, NY, USA: Basic Books

Georgescu-Roegen, N. (1971) *The Entropy Law and the Economic Process* (1971). Cambridge, MA, USA: Harvard University Press.

Gereffi, G., Dubay, K. & Lowe, M. (2008) *Manufacturing Climate Solutions: Carbon-Reducing Technologies and U.S. Jobs.* Center on Globalization, Governance & Competitiveness, Duke University. Online: http://www.cggc.duke.edu/environment/climatesolutions. Vewed: 14/5/2009.

German Federal Ministry for the Environment, Nature Conservation & Nuclear Safety. (2006) *Memorandum for a "New Deal" for the economy, environment and employment*. Berlin, Germany: Federal Ministry for the Environment, Nature Conservation & Nuclear Safety. Online: http://www.bmu.de/files/pdfs/allgemein/application/pdf/memorandum_oekol_industriepolitik_eng.pdf. Accessed: 26/9/2008.

German Federal Ministry for the Environment, Nature Conservation & Nuclear Safety. (2007) *Environment – Innovation – Employment: Elements of a European Ecological Industrial Policy*, Working Paper to the Informal Meeting of Environment Ministers in Essen 1st-3rd June, 2007. Berlin, Germany: Federal Ministry for the Environment, Nature Conservation & Nuclear Safety. Online: http://www.eu2007.de/en/News/download_docs/Juni/0601-U/035Arbeitspapier.pdf. Accessed: 26/9/2008.

Geoscience Australia (2007) *Australia's Identified Mineral Resources 2007.* Canberra, Australia: Geoscience Australia.

Gibbs, D. (1998) Regional Development Agencies and Sustainable Development. *Regional Studies,* 32, 4: 365-368.

Gibbs, L. (2003) Decolonising, multiplicities and mining in the Eastern Goldfields, Western Australia, *Australian Geographical Studies,* 41, 1: 17-28.

Gibson-Graham, J.K. & Roelvink, J. (2008) Social innovation for community economies. In D. MacCallum, F. Moulaert, J. Hillier & S. Vicari (eds) *Social Innovation and Territorial Development* London, UK: Ashgate.

Gilchrist, G. (1994) *The big switch: Clean energy for the twenty-first century.* St. Leonards, Australia: Allen & Unwin.

Giurco, D., Warnken, M., Lewis, J., Langham, E. & Cohen, B. (2007) *Latrobe Valley Resources Vision: Future development for business clusters*. Melbourne, Australia: Institute for Sustainable Futures (UTS) & Warnken ISE.

Giurco, D., Evans, G., Cooper C., Mason, L., Franks, D. (2009a). *Mineral Futures Discussion Paper: Sustainability Issues, Challenges and Opportunities*. Prepared for CSIRO Minerals Down Under Flagship, by the Institute for Sustainable Futures, UTS: Sydney & the Centre for Social Responsibility in Mining, University of Queensland.

Giurco, D., Evans, G, Cooper, C, Mason, L., Moffat, K. Littleboy, A. (2009b) *Minerals and sustainability – exploring cross-scale issues and responses.* Paper for presentation at Society for Sustainability & Environmental Engineering Conference (SSEE 09), 23-24/11/2009, Melbourne., Australia.

Glasbergen, P., Biermann, F, Mol, P. J. (2007) *Partnerships, Governance and Sustainable Development: Reflections on Theory and Practice*. Cheltenham, UK: Edward Elgar.

Glaser, B. (1978). *Theoretical Sensitivity.* Mill Valley, CA, USA: Sociology Press.

Glaser, B. & Strauss, A. (1967) *The Discovery of Grounded Theory.* Chicago, IL, USA: Aldine.

Glasser, H. (2007) Minding the gap: The role of social learning in linking our stated desire for a more sustainable world to our everyday actions and policies. In A. Wals (ed.) *Social Learning Towards a Sustainable World: Principles, perspectives and praxis.* Wageningen, The Netherlands: Wageningen Academic Publishers.

Global Carbon Project (2008) *Global Carbon Project figures: Factsheet*, CSIRO. Online: http://www.csiro.au/resources/GlobalCarbonProjectFigures.html#3 Accessed: 25/2/2009

Global Footprint Network (2009) *Fighting Poverty: Our Human Development Initiative*. Online: http://www.footprintnetwork.org/en/index.php/GFN/page/fighting_poverty_our_human_development_initiative/. Accessed: 18/02/2009

Global Info Mine (2007) *Ecologically sustainable development.* Online: http://www.infomine.com/publications/articles/36/937/sustainable.ecology.australia/ecologically.sustainable.development.aspx. Accessed: 30/1/2009.

Global Reporting Initiative (2002) *Sustainability Reporting* Guidelines *2002.* Amsterdam, The Netherlands: GRI. Online: http://www.globalreporting.org/guidelines/2002.asp. Accessed: 6/8/2007.

Global Reporting Initiative (2005) *GRI Mining and Metals Sector Supplement Pilot Version 1.0*, Incorporating an abridged version of the GRI 2002 Sustainability Reporting Guidelines, February 2005. Amsterdam, The Netherlands: GRI. Online: http://www.globalreporting.org/guidelines/sectors/Mining_Pilot1.pdf. Accessed: 6/8/2007.

Gold, R. (1969) Roles in sociological field observation. In G. McCall & J. Simmons (eds) *Issues in Participant Observation: A Text and Reader.* London, UK: Addison Wesley.

Goldemberg J & Johansson TB (eds). (2004) World Energy Assessment Overview 2004 update. New York, NY, USA: United Nations Development Programme.

Goldman B. & Fitton, L. (1994) *Toxic Wastes and Race Revisited*. Washington DC, USA: Center for Policy Alternatives, National Association for the Advancement of Colored People, United Church of Christ.

Goldman, M (1998) *Privatizing Nature: Political Struggles for the Global Commons.* Chapel Hill, NC, USA: Rutgers University Press.

Gollan, R. (1963) *Coalminers of New South Wales: A History of the Union, 1860-1960.* Melbourne, Australia: Melbourne University Press.

Goodin, R. (1992) *Green Political Theory*. Cambridge, MA, USA: Polity Press.

Goodman, J. & Worth, D. (2008) The Minerals Boom and Australia's 'Resource Curse', *Journal of Australian Political Economy*, 61.

Gonsalves, J., T., Becker, A., Braun, D., Campilan, H., De Chavez, E., Fajber, M., Kapiriri, J., Rivaca-Caminade & Vernooy, R. (2005) *Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook.* Laguna, Philippines & Ottawa, Canada: International Potato Center-Users' Perspectives With Agricultural Research & Development & the International Development Research Centre.

Gordon, T. (2002) Dust storm: Lead contamination in Lake Macquarie. In K. McPhillips (ed) *Local heroes: Australian crusades from the environmental frontline*. Annandale, Australia: Pluto Press.

Gordon, K., Hays, J., Sompolinsky, L. Tan, E., Tsou, J. (2007) *Community Jobs in the New Economy*. San Francisco, CA, USA: Apollo Alliance & Urban Habitat Online: http://apolloalliance.org/downloads/resources_Community_Jobs_in_the_Green_Economy.pdf. Accessed: 19/4/2009.

Gordon, K. & Hays, J. (2008) *Green-Collar Jobs In America's Cities: Building Pathways Out of Poverty and Careers in the Clean Energy Economy*. San Francisco, CA, USA: Green For All, Apollo Alliance.

Gottlieb, R. (2005). *Forcing the spring: The transformation of the American environmental movement* (Rev. ed.). Washington, DC, USA: Island Press.

Gowdy, J. & O'Hara, S. (1997) Weak sustainability and viable technologies, *Ecological Economics*, 22, 3: 239-47.

Gowdy, J.M. & McDaniel, C. (1999) The Physical Destruction of Nauru: An Example of Weak Sustainability, *Land Economics*, 75, 2:333-338.

Graedel, T. E. & Allenby, B. R. (2003) *Industrial ecology*, 2nd ed. Upper Saddle River, NJ, USA: Prentice Hall

Graham-Brown, S. (1991) *Education in the Developing World. Conflict and crisis*. London, UK: Longman.

Gramsci, A. (1971) *Selections from the Prison Notebooks.* New York, NY, USA: International Publishers.

Gray, R. (2007) Practical bioregionalism: a philosophy for a sustainable future and a hypothetical transition strategy for Armidale, New South Wales, Australia, *Futures*, 39, 7: 790-806.

Green For All (20098) *Green Pathways Out of Poverty: Workforce Development Initiative*. Oakland, CA, USA: Green For All. Online: Accessed: 12/6/2009

Greenpeace Australia Pacific (2006a) Activists halt Australian coal export to Thailand. Sydney, Australia: Greenpeace Australia Pacific. Online: http://www.greenpeace.org/australia/news-and-events/news/Climate-change/thai-coal-export. Accessed: 9/12/2006.

Greenpeace Australia Pacific (2006b) *Climate change and clean energy: What the powerholders should do*. Sydney, Australia: Greenpeace Australia Pacific. Online: http://www.greenpeace.org/australia/issues/climate-change/government. Accessed: 12/6/2008.

Greenpeace Australia Pacific (2007) *A way forward for coal communities*. Sydney, Australia: Greenpeace Australia Pacific. Online: http://www.greenpeace.org/raw/content/australia/resources/fact-sheets/climate-change/a-way-forward-for-coal-communi.pdf Accessed: 1/5/2008.

Greenpeace Australia Pacfic (2008) *Just Transitions*. Online: http://www.greenpeace.org/raw/content/australia/resources/fact-sheets/climate-change/just-transitions.pdf Accessed: 26/3/2009.

Greenpeace Australia Pacfic (2008b) Renewable energy 'Silicon Valley': Hunter region jobs boost if Rudd ensures a 'just transition' for workers. Media release, 1/7/2008. Online: http://www.greenpeace.org/australia/news-and-events/media/releases/climate-change/renewable-energy-silicon-vall.Accessed: 26/7/2009.

Greenpeace Australia Pacific (2009) *ETS still off target*. Mediarelease, 4/5/2009. Online: http://www.greenpeace.org/australia/news-and-events/media/releases/climate-change/ets-still-off-target Accessed: 5/5/2009.

Greenpeace International (2008) *Clean Development Mechanism: no place for Carbon Capture and Storage* Online: http://www.greenpeace.org/raw/content/international/press/reports/CCS-CDM.pdf Accessed: 8/1/2009.

Greenwood, D. & Levin, M. (2000) Reconstructing the Relationships Between Universities and Society Through Action Research. In N. Denzin & Y. Lincoln (eds) *Handbook of Qualitative Research*. Thousand Oaks, CA, USA: SAGE.

Greer, J. & Bruno, K. (1997) *Greenwash: The Reality Behind Corporate Environmentalism*. New York, NY, USA: Apex Press.

Gregory, R. (1976) Some Implications of the Growth of the Mineral Sector, *The Australian Journal of Agricultural Economics*, 20: 72-91.

Grierson, S. (2007) Being energy leaders is right up our Valley. *Newcastle Herald, 2/8/2007,* Newcastle, Australia.

Grierson, S. (2008) *CPRS White Paper Gets The Balance Right*. MediaRelease, 16/12/2008. Online: http://www.sharongrierson.com/SharonGrierson/resources/081215_cprs.pdf Accessed: 8/1/2009

Grierson, S. & Ferguson, M. (2008) *CCS Legislation Open For Public Consultation. Media*Release, 22/5/2008. Online: http://www.sharongrierson.com/SharonGrierson/resources/080522_ccs.pdf Accessed: 8/1/2009.

Griffin, G. & Svensen, S. (1996),The Decline of Australian Union Density - A Survey of the Literature, Journal of Industrial Relations, 38, 4: 505-547

Grin, J. & Loeber, A. (2006) Theories of Policy Learning: Agency, Structure and Change. In F. Fischer, G. Miller & M. Sidney (eds.) *Handbook of Public Policy Analysis: Theory, Politics and Methods.* London, UK: Taylor & Francis.

Grothen, J. (1988) *The History in and about Glenrock Lagoon*. Newcastle, Australia: Self-published.

Grove, R. H. 'Colonial conservation, ecological hegemony and popular resistance: towards a global synthesis. In J. M. MacKenzie (ed) Imperialism and the natural world, Manchester, UK: Manchester University Press

Grove-White, R., Kearnes, M., Macnaghten, P. & Wynne, B., (2006) Nuclear Futures: Assessing Public Attitudes to New Nuclear Power, *The Political Quarterly*, 77(2), April-June 2006: 238-246.

Grunwald, M. (2008) Obama's Agenda: Get America Back on Track: A New 'New Deal', *Time*. Online: http://www.time.com/time/specials/packages/article/0,28804,1856381_1856380,00.html. Accessed: 24/11/2008

Guba, E. & Lincoln, Y. (1994) Competing Paradigms in Qualitative Research. In N. Denzin & Y. Lincoln (eds) *Handbook of Qualitative Research*, Thousand Oaks, CA, USA: SAGE.

Gubrium, J. & Holstein, J. (1997) *The New Language of Qualitative Method.* New York, NY, USA: Oxford University Press.

Guha, R. & Martinez-Alier, J. (1997) *Varieties of Environmentalism: Essays North and South*. London, UK: Earthscan.

Guigni, M., McAdam, D. & Tilly, C. (eds). (1999) *How Social Movements Matter*, Minneapolis, MN, USA, & London, UK: University of Minnesota Press.

Gunderson, L. (1999) Resilience, flexibility and adaptive management - - antidotes for spurious certitude? *Conservation Ecology*, 3(1): 7. Online: http://www.consecol.org/vol3/iss1/art7/.

Gunderson, L. H. & Holling, C.S. (eds) (2002) *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington DC, USA: Island Press.

Gunderson, L.H., Holling & Light, S.S. (1995) *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. New York, NY, USA: Columbia University Press.

Gunson, N. (1974) *Australian Reminiscences and Papers of L.E. Threlkeld, Missionary to the Aborigines, 1824-1859.* Canberra, Australia: Australian Institute of Aboriginal Studies.

Gutes, M. (1996) The concept of weak sustainability. *Ecological Economics*, 17: 147-156.

Guthrie, R. D. (1994),The Ethical Relationships between Humans and other Organisms. In: S. Armstrong & R. Botzler (eds) *Environmental ethics: Divergence and convergence*. New York, NY, USA: McGraw Hill.

Gylfason, T. (2004). *Natural resources and economic growth: From dependence to diversification,* Discussion Paper No. 4804. London, UK: CEPR.

Gylfason, T., Herbertsson, T.T. & Zoega, G. (1999) A mixed blessing: natural resources and economic growth, *Macroeconomic Dynamics,* 3: 204–225.

Gylfason, T. & Zoega, G. (2003). Inequality and growth: do natural resources matter? In T. Eicher & S.J. Turnovsky (eds.), *Growth and Inequality: Theory and Policy Implications.* Cambridge, MA, USA: MIT Press.

Hager, N. & Burton, B. (1999) *Secrets And* Lies*: The Anatomy Of An Anti-environmental PR Campaign*. Nelson, New Zealand: Craig Potton Publishing.

Hajer, M. (1997) *The Politics of Environmental Discourse*: *Ecological Modernization and the Policy Process.* Oxford, UK: Clarendon *Press.*

Hajer, M. & Versteeg, W. (2005),A decade of discourse analysis of environmental politics: Achievements, challenges, perspectives, *Journal of Environmental Policy & Planning*, 7, 3: 175-184

Hak, T., Moldan, B., Dahl, A. L. (2008) *Sustainability Indicators: A Scientific Assessment*. Washington DC, USA: Island Press.

Hall, B. (2001) I Wish This Were a Poem of Practices of Participatory Research. In Reason P. & H. Bradbury, H. (eds), *Handbook of Action Research: Participative Inquiry and Practice*. London, UK: SAGE.

Hall, N., & Taplin, R. (2005) Revolution Or Inch-By-Inch? Campaign Approaches on Climate Change by Environmental Groups, *The 9th Environmental Research Event Conference,* University of Tasmania, 30 November- 2 December, 2005.

Hall, N. & Taplin, R. (2007) Solar Festivals and Climate Bills: Comparing NGO climate change campaigns in the UK and Australia. Conference paper presented at *Global Warming: Energy Security or Energy Sovereignty?*, University of Sydney, March 2, 2007

Hamilton, E. & Cunningham, P. M. (1989) Community-based adult education. In S. B. Merriam & P. M. Cunningham (eds.) *Handbook of Adult and Continuing Education,* San Francisco, CA, USA: Jossey-Bass.

Hamilton, C. (2007) *Scorcher: the dirty politics of climate change.* Melbourne, Australia: Schwartz Publishing.

Hamilton, C. & Andrew Macintosh, A. (2004) *Taming the Panda: The relationship between WWF Australia and the Howard Government.* Canberra, Australia: The Australia Institute

Hamilton, C. & Downie, C. (2007) *University Capture. Australian universities and the fossil fuel industry.* Canberra, Australia: The Australia Institute.

Hammerley, M. (1998) *Reading Ethnographic Research.* London, UK: Longman.

Hansen, J. (2007) Huge sea level rises are coming — unless we act now, *New Scientist*, 28 July 2007.

Hansen, J. E. (2009) Coal-fired power stations are death factories. Close them, *The Observer*, 15/2/2009. Online: http://www.guardian.co.uk/commentisfree/2009/feb/15/james-hansen-power-plants-coal Accessed: 10/3/2009.

Hansen, J., Sato,M. Kharecha,P. Beerling, D. Masson-Delmotte, V., Mark Pagani, M., Maureen Raymo, M., Royer, D., James C. Zachos, J. (2008) Target CO2: Where should humanity aim?, *Science*, April 2008.

Hansson A., Bryngelsson M., (2009) Expert opinion on carbon capture and storage-A framing of uncertainties and possibilities, *Energy Policy* 37: 2273-2282

Hardcastle, A. (2009) *Green Economy Jobs in Washington State.* Pullman, WA, USA: Washington State University, Extension Energy Program.

Hargraves, A. J., Kininmonth, R. J., Martin, C. H. & Saywell, S. M. C. (1993) *History of Coal Mining in Australia.* Parkville, Victoria, Australia: Australasian Institute of Mining & Metallurgy.

Harris, J. & Deane, P. (2005) The Ethics of Social Engagement: Learning to Live and Living to Learn. In M. Keen, V. Brown, & L.R. Dyball (eds.) *Social Learning in Environmental Management: Towards a Sustainable Future.* London, UK: Earthscan.

Harris, M. (2009) I won't budge: landowner says no to mine, *Newcastle Herald*, 9/03/2009. Online: http://www.theherald.com.au/news/local/news/general/i-wont-budge-landowner-says-no-to-mine/1453810.aspxAccessed: 13/3/2009.

Harris, S. & Taylor, G. (1982) Themes and issues in resource development. In S. Harris & G. Taylor (eds) *Resource development and the future of Australian society. Canberra, Australia:* Centre for Resource & Environmental Studies, ANU.

Hart, M. (1999) *Guide to Sustainable Community Indicators.* West Hartford, CT, USA: Sustainable Measures.

Hartig, K. & Holmes, J. (2000) Whatever Happened to Coaltown? In P. McManus, P. O'Neill & R. Loughran (eds) *Journeys: The Making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

Hartwick, J. (1977) Intergenerational equity and the investing of rents from exhaustible resources. *American Economic Review*, 66: 972-974.

Harvey, D. (1996) *Justice, Nature and the Geography of Difference.* Maldon, MA, USA: Blackwell.

Harvey, D. (1999) Considerations on the environment of justice, in N. Low (ed) *Global Ethics and the Environment.* London, UK: Routledge.

Haskell, B., Norton, B. & Costanza, R. (1992) What is ecosystem health and why should we worry about it? In R. Costanza, B.G. Norton & B.D. Haskell, (eds), *Ecosystem Health: New Goals for Environmental Management*, Washington, DC, USA: Island Press.

Hatfield-Dodds, S., Turner, G., Schandl, H. & Doss, T. (2008) *Growing the Green Collar Economy: Skills and labour challenges in reducing our greenhouse emissions and national environmental footprint.* Report to the Dusseldorp Skills Forum. Canberra, Australia: CSIRO Sustainable Ecosystems.

Haugaard, M., Lentner, H., & the International Political Science Association Research Committee on Political Power (2006) *Hegemony and Power: Consensus and Coercion in Contemporary Politics*. Lanham, MD, USA: Lexington Books, 2006

Hawken, P., Lovins, A. & Lovins, H. (2008) *Natural Capitalism: Creating the Next Industrial Revolution*. Boston, MA, USA: Back Bay Books

Healthy Rivers Commission of NSW (2002) *Final Report - Independent Inquiry into the Hunter River.* Sydney, Australia: NSW Government.

Heinberg, R. (2004) *Powerdown: Options and Actions for a Post-Carbon World.* Gabriola Island, BC, Canada: New Society Publishers.

Heinberg, R. (2006) *The Oil Depletion Protocol: A Plan to Avert Oil Wars, Terrorism and Economic Collapse.* Gabriola Island, BC, Canada: New Society Publishers.

Heinberg, R. (2007a) *Peak Everything: Waking Up to the Century Of Declines.* Gabriola Island, BC, Canada: New Society Publishers.

Heinberg, R. (2007b) Peak coal: sooner than you think. *Energy Bulletin*. 21/5/2007. Online: http://www.energybulletin.net/node/29919 Accessed: 22/12/2008

Held, D., McGrew, A., Goldblatt, D. & Perrtion, J. (1999) *Global Transformations: Politics, Economic and Culture.* Cambridge, UK: Polity Press.

Held, D. & McGrew, A. (2007) Globalization/Anti-Globalization: Beyond the Great Divide, 2nd Ed, Maldon, MA, USA: Polity, 2007

Helper, S. (2008) Renewing U.S. Manufacturing: Promoting a High-Road Strategy, Briefing Paper 212, Washington DC, USA: Economic Policy Institute

Hempel, L. (1998) *Sustainable Communities: From Vision to Action*. Claremont, CA, USA: Claremont Graduate University.

Hennessy, K., Lucas, C., Nicholls, N., Bathols, J., Suppiah, R. & Ricketts, J. (2005) *Climate change impacts on fire-weather in south-east Australia*. Aspendale, Australia: CSIRO Marine & Atmospheric Research.

Hepburn, J. (2007) Climate Changed, *Social Alternatives*, Brisbane, Australia.

Heron, J. (1998) *Cooperative Inquiry: Research into the Human Condition.* London, UK: SAGE Publications.

Heron J., & Reason, P.(2001) The Practice of Co-operative Inquiry: Research 'with' rather than 'on' People. In P. Reason & H. Bradbury (eds) *Handbook of Action Research: Participative Inquiry and Practice*. London, UK: SAGE Publications.

Highlander Research & Education Center (2008) *About Us.* New Market, Tennessee: Highlander Research & Education Center. Online: http://www.highlandercenter.org/about.asp Accessed: 26/6/2008.

Higginbotham, N., L. Connor, G. Albrecht, S. Freeman & Agho, K. (2006) Validation of an Environmental Distress Scale. *EcoHealth*, 4: 245-254.

Highlander Research & Education Center (2008) Online: http://www.highlandercenter.org/index.html Accessed: 22/12/2008.

Hildyard, N. (2009),*A (Crumbling) Wall of Money: Financial Bricolage, Derivatives and Power*, Briefing 39, October 2008, Dorset, UK: The Corner House.,Online: http://www.thecornerhouse.org.uk/pdf/briefing/39wallmoney.pdf. Accessed: 21/9/2009.

Hillman, M. (2003) Taming the Strong Brown God: Post-colonial Conceptions of River Health in the Hunter Valley, New South Wales. In G. Albrecht (ed.) *Airs Waters Places Transdisciplinary Conference on Ecosystem Health in Australia.* Newcastle, Australia: School of Environmental & Life Sciences, University of Newcastle

Hillman, M. (2004). The importance of environmental justice in stream rehabilitation. *Ethics, Place and Environment*, 7, 1-2: 19-43.

Hillman M (2005) Justice in river management: community perceptions from the Hunter Valley, New South Wales, Australia. *Geographical Research* 43, 2: 152-161

Hillman M. (2006). Situated justice in environmental decision-making: lessons from river management in Southeastern Australia. *Geoforum* 37: 695-707.

Hillman, M. & R. Howitt (2008). Institutional change in natural resource management in New South Wales, Australia: Sustaining capacity and justice. *Local Environment*, 13,1: 55-66.

Hindley, M. (1983) From Wiers, Dams & Sand. In J. Armstrong (ed.) *Shaping the Hunter.* Newcastle, Australia: Institution of Engineers Australia, Newcastle Division.

Hirsch, R.L., Bezdek, R.H, Wendling, R.M. (2005) *Peaking of World Oil Production: Impacts, Mitigation and Risk Management*. Washington DC, USA: DOE NETL. Online:

http://www.netl.doe.gov/publications/others/pdf/oil_peaking_netl.pdf. Accessed: 3/5/2008.

Hofrichter, R. (ed.). (1993). *Toxic Struggles: The Theory and Practice of Environmental Justice*. Philadelphia, PA, USA: New Society Publishers.

Holla & Barclay, (2000) Mine Subsidence in the Southern Coalfield, NSW, Australia, Department of Mineral Resources.

Holland, J.H. (1996) *Hidden order: How adaptation builds complexity*, Reading, MA, USA: Addison Wesley.

Holland, J.H. (1998) *Emergence: From chaos to order*, Cambridge, MA, USA: Perseus Books.

Holling, C. S. (1973) Resilience and stability of ecological systems. *Annual Review in Ecology and Systematics*, 4: 1-23.

Holling C.S. (ed) (1978) *Adaptive environmental management and assessment*. Chichester, UK: Wiley.

Holling, C.S. (1986). The resilience of terrestrial ecosystems; local surprise and global change. In W.C. Clark & R. E. Munn (eds), *Sustainable Development of the Biosphere*. Cambridge, UK: Cambridge University Press.

Holling, C. S (1996) Engineering resilience versus ecological resilience. In P. C Schultze. (ed.) *Engineering within Ecological Constraints.* Washington, DC, USA: National Academy Press.

Holling, C. S. (2001) Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems*, 4**:** 390-405.

Holling, C.S., Gunderson L. & Ludwig D. (2002) In Quest of a Theory of Adaptive Change. In L. Gunderson & C.S. Holling (eds), *Panarchy: Understanding Transformations in Human and Natural Systems,* Washington DC, USA: Island Press.

Holling, C.S. & Gunderson, L. (2002) Resilience and Adaptive Cycles. In L. Gunderson, L. & C.S. Holling, (eds.) *Panarchy: Understanding Transformations in Human and Natural Systems,* Washington DC, USA: Island Press.

Holmberg, J. & Sandbrook, R. (1992), Sustainable development: what is to be done? In J. Holmberg (ed) *Policies for a Small Planet*. London, UK: Earthscan.

Holst, J. D. (2002) *Social Movements, Civil Society, and Radical Adult Education*, New York, NY, USA: Bergin & Garvin.

Homer-Dixon, T. (1995) *Strategies for Studying Causation in Complex Ecological Political Systems*, Occasional Paper, Project on Environment, Population & Security. Washington, D.C.: American Association for the Advancement of Science & the University of Toronto. Online: http://www.library.utoronto.ca/pcs/eps/method/methods1.htmAccessed: 20/1/2009.

Homer-Dixon, T. (2002) *The Ingenuity Gap: Facing the Economic, Environmental, and Other Challenges of an Increasingly Complex and Unpredictable Future*. New York, NY, USA: Vintage.

Homer-Dixon, T. (2006) *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization*. Washington DC, USA: Island Press, 2006.

Hooke, M. (2008) *Minerals Council of Australia welcomes infrastructure package.* Media Release, 12/12/2008. Canberra, Australia: Minerals Council of Australia. Online: http://www.minerals.org.au/__data/assets/pdf_file/0012/33024/MHH_statement_infrastructure_package_121208.pdfAccessed: 13/3/2009.

Hopkins, R. (2008) The Transition Handbook: From Oil Dependency to Local Resilience. Totnes, Devon, UK: Green Books.

Horstman, M. & Wightman, G. (2001) Karparti ecology: Recognition of Aboriginal ecological knowledge and its application to management in North-Western Australia., *Ecological Management & Restoration*, 2, 2: 99-109

Horton, M. & Freire, P. (1990) *We Make the Road by Walking*, Philadelphia, PA, USA: Temple University Press.

Horwitz, P. (2003) *Environmental Risk, Environmental Justice and the Experiences of Vulnerable Communities*, Scoping Paper 3 August 2003 Version 1, Sustainable Communities Network. Online: http://scn.ecu.edu.au/Scoping%20Paper%203%20-%20Environmental%20Risk%20and%20Justice.pdf. Accessed: 23/11/2008.

Horwitz, P. & Rapport, D. (2000) Ecosystem Health: An Antipodean Perspective. *Ecosystem Health*, 6: 83-84.

Horwitz, P., Lindsay, M. & O'Connor, M. (2001) Biodiversity, endemism, sense of place, and public health: Inter-relationships for Australian inland aquatic systems. *Ecosystem Health*, 7**:** 253-265.

House, S (2003) *Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy*, Technical Report, Digital Aerial Photo Interpretation and Updated Extant Vegetation Community Map, May 2003. Callaghan, Australia: Lower Hunter and Central Coast Regional Environmental Management Strategy,.

Howard, K. (2008) Technology will offer industry opportunities, *Newcastle Herald*, 27/5/2008, Newcastle, Australia.

Howes, M. (2005) *Politics and the Environment: Risk and the Role of Government and Industry*. Sydney, Australia: Allen & Unwin.

Howes, P. (2008a) Give workers a voice in climate change solutions, *The Age*, 24/7/2008. Melbourne, Australia. Online: http://www.awu.net.au/146_2.html. Accessed: 5/10/2008.

Howes, P. (2008b) *Indulgent Greens miss point of White Paper*, ABC Online Opinion, 19/12/2008, Online: http://www.awu.net.au/196_2.html Accessed: 22/12/2008

Howitt, R. (2001) *Rethinking Resource Management: Justice, Sustainability and Indigenous Peoples*. London, UK: Routledge.

Huckle, J. & Sterling, S. (1996) *Education for Sustainability*, London, UK: Earthscan.

Huckle, J. (1998) *Key propositions for a critical EfS* Online: http://john.huckle.org.uk/efsdetail.jsp?efsDisplay_id=2321 Accessed: 3/7/2008.

Humphreys, D. (2000) Corporate Strategies in the Global Mining Industry, *Centre for Energy, Petroleum and Mineral Law and Policy Internet Journal*, Vol. 12, article 9.

Online: http://www.dundee.ac.uk/cepmlp/journal/html/vol12/article12-9.html Accessed: 25/2/2009.

Humphreys, M. Sachs, J. & Stiglitz, J. (2007) *Escaping the resource curse,* New York, USA: Columbia University Press.

Hunter Business Chamber (2008) *Submission by the Hunter Business Chamber to Australian Government CPRS Green Paper Review.* Online: http://www.climatechange.gov.au/greenpaper/consultation/pubs/0388-hunter-business-chamber.pdf Accessed: 12/3/2009.

Hunter Catchment Management Trust (2003) *Integrated Catchment Management Plan for the Hunter Catchment 2002,* Sydney, Australia, NSW Department of Land & Water Conservation. Online: http://www.hcr.cma.nsw.gov.au/pubs/hunter_blueprint.pdf Accessed: 1/5/2008.,

Hunter–Central Rivers Catchment Management Authority (2007) *Hunter-Central Rivers Catchment Action Plan,* Paterson, NSW, Australia: Hunter–Central Rivers Catchment Management Authority. Online: http://www.hcr.cma.nsw.gov.au/pubs/cap/hcrcma_cap.pdf. Accessed: 1/5/2008.

Hunter Community Environment Centre (2006) *Submission to the NSW Department of Planning regarding the proposed coal loading terminal in the Port of Newcastle, September 2006.* Newcastle, Australia: HCEC.

Hunter Councils (2007) Hunter & Central Coast Regional Environmental Management Strategy. Online: http://www.hccrems.com.au/about/index.html. Accessed: 1/5/2008.

Hunter Economic Development Corporation (2005) *Regional Leadership for Regional Growth*, Newcastle, Australia:, HEDC. Online: http://www.hunterregion.com/hedc.shtml. Accessed: 14/09/2006.

Hunter Environment Lobby (2003) The Maitland Statement. *Hunter Environment Forum 21 September 2003.* Maitland, Australia: Hunter Environment Lobby.

Hunter Environment Lobby (2005) Building a Shared Vision and Partnerships for Justice and Sustainability in the Hunter. *Hunter Environment Forum 21 September 2003.* Maitland, Australia: Hunter Environment Lobby.

Hunter Region Community Forum (1990) *Revitalisation of Newcastle: a community strategy.* Newcastle, N.S.W: Hunter Region Community Forum.

Hunter Regional Organisation of Councils (HROC) (2000) *Pathways to a Sustainable Hunter: Business and Sustainability Conference Report December 1999,* Maitland, Australia: HROC.

Hunter Regional Planning Committee (1977) *The Hunter Region: Problems and Proposals*. Sydney, Australia: NSW Planning & Environment Commission.

Hunter Valley Research Foundation (HVRF) (2003) *Newcastle and the Hunter Region 2002 – 2003.* Newcastle, Australia: HVRF. Online:

http://www.hvrf.com.au/data/Yearbook%20Chapters%20PDFs/Yearbook_Population.pdf Accessed: 14/09/2005.

Hunter Valley Research Foundation (2005) *Hunter Region Facts*, Newcastle, Australia: HVRF. Online: www.hvrf.com.au/hunter_facts.htm Accessed: 14/09/2005.

Hunter Valley Research Foundation (2007a) *Hunter Region Economic Indicators*, March Quarter 2007, Newcastle, Australia: HVRF.

Hunter Valley Research Foundation (2007b) *Upper Hunter Region Environmental Attitudes Survey 2006*. Newcastle, Australia: HVRF.

Hunter Valley Research Foundation (2008a) *Newcastle and the Hunter Region 2008 – 2009,* Newcastle, Australia: HVRF.

Hunter Valley Research Foundation (2008b) *Upper Hunter Region Environmental Attitudes Survey 2007*, Newcastle, Australia: HVRF.

Hunter Valley Thoroughbred Horsebreeders Association (2006) *Submission regarding the Anvil Hill mine proposal to NSW Department of Planning,* Denman, Australia.

Hunter Thoroughbred Breeders Association Inc, Thoroughbred Breeders Australia Ltd & Aushorse Ltd. 2007. *The Upper Hunter Thoroughbred Horse Industry: Jeopardised by Coal Mining*, Denman, NSW, Australia: Self-published pamphlet.

Hutton, D., & Connors, L. 1999) *A History of the Australian Environment Movement.* Cambridge, UK & Melbourne, Australia: Cambridge University Press.

Huxtable, C. H., Koen, T. B. & Waterhouse, D. (2005) Establishment of native and exotic grasses on mine overburden and topsoil in the Hunter Valley, New South Wales. *The Rangeleand Journal,* 27, (2).

Inayatullah, S. (2005 *Questioning the Future: Methods and Tools for Organisational and Societal Transformation*, Taipei, Taiwan: Tamkang University.

Institute for Sustainable Futures (2000) *Pathways to a Sustainable Hunter: Hunter Region Sustainability Indicators Project Report*, Thornton, NSW, Australia: Hunter Regional Organisation of Councils.

International Council on Mining & Metals (ICMM) (2003) *ICMM Sustainable Development Framework***.** Online: http://www.icmm.com/our-work/sustainable-development-framework Accessed; 30/5/2008.

International Council on Mining & Metals (ICMM) (2005) *Community Development Toolkit*. Report 310/05, Washington, D.C., USA, ICMM, World Bank & ESMAP. Online: http://www.icmm.com/document/2. Accessed: 17/09/2008

International Federation of Chemical Energy Mine & General Workers' Unions (ICEM) (2001) *Labour and Climate Change*, Brussels, Belgium: ICEM. Online: http://www.cfmeu.com.au/storage/documents/ICEM_climate_change2001.pdf Accessed 2/8/2008. Accessed: 3/9/2004.

International Finance Corporation (IFC) (2007) *Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets*. Washington D.C., USA: International Finance Corporation.

International Institute for Environment & Development (IIED) (2002) *Breaking New Ground: Mining, Minerals, and Sustainable Development,* London, UK, IIED. Online: http://www.iied.org/mmsd/finalreport/index.html. Accessed: 30/5/2008.

Intergovernmental Panel on Climate Change (IPCC) (2001) *Third Assessment Report: Climate Change 2001: Synthesis Report,* March 2001, Geneva, Switzerland: IPCC.

Intergovernmental Panel on Climate Change (IPCC) (2006) *Carbon Dioxide Capture and Storage: Summary for Policymakers and Technical Summary*. Geneva, Switzerland, Intergovernmental Panel on Climate Change (IPCC). Online: http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf Accessed: 15/6/2008.

Intergovernmental Panel on Climate Change (2007a). *Climate Change 2007: The Physical Science Basis.* Contribution of Working Group I of the Intergovernmental Panel on Climate Change, Summary for Policymakers, Geneva, Switzerland: IPCC.

Intergovernmental Panel on Climate Change (2007b) *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Summary for Policymakers, Geneva, Switzerland: IPCC.

International Business Times (2009) *Japan: Another record plunge in industrial production,* 30/1/2009. Online: http://www.ibtimes.com/articles/20090130/japan-another-record-plunge-industrial-production.htm Accessed: 25/2/2009.

International Council for Local Environmental Initiatives (ICLEI) (2008) *Local Governments for Sustainability*. Online: http://www.iclei.org/. Accessed: 2/2/2009.

International Energy Agency (IEA). 2005. *Electricity Information 2005,* Paris, France: International Energy Agency & OECD.

International Trade Union Confederation (ITUC) (2009) *Copenhagen Climate Summit: "Just Transition" on the Agenda.* Online: http://www.ituc-csi.org/spip.php?article3696&var_recherche=climate%20change. Accessed: 30/6/2009.

International Trade Union Confederation (ITUC) (2008) Trade unions and climate change:,Equity, justice & solidarity,in the fight against climate change. Brussels, Belgium: ITUC. Online: http://www.ituc-csi.org/IMG/pdf/No_45_-_TradeUnions_ClimateChange_COP14.pdf. Accessed: 30/6/2009,

International Union for Conservation of Nature & Natural Resources (IUCN), UNEP & WWF (1980) World Conservation Strategy: Living Resource Conservation for Sustainable Development. Gland, Switzerland: IUCN

Irwin, D. (2000) *How Did the United States Become a Net Exporter of Manufactured Goods?* Research paper presented at the Department of Economics, Dartmouth College, Hanover, NH, USA.

Jacobs, P. & Mulvihill, P. (1995) Ancient lands: new perspectives. Towards multicultural literacy in landscape management. *Landscape and Urban Planning,* 32:,7-17.

Jameson, N. (2007) Miner adjustment. *Newcastle Herald,* 4/8/2007, Newcastle, Australia.

Jameson, N. (2009) To protect and defend, *Newcastle Herald,* Weekender magazine, 18/4/2009, Newcastle, Australia.

Janesick, V. (2003) The Choreography of Qualitative Research Design: Minuets, Improvisations and Crystallization. In N. Denzin & Y. Lincoln, (eds.) *Strategies of Qualitative Inquiry,* Thousand Oaks, CA, USA, SAGE.

Jänicke, M. (2002) The Political System's Capacity for Environmental Policy: The Framework for Comparison. In H. Weidner, M. Jänicke, & H. Jörgens (eds), *Capacity Building in National Environmental Policy: A Comparative Study of 17 Countries*. Heidelberg, Germany: Springer

Jänicke, M. Jacob, K., Binder, M. & Wieczorek, A. (eds) (2004) *Industrial transformation between ecological modernisation and structural change.* Governance for industrial transformation. Proceedings of the 2003 Berlin Conference on the Human Dimensions of Global Environmental Change *Environmental Policy Research Centre* Berlin, Germany.

Janssen, M. & Ostrom, E. (2006) Resilience, vulnerability, and adaptation: A cross-cutting theme of the International Human Dimensions Programme on Global Environmental Change, *Global Environmental Change*, 16: 237–239.

Jardine, A., Speldewinde, P., Carver, S. & Weinstein, P. (2007) Dryland Salinity and Ecosystem Distress Syndrome: Human Health Implications. *EcoHealth,* 4: 10-17.

Jay, C. (1994) *The coal masters: the history of Coal & Allied 1844-1994.* Double Bay, NSW, Australia: Focus Publishing.

Jay, C. (1999). *A Future More Prosperous: The History of Newcastle Steelworks 1912-1999.* Newcastle, Australia: Broken Hill Propriety Co. Ltd.

Jenkins, R., 2001. *Corporate codes of conduct: self-regulation in a global economy*, Geneva, Switzerland: United Nations Research Institute for Social Development.

Johnson, K. (2009) Steven Chu: 'Coal is My Worst Nightmare', *Environmental Capital, Wall Street Journal,* 11/12/2008. Online: http://blogs.wsj.com/environmentalcapital/2008/12/11/steven-chu-coal-is-my-worst-nightmare/ Accessed: 3/1/2009.

Johnston, J. (2006) Who cares about the Commons. In J. Johnston, M. Gismondi & J. Goodman (eds), *Nature's Revenge: Reclaiming Sustainability in an Age of Corporate Globalisation*, Toronto, ON, Canada: Broadview Press.

Johnston, J., Gismondi, M. & Goodman, J. (eds), (2006) *Nature's Revenge: Reclaiming Sustainability in an Age of Corporate Globalisation*, Toronto, ON, Canada: Broadview Press.

Johnston, R. (2009a) *Foresighting for Minerals Futures,* Sydney, Australia: Australian Centre for Innovation.

Johnston, R. (2009b) *Roadmap for Minerals Futures Foresighting Project,* Sydney, Australia: Australian Centre for Innovation.

Jones, R. & Hennessy, K. (2000) *Climate Change Impacts in the Hunter Valley: A Risk Assessment of Heat Stress Affecting Dairy Cattle.* Aspendale, Victoria, Australia: CSIRO Atmospheric Research.

Jones, V. (2008a) *The green-collar economy: How one solution can fix our two biggest problems.* New York, NY, USA: Harper One.

Jones, V. (2008b),Working Together for a Green New Deal, *The Nation*, 17/11/2008. Online: http://www.thenation.com/doc/20081117/jones. Accessed: 24/11/2008.

Jones, W. (2003) Complex Adaptive Systems. In G. Burgess & H. Burgess (eds) *Beyond Intractability*, Boulder, CO, USA: Conflict Research Consortium, University of Colorado. Online: http://www.beyondintractability.org/essay/complex_adaptive_systems/. Accessed: 1/9/2008.

Jorgensen, D. (1989) *Participant Observer: A Methodology for Human Studies*, Newbury Park, CA, USA: SAGE.

Kahn, R. (2008) From Education for Sustainable Development to Ecopedagogy: Sustaining Capitalism or Sustaining Life?, *Green Theory & Praxis: The Journal of Ecopedagogy*, 4, 1: 1-14. Online: http://greentheoryandpraxis.org/journal/index.php/journal/issue/view/6 Accessed: 12/9/2009.

Kajikawa, Y. (2008) Research core and framework of sustainability science, *Sustainability Science*, 3: 215-239.

Kammen, D., Kapadia, K., & Fripp, M. (2004) Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?, *RAEL Report*, University of California, Berkeley.

Kane, L. (2001) *Popular Education and Social Change in Latin America*. London, UK: Latin American Bureau.

Karl, T. R, Melillo, J. R. & Peterson, T. C. (eds) (2009) *Global Climate Change Impacts in the United States*. Cambridge, MA, USA: Cambridge University Press

Karliner, J. (1997) *The Corporate Planet: Ecology and Politics in the Age of Globalization*, San Francisco, CA, USA: Sierra Club Books.

Karliner, J. (2001) *A Brief History of Greenwash*. San Francisco, CA, USA: CorpWatch

Kasperson, J.X. & Kasperson, R.E. (eds) (2001) *Global Environmental Risk*, London, UK: United Nations University Press & Earthscan.

Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C.C., Lowe, I., McCarthy, J.J., Schellnhuber, H.J., Bolin, B., Dickson, N.M., Faucheux, S., Gallopin, G.C., Grübler, A., Huntley, B., Jäger, J., Jodha, N.S., Kasperson, R.E., Mabogunje, A., Matson, P., Mooney, H., Moore, B. III, O'Riordan, T. & Svedin, U. (2001), Environment and development – sustainability science, *Science*, 292,5517: 641-642.

Kates, R., Leiserowitz, A. & Parris, T. (2006) *Great Transition Values*: Present Attitudes, Future Change. GTI Paper Series No. 9. Boston, MA, USA: Tellus Institute.

Kavalov, B. & Peteves, D., (2007) *The Future of Coal*, prepared for European Commission DG Joint Research Centre Institute for Energy (JRC IFE), February 2007. Online: http://ie.jrc.ec.europa.eu/publications/scientific_publications/2007/EUR22744EN.pdf Accessed: 2/1/2009.

Kavouridis, K. & Koukouzas, N. (2008) Coal and sustainable energy supply challenges and barriers, Energy Policy 36: 693–703

Kay, J. (1994) The Ecosystem Approach, Ecosystems as Complex Systems and State of the Environment Reporting, *State of North American Ecosystem meeting,* Montreal, Canada.

Kay, J. (1999) An ecosystem approach for sustainability: addressing the challenge of complexity. *Futures,* 31: 721-742.

Kearns, R. (2000) Being There: Research Through Observing and Participating. In I. Hay (ed.) *Qualitative Research Methods in Human Geography.* South Melbourne, Australia: Oxford University Press.

Kearns, R. (2005) Knowing Seeing? Undertaking observational research. In I. Hay (ed.) *Qualitative research methods in human geography.* South Melbourne, Australia: Oxford University Press.

Keating, M. (2001) *Cradle to Grave: The Environmental Impacts from Coal,* Boston, MA, USA: Clean Air Task Force.

Keck, M., & Sikkink, K. (1998) *Activists beyond borders: advocacy networks in International politics*. Ithaca, NY, USA: University of Cornell Press.

Keen, M., Brown, V. & Dyball, L, R. (2005) Social Learning: A New Approach to Environmental Management. In M. Keen, V. Brown & R. Dyball. (eds.) *Social Learning in Environmental Management: Towards a Sustainable Future.* London, UK: Earthscan.

Keen, M. & Mahanty, S. (2005) Collaborative Learning: Bridging Scales and Interests. In M. Keen, V. Brown & R. Dyball. (eds.) *Social Learning in Environmental Management: Towards a Sustainable Future.* London, UK: Earthscan.

Keith, M. & Steve Pile, S. (eds) (1993) *Place and the Politics of Identity*. New York, USA: Routledge.

Kelly, A. (2005). Cancer scare: Hunter death rate highest in state. *Newcastle Herald,*14/2/2005. Newcastle, Australia.

Kelly, M. (2008a) Toxic alarm over Hunter gas emissions, *Newcastle Herald*, 24/11/2008. Newcastle, Australia.

Kelly, M. (2008b) No data on mine health, *Newcastle Herald*, 18/12/2008. Newcastle, Australia.

Kemmis, S. & McTaggart, R. (1988) *The Action Research Planner,* Geelong, Australia: Deakin University Press.

Kilpatrick, S., Barrett, M. & Jones, T. (2003) *Defining Learning Communities*. Launceston, Tasmania, Australia: University of Tasmania.

Kilvington., M. (2006?) *Social learning as a framework for building capacity to work on complex environmental management problems.* Online: http://www.landcareresearch.co.nz/publications/researchpubs/Social_learning_review.pdf Accessed: 13/3/2009

King, K. (1991) *Aid and Education in the Developing World*, Harlow, UK: Longman.

King, L.A. & Hood, V.L. (1999). Ecosystem Health and Sustainable Communities: North and South. *Ecosystem Health* 5, (1): 49-57.

Kingdon, J. W. (1995) *Agendas, alternatives, and public policies.* New York, NY, USA: Harper Collins.

Kinzig, A., Ryan, P., Etienne, M., Allyson, H., Elmqvist, T. & Walker, B. H. (2006) Resilience and regime shifts: assessing cascading effects. *Ecology & Society* 11, 1: 20. Online: http://www.ecologyandsociety.org/vol11/iss1/art20/.

Kirkwood, I. (2006) Our valley's too green: Minister, *Newcastle Herald,* 28/10/2006, Newcastle, Australia.

Kirkwood, I. (2008) Rees plans to raise coal royalties, *Newcastle Herald,* 7/11/2008, Newcastle, Australia.

Kirkwood, I. (2009a) Doctor's study to mine data on Hunter air health, *Newcastle Herald,* 17/3/2009, Newcastle, Australia. Online: http://www.theherald.com.au/news/local/news/general/doctors-study-to-mine-data-on-hunter-air-health/1460669.aspx. Accessed: 17/3/2009.

Kirkwood, I. (2009b) Green light, *Newcastle Herald*, 18/5/2009. Newcastle, Australia.

Kirkwood, I. (2009c) Coal flow to double, *Newcastle Herald*, 23/9/2009. Newcastle, Australia.

Kirkwood, I. & Ray, G. (2005) Resource giants have the power. *Newcastle Herald,* 10/2/2005, Newcastle, Australia.

Kirschbaum, E. (2008) Germany Urges Obama To Give World New "Green" Deal, *Reuters* 6/11/2008. Online: http://www.reuters.com/article/environmentNews/idUSTRE4A55VF20081106. Accessed: 24/11/2008.

Klandermans, B. (ed) (1989) *Organizing for Change*, Greenwich, CT, USA: JAI Press.

Klandermans, B. (1991) New social movements and resource mobilization: The European and American approach revisited. In D. Rucht (ed) *Research in social movements*, Boulder, CO, USA: Westview Press.

Kofoed-Wiuff A., Sandholt K., Marcus-Møller C., (2006) *Renewable Energy Technology Deployment (RETD)- Barriers, Challenges and Opportunities*, IEA RETD Implementing Agreement, online at <http://www.iea-retd.org/files/Barriers%20Challenges%20and%20Opportunities.pdf. Accessed: 28/6/2009.

Kolb, D. A. (1984) *Experiential learning: Experience as the source of learning and development*, Englewood Cliffs, NJ, USA: Prentice-Hall.

Komiyama H. and Takeuchi K (2006) Sustainability science: Building a new discipline. *Sustainability Science*, (2006), 1: 1-6.

Korten, D. (2006) *The Great Turning: From Empire to Earth Community*. San Francisco, CA, USA: Berrett-Koehler Publishers.

Korten, D. (2006) *Agenda for a New Economy*. San Francisco, CA, USA: Berrett-Koehler Publishers.

Kretzmann, J. and McKnight, J. (1993) *Building Communities From the Inside Out: A Path Toward Finding and Mobilizing a Community's Assets*, Evanston, IL, USA: The Asset-Based Community Development Institute, Northwestern University.,

Kriegman, O. (2006) *Dawn of the Cosmopolitan*: *The Hope of a Global Citizens Movement*. GTI Paper Series, No.15. Boston, MA: Tellus Institute.

Kuhn, P. (ed.) (2002), *Losing Work, Moving On: International Perspectives on Worker Displacement*, Kalamazoo MI, USA: W.E. Upjohn Institute.

Kvale, S. (1995) The Social Construction of Validity *Qualitative Inquiry,* 1: 19-40.

Kyle, J. (2000) Consolidation of the Global Coal Industry. *Pincock Perspectives.* Online: www.hartcrowser.com/PDFs.Issue13-Coal.pdf. Accessed: 11/11/2005.

Lake Macquarie City Council (2008) Submission to the House of Representatives Standing Committee on Climate Change, Water, Environment & the Arts Inquiry into Climate Change & Environmental Impacts on Australian Coastal Communities. Online: http://www.aph.gov.au/house/committee/ccwea/coastalzone/subs/sub044.pdf Accessed: 6/7/2009..

Larsen, E. (2004) *Escaping the Resource Curse and the Dutch Disease? When and Why Norway Caught Up and Forged Ahead of Its Neighbours*, Discussion Paper No. 377, Statistics Norway, Research Department, May 2004.

Lakoff, G. (2004) *Don't Think of an Elephant*. White River Jct., VT, USA: Chelsea Green Publishing.

LaMonica, M. (2009) Obama signs stimulus plan, touts clean energy, 17/2/2009. Online: Accessed: 2/4/2009.

Langhelle, O. (2000) Why ecological modernization and sustainable development should not be conflated, *Journal of Environmental Policy & Planning*, 2, 4, 303-322.

Langton M (1996) The European construction of wilderness. In *Wilderness News*, Summer Edition, 1995/1996, The Wilderness Society.

Langton, M. (1998) *Burning questions: emerging environmental issues for indigenous peoples in Northern Australia.* Darwin, Australia: Centre for Indigenous Natural and Cultural Resource Management, Northern Territory University.

Lansbury Hall, N. & Taplin, R. (2006). Confronting Climate Change: A Review of Theoretical Perspectives on Environmental NGOs and their Campaign Effectiveness. Paper presented at the *Ecopolitics XVI conference*, July 4-6, 2005, Griffith University, Brisbane, Australia.,

Le Billon, P. (2005) The resource curse, *Adelphi Papers,* 45, 373: 1-27.

Lebel, J. & Burley, L. (2003) The Ecosystem Approach to Human Health in the Context of Mining in the Developing World. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Lebel, L., Anderies, J. M., Campbell, B., Folke, C., Hatfield-Dodds, S., Hughes T. P. & Wilson, J. (2006) Governance and the capacity to manage resilience in regional social-ecological systems. *Ecology and Society*, 11(1): 19. Online: http://www.ecologyandsociety.org/vol11/iss1/art19/.

Lederman, D. & Maloney, W. (eds) (2007) *Natural resources: Neither curse nor destiny.* Washington DC, USA: The World Bank & Stanford University Press, California.

Lee, J. & Ito, J. (2009a) *Growing A Grassroots, Green Jobs Movement in South Los Angeles.* Los Angeles, CA, USA: Strategic Concepts in Organizing & Policy Education (SCOPE)

Lee, J. & Ito, J. (2009b) *A Greener Future For Los Angeles Principles to Ensure an Equitable Green Economy.* Los Angeles, CA, USA: Strategic Concepts in Organizing & Policy Education (SCOPE).

Leeuwis, C. (2000) Re-conceptualizing participation for sustainable rural development. Towards a negotiation approach. *Development & Change*, 31: 931-959.

Lenzen, M. & McMurray, S. (2003) *The Ecological Footprint – Issues and Trends*. Sydney, Australia: Sydney University Integrated Sustainability Analysis. Online: http://www.isa.org.usyd.edu.au/publications/documents/Ecological_Footprint_Issues_and_Trends.pdf. Accessed: 6/02/2009.

Leopold, A. (1949) *A Sand County Almanac, and Sketches Here and There,* London, UK: Oxford University Press.

Lester, R. (2006) Universities, innovation, and the competitiveness of local and national economies. *Centre for Business Research 10-year Anniversary Summit on Innovation and Governance,* Cambridge, UK: University of Cambridge.

Leuteritz, T. E. J. & Ekbia., H.R. (2008) Not all roads lead to resilience: a complex systems approach to the comparative analysis of tortoises in arid ecosystems. *Ecology & Society* 13, 1. Online: http://www.ecologyandsociety.org/vol13/iss1/art1/.

Levin, S. (1998) Ecosystems and the Biosphere as Complex Adaptive Systems, *Ecosystems,* 1: 431-436.

Levy, K., Young, T., Fujita, R. (2003) A conceptual framework for choosing indicators of ecological integrity: Case-study of the San Francisco Bay-Delta-River System. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Lewis, D. (2005) How green is our valley, *Sydney Morning Herald*, 28/11/2005. Online: http://www.smh.com.au/news/national/how-green-is-our-valley/2005/11/27/1133026350593.html?page=fullpage Accessed: 2/10/2007.

Lewis, P. (various dates 2005-2008) Cartoons, *Newcastle Herald*, Newcastle, Australia.. Online: http://www.lewisart.biz/news.html. Accessed: 2/7/2009.

Ley, D. (1974) *The Black Inner City As Frontier Outpost: Images and Behaviour of a Philadelphia Neighborhood,* Washington, DC, USA: Association of American Geographers.

Lipietz, A. (1996) Geography, Ecology, Democracy, *Antipode,* 28, 3: 219-228.

Lipschutz, R. (1999) Bioregionalism, civil society and global environmental governance. In M. McGinnis (ed.), *Bioregionalism*. London, UK: Routledge.

Lipschutz, R. (2004a) *Global Environmental Politics: Power, Perspectives, and Practice*, Washington DC, USA: CQ Press.

Lipschutz, R. (2004b) Imitations of Empire, *Global Environmental Politics*, 4, 2: 20-23.

Local Government Association of NSW (2001) Submission on PlanFIRST – Review of plan making in NSW: White paper by the Department of Urban Affairs & Planning. Sydney, Australia, LGA NSW. Online: http://www.lgsa.org.au/resources/documents/submission_planfirst_281105.pdf. Accessed: 24/10/2008.

Local Government Association of NSW (2007) *Record of Decisions Local Government Association of NSW Decisions of 2007 Annual Conference*, Decision 73a, p. 16. Sydney, Australia, LGA NSW. Online: http://www.lgsa-plus.net.au/resources/documents/2007-lga-conference-record-of-decisions_161107.pdf. Accessed: 30/5/2008.

Lohmann, L. (2009) *When Markets Are Poison Learning about Climate Policy from the Financial Crisis*, Briefing 40, September 2009, Dorset, UK: The Corner House. Online: http://www.thecornerhouse.org.uk/pdf/briefing/40poisonmarkets.pdf. Accessed: 21/9/2009.

Lomborg, B. (2001) *The Skeptical Environmentalist*, Cambridge, UK: Cambridge University Press.

Long, S. (2008),*The perverse organisation and its deadly sins*.,London, UK: Karnac.

Long, S. (2009) *OECD says Australia especially vulnerable to global economic storm*, ABC Radio National PM, 4/2/2009. Online: http://www.abc.net.au/pm/content/2008/s2482502.htm.Accessed: 22/9/2009.

Lovelock, J. (1979) Gaia: A New Look at Life on Earth. Oxford, UK: Oxford University Press. ,

Lovelock, J. (2006) *The revenge of Gaia.* London, UK: Allen Lane.

Lovett, T. (1988) *Radical approaches to adult education: A reader*, London, UK: Routledge.

Low, N. (ed) (1999) *Global Ethics and the Environment*, London, UK: Routledge.

Low, N. & Gleeson, B. (1997) Justice in and to the environment: ethical uncertainties and political practices, *Environment & Planning A*, 29, 1: 21-42.

Low, N. & Gleeson, B. (1998) *Justice, Society and Nature: An Exploration of Political Ecology.* London, UK: Routledge.

Lowe, I. (2004) *Population and environment: some integrating ideas, Summary remarks at the Fenner Conference on the Environment,* May, 2004, Australian Academy of Science, Canberra, Australia. Online: http://dea.org.au/docs/Ian_Lowe_at_Fenner_Conference.pdf. Accessed: 27/11/2008.

Lowe, I. (2005) Environmental values in the globalizing world: Grounds for cautious optimism. In J. Paavola & I. Lowe (eds) *Environmental Values in a Globalising World.* Abingdon, UK: Routledge.

Lowe, I. (2009) *A Big Fix: Radical Solutions for Australia's Environmental Crisis.* 2nd edition Melbourne, Australia: Black Inc.

Lowe, I. (2005) *Living in the Hothouse: How Global Warming Affects Australia.* Melbourne, Australia: Scribe Publications.

Lynch, D. (2008) *Post Carbon Cities: Planning for Energy and Climate Uncertainty.* Sebastopol, CA, USA: Post Carbon Press.

McBride, K. (2003) Place of many grass trees returned. *Bush Telegraph*, Journal of NSW Dept of Primary Industries & Forests: Online: http://www.forest.nsw.gov.au/bush/jun03/stories/19.asp. Accessed: 12/6/2006.

Macdonald, D. & Burgess, J. (1998) Globalisation and Industrial Relations in the Hunter Region, *The Journal of Industrial Relations*, 40(1): 3-24.

Macdonald, F. & Holm, S. (2001) Employment for 25- to 34- year olds in the flexible labour market: a generation excluded? In L. Hancock, B. Howe, M. Frere & A. O. Donnell, *Future directions in Australian social policy: new ways of preventing risk.* Melbourne, Australia: CEDA.

Macdonald, I. (2004) Benchmarks for the Mining Industry, Appendix 1 of the *Mining Ombudsman Annual Report 2004*, Oxfam Community Aid Abroad, Fitzroy, Australia. Online: http://www.oxfam.org.au/campaigns/mining/docs/2004-annual-report-benchmarks.pdf Accessed: 30/5/2008.

Macdonald, I. (2008) *Opening address of Minister for Mineral Resources to the NSW Clean Coal Summit*, 8/5/2008, Parliament House, Sydney, Australia. Online: http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0017/223910/Macdonald-clean-coal-summit-speech.pdf Accessed: 2/1/2009.

MacGill, I. (2008) Hot Topics Rapid,Roundup:,Carbon Pollution Reduction Scheme - White Paper - experts respond, Australian Science Media Centre, 15/12/2008. Online: http://www.aussmc.org/CPRS_White_Paper.php,Accessed: 8/1/2009.,

MacGill, I, Watt, M., & Passey, R. (2002) '*Jobs and Investment Potential of Renewable Energy: Australian Case Studies*', Australian Cooperative Research Centre for Renewable Energy, University of New South Wales, Sydney.

Maclean, C. & Warhurst, A. (1999) Conceptual Approaches to Human health and Well-Being in Minerals development and a Case Study in Southern Africa. MERN Working Paper 184. Warwick, UK: University of Warwick.

Maclean, C., Warhurst, A., Milner, P. (2003) Conceptual Approaches to Health and Well-Being in Minerals Development: Illustrations with the Case of HIV/AIDS in Southern Africa. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Maddock, M. (2004) *Critical events and development affecting the Hunter Estuary since 1970*. Shortland, N.S.W, Australia: Wetlands Centre

Maffi L (ed) (2001) *On biocultural diversity: Linking language, knowledge and the environment.* Washington, DC, USA: Smithsonian Institution Press.

Maher, T. (2007) Coal's long term future depends on investment in clean technology, *Common Cause*, 72,(3).

Maher, T. (2007b) *Public Voice Presentation to Newcastle City Council by the National President of the Construction, Forestry, Mining & Energy Union (Mining & Energy Division) l*, February 1 2007. Newcastle, Australia: Newcastle City Council.

Maher, T. (2007c) *Crib Rooms and Climate Change: Empowering Mine Workers*. Speech to NSW Minerals Council Environment Conference, 16/8/2007, Terrigal, Australia:

CFMEU Mining & Energy Division. Online: http://www.cfmeu.com.au/storage/documents/NSWMC_enviro2007.pdf. Accessed 8/12/2007

Maguire, P. (2006) Wither on the vine: How climate change is threatening the Hunter's $350m wine industry. *Newcastle Herald.* 14/8/2006, Newcastle, Australia.

Mander, J. & Goldsmith, E. (Eds.) (1996) *The Case Against the Global Economy: and for a Turn Towards the Local.* San Francisco, CA, USA: Sierra Club.

Marsden, S. (2002) *Coals to Newcastle: A History of Coal Loading at the Port of Newcastle, New South Wales -1797-1997.* Wagga Wagga, Australia: Bobby Graham Publishers.

Martin, R. & Sunley, P. (2006) Path dependence and regional economic evolution. *Journal of Economic Geography,* 6:,395-437.

Martinez-Alier, J. (1990) *Ecological Economics: Energy, Environment & Society*. Oxford, England: Basil Blackwell.

Mason, B. (Senator) Parliamentary Secretary to the Minister for Health and Ageing (2007) Speech to Hunter Valley APEC Food Safety Cooperation Forum, 2/4/2007. Online: http://www.foodstandards.gov.au/newsroom/archive/evaluationstrategy200120 03/speeches/speeches2007/. Accessed: 21/7/2009.

Mason, C., Kuiper, G. & Woodward, A. (2002) *Legal and Conceptual Frameworks for State of the Environment Reporting*. Thornton, NSW, Australia: Lower Hunter & Central Coast Regional Environmental Management Strategy.

Maser, C. (1996) *Sustainable Community Development: Principles and Concepts*. Delray, FL:, USA: St. Lucie Press.

Mattera, P. (2009) High Road or Lowroad? Job Quality In The New Green Economy. Washington, DC, USA: Good Jobs First

Max-Neef, M.A. (2005) Foundations of transdisciplinarity, *Ecological Economics* 53, 1: 5–16.

Maynard, J. (1996) *Awabakal dreaming stories.* Newcastle, Australia: *Unpublished paper.*

Mayo, P. (1999) *Gramsci, Freire and Adult Education: Possibilities for Transformative Action.* New York, NY, USA: Zed Books

McDaniel, R. & Driebe, D. (2005) *Uncertainty and Surprise in Complex Systems: Questions on Working with the Unexpected.* New York, NY, USA: Springer.

McDonough, W. & Braungart, M. (2002) *Cradle to Cradle: Remaking the Way We Make Things.* New York, NY, USA: North Point Press

McGinnis, M. V., House, F. & Jordan, I. W. (1999) Bioregional restoration: Re-establishing an ecology of shared identity. In M. McGinnis (ed.) *Bioregionalism.* London, UK: Routledge.

McGowan, B. (2004) Class, Hegemony and Localism: the Southern Mining Region of New South Wales, 1850–1900, *Labour History*, 86, May 2004. Online: http://www.historycooperative.org/journals/lab/86/mcgowan.html#FOOT6 Accessed: 6/1/2009

McGuirk, P. & Rowe, D. (2000) The Newcastle Knights: Capturing the spirit of a region? In P. McManus, P. O'Neill & R. Loughran (eds.) *Journeys: The Making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

McKibben, B. (2008) *Deep Economy: The Wealth of Communities and the Durable Future.* New York, NY, USA: Holt Publishers.

McKinsey & Company (1994) *Lead Local Compete Global.* Canberra, Australia: Office of Regional Development, Department of Housing & Regional Development.

McKinsey & Company (2008a) An Australian cost curve for greenhouse gas reduction. Sydney, Australia: McKinsey Pacific Rim Inc.

McKinsey & Company (2008b) The case for investing in energy productivity. www.mckinsey.com/mgi. Accessed: 20/6/2008.

McLennan Magasanik Assoc. P/L (2008) *Installed capacity and generation from geothermal sources by 2020. Report for the* Australian Geothermal Energy Association.,Online: http://www.agea.org.au./media/docs/agea_finalreport.pdf Accessed: 16/3/2009.

McManus, P. (2005) *Vortex Cities to Sustainable Cities: Australia's Urban Challenge*. Sydney, Australia: UNSW Press.

McMichael, A. (1993) *Planetary Overload: Global Environmental Change and the Health of the Human Species*. Cambridge, UK: Cambridge University Press.

McMichael, A. (2001) Footprints to the Future: Trading Less Heavily. In *Human Frontiers, Environments and Disease.* Cambridge, UK: Cambridge University Press.

McMichael, A., Butler, C.D., Folke, C. (2003) New Visions for Addressing Sustainability, *Science*, 302, 1919- 1920.

McNeely, J. A., Miller, K. R., Reid, W. V., Mittermeier, R. A. & Werner, T. B. (1990) *Conserving the world's biological diversity.* Gland, Switzerland & Washington, DC, USA: IUCN, World Resources Institute, Conservation International, World Wildlife Fund-US & World Bank.

McNichol, I. (2004) *Residential Sector EEI potential*. Presentation to NFFE modelling workshop, April 2004.

McPhillips, K. (ed) (2002) *Local heroes: Australian crusades from the environmental frontline*. Annandale, Australia: Pluto Press.

McSorley, J. & Fowler, R. (2002) Mineworkers on the Offensive. In G. Evans, J. Goodman & N. Lansbury (eds.) *Moving Mountains: Communities Confront Mining and Globalisation.* London, UK: Zed Books.

Meadows D, Randers J, Meadows D (2004) *The limits to growth: The 30 year update*. White River Junction, VT, USA: Chelsea Green Publishing,

Meadows, D. (1998) *Indicators and Information Systems for Sustainable Development.* Hartland Four Corners, VT, USA: The Sustainability Institute,. Online: http://www.iisd.org/pdf/s_ind_2.pdf Accessed: 30/5/2008.

Meehan, M. (2006) MP rallies coal industry, *Maitland Mercury*, 10/11/2006. Maitland, NSW, Australia.

Meinshausen, M. (2006) What does a 2C target mean for greenhouse gas concentrations? Avoiding Dangerous Climate Change. In H. J. Schellnhuber, W. Cramer, N. Nakicenovic, T. Wiggley, & G. Yohe (eds.) *Avoiding Dangerous Climate Change.* Cambridge, UK: Cambridge University Press.

Melo-Escrihela, C. (2008) Promoting Ecological Citizenship: Rights, Duties and Political Agency, *ACME*, 7, 2: 113-134.

Melucci, A. (1984) An end to social movements?, *Social Science Information,* 23: 819-835.

Menghetti, D. (1981) *The Red North. The Popular Front in North Queensland.* Townsville, Australia: History Department James Cook University.

Mercer, D. (2000) *A question of balance: natural resources conflict issues in Australia*. Sydney, Australia: Federation Press.

Mercer, D. & Marden, P., (2006). Ecologically Sustainable Development in a 'Quarry' Economy: One Step Forward, Two Steps Back, *Geographical Research,* 44, 2:183–203.

Merchant, C. (1980) *The Death of Nature: Women, Ecology, and the Scientific Revolution*. New York, NY, USA: Harper & Row.

Merchant, C. (1992) *Radical Ecology: The Search for a Liveable World*. New York, NY, USA: Routledge.

Mergler, D. (2003) Integrating Human Health into an Ecosystem Approach to Mining. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Metcalfe, A. (1988) *For Freedom and Dignity: Historical Agency and Class Structures in the Coalfields of NSW.* North Sydney, Australia: Allen & Unwin.

Mezirow, J. (1991). *Transformative Dimensions Of Adult Learning*. San Francisco, CA, USA: Jossey-Bass.

Mezirow, J. (1997) Transformative Learning: Theory to Practice. In P. Cranton. (ed). *Transformative Learning In Action: Insights From Practice. New Directions for Adult and Continuing Education*, San Francisco, CA: Jossey-Bass.

Mies, M & Shiva, V. (1993) *Ecofeminism*. London, UK: Zed Books.

Millenium Ecosystem Assessment (2005) *Ecosystems and Human Well-being: Synthesis.* Washington DC, USA: Island Press.

Miller, J. (1985) *Koori: a will to win. The heroic resistance, survival and triumph of black Australia.* London, UK: Angus & Robertson.

Milne, M., Kearins, K. & Walton, S. (2006) Business makes a 'journey' out of 'sustainability': Creating adventures in Wonderl&?, *Organization*, 13, 6: 801-839.

Minerals Council of Australia (2000) *Australian Minerals Industry Code for Environmental Management.* Dickson, ACT, Australia: Minerals Council of Australia.

Minerals Council of Australia (2004) *Enduring Value – the Australian Minerals Industry Framework for Sustainable Development.* Dickson, ACT, Australia: Minerals Council of Australia. Online: http://www.minerals.org.au/__data/assets/pdf_file/5514/19187_MCA_ev_booklet.pdf. Accessed: 9/9/2005.

Minerals Council of Australia (2005) Minerals Council of Australia Minerals Industry Survey Report 2005, Dickson, ACT, Australia: Minerals Council of Australia. Online: http://www.minerals.org.au/__data/assets/pdf_file/10548/2005_MIS_Report_051207.pdf Accessed: 9/9/2005.

Minerals Council of Australia (2007) *Minerals Industry Survey Report 2007.* Dickson, ACT, Australia: Minerals Council of Australia.

Minerals Council of Australia (2008a) *White Paper On Climate Change: Too High A Price For Global Leadership*. Mediarelease, 15/12/2008. Online: http://www.minerals.org.au/__data/assets/pdf_file/0014/33053/MCA_response_to_White_Paper_on_Climate_Change_151208.pdf Accessed: 13/3/2009.

Minerals Council of Australia (2008b) *Carbon Capture and Storage Institute – Missing Link In Climate Change Strategy*. Mediarelease, 19/12/2008. Online: http://www.minerals.org.au/__data/assets/pdf_file/0015/31461/MR008-_CCS_19_Sept_2008.pdfAccessed: 16/3/2009.

Minerals Council of Australia (2008c) *Renewable Energy Target Scheme*, Letter to

The Renewable Energy Sub-Group Secretariat Renewables, Offsets & COAG Branch Department of Climate Change commenting on the discussion paper, *Design Options for the Expanded National Renewable Energy Target Scheme.* Online: http://www.climatechange.gov.au/renewabletarget/consultation/pubs/108mineralscouncilaust.pdf Accessed: 1/7/2009

Minerals Council of Australia (2009) Changes to CPRS on the margin: major flaws remain. Media release, 5/5/2009. Online: http://www.minerals.org.au/__data/assets/pdf_file/0017/33722/MCA_CPRS_statement_4_May_09.pdf Accessed; 14/5/2009.

Mines & Communities, (2001) *The London Declaration.* London, UK: Mines & Communities, London. Online: http://www.minesandcommunities.org/Charter/londondec.htm.Accessed: 7/6/2008.

Mineweb (2008) *Thermal Coal prices to drop more in 2009*, 11/12/2008. Online: http://www.mineweb.net/mineweb/view/mineweb/en/page38?oid=74974&sn=Detail Accessed: 25/2/2009

Miranda, M., Chambers, D. & Coumans, C. (2005. *Framework for Responsible Mining: A Guide to Evolving Standards,* Center for Science in Public Participation. Online: http://www.frameworkforresponsiblemining.org/ Accessed: 8/6/2008.

Mitchell, J. C. (1983) Case and situation analysis, *The Sociological Review*, 31, 2:187-211.

Mitchell, D. (2002) *Making Kyoto Work: A Transition Strategy for Canadian Energy Workers.* Ottawa, ON, Canada: Canadian Centre for Policy Alternatives.

Mitchell, P. (2006) *Mining and the development of local and national economies,* ICMM – PDAC Conference, March 2006. Toronto, ON, Canada.

Mitchell, W. & Bill, A. (2006) The two-speed Australian economy – the decline of Sydney's labour market, *People & Place*, 14, 4: 14-24.

Mohai, P. (1990) Black Environmentalism, *Social Science Quarterly* 71, 4: 744-765

Mohr, S. (2009) *Peak Coal In NSW.* Email to author, 13/3/2009.

Mohr, S. & Evans, G. (2009) Forecasting coal production until 2100. *Fuel*, 88, 11: 2059-2067.

Moldan, B. & Billharz, S. (1997) *Sustainability Indicators*. England: John Wiley & Sons.

Monbiot, G. (2006) Heat: How to Stop the Planet Burning. London, UK:, Allen Lane.

Mondros, J. & Wilson, S. (1994) *Organizing for Power and Empowerment.* New York, USA: Columbia University Press.

Moore, F., Gorman, P. & Harrison, R. (1998) *At the Coalface: The human face of coal miners and their communities: An Oral History of the early days,* Sydney, Australia, CFMEU Mining & Energy Division.

Moore, H. & Puntenney, D. (1999) *Leading by Stepping Back: A Guide for City Officials on Building Neighbourhood Capacity,* Evanston, IL, USA: The Asset-Based Community Development Institute, Northwestern University.

Morgan, J. (2003), *Research shows coal fired power is Australia's top greenhouse polluter*, World Wildlife Fund. Media release, 6/4/2003, Sydney, Australia: WWF Australia.

Morgan, K. (1997) The Learning Region: Institutions, Innovation & Regional Renewal. *Regional Studies,* 31: 491-503.

Morris, A. & Staggenborg, S. (2004) Leadership in Social Movements. In D. Snow, S. Soule & H. Kreisi (2004) *The Blackwell Companion to Social Movements.* Oxford, UK: Blackwell.

Mowbray, M. (1986) The Red Shire of Kearsley, 1944-1947: Communists in Local Government, *Labour History,* 51: 83-94.

Moyer, B., McAllister, A., Finley, M. L. & Soifer, S. (2001) *Doing Democracy: The MAP Model for Organising Social Movements.* Gabriola Island, BC, Canada: New Society Publishers.

Muir, J. (1911) *My first summer in the Sierra*. Boston, MA, USA: Houghton Mifflin.

Munck, R., Waterman, Peter (1999). *Labour Worldwide in the Era of Globalisation: Alternative Union Models in the New World Order*. Hampshire, UK: Macmillan.

Mundey, J. (1981) *Green Bans and Beyond.* Sydney, Australia: Angus & Robertson.

Muñoz-Erickson, T. A., B. Aguilar-González, & T. D. Sisk. (2007) Linking ecosystem health indicators and collaborative management: a systematic framework to evaluate ecological and social outcomes. *Ecology & Society* 12(2): 6

Murdy W.H. (1994) Anthropocentrism: A modern view. In: S. Armstrong & R. Botzler (eds) *Environmental ethics: Divergence and convergence*. New York, NY, USA: McGraw Hill.

Murray-Darling Basin Commission (2008) *Sustainable Rivers Audit-SRA Report 1: A report on the ecological health of rivers in the Murray-Darling Basin, 2004-2007.* Canberra, Australia: Murray-Darling Basin Commission.

Muswellbrook Shire Council (2006) *Anvil Hill Open Cut Coalmine Project (520.022). Report of Environment Committee*. Muswellbrook, Australia: Muswellbrook Shire Council.

Myers, J (2005) Converging Stories: Race, Ecology, and Environmental Justice in American Literature. Athens: GA, USA: University of Georgia Press.

Myers, N. & Kent, J. (2001) Perverse subsidies: How tax dollars can undercut the environment and the economy. Washington, DC, USA: Island Press.

Naess, A. (1984) Intuition, Intrinsic Value and Deep Ecology, *The Ecologist*, 14, 1984.

Naess, A. (1986) The Deep Ecology Movement: Some Philosophical Aspects, *Philosophical Inquiry*, 8, 1986

Naess, A. (1989) *Ecology, community and lifestyle*. Cambridge, UK: Cambridge University Press.

Najam, A., Papa, M. & Taiyab, N. (2006) *Global Environmental Governance: A Reform Agenda*. Winnipeg, MN, Canada: International Institute for Sustainable Development (IISD)

Naronha, L. (2003) A Conceptual Framework for the Development of Tools to Track Health and Well-Being in a Mining Region: Report from an Indian Study. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Nash, R. (1989) *The Rights of Nature: A History of Environmental Ethics.* Madison, WI, USA: University of Wisconsin Press.

National Framework for Energy Efficiency (NFFE) (2003) *Preliminary Assessment of Demand-Side Energy Efficiency Improvement Potential and Costs*. Background Report (V4.1).

National Pollutant Inventory (2008) *Tracking emissions across Australia*. Canberra, Australia: Department of the Environment, Water, Heritage & the Arts. Online: http://www.npi.gov.au/. Accessed 13/8/2008

National Academy of Sciences Research Council (1999) *Our Common Journey: A Transition Toward Sustainability*, Board on Sustainable Development Policy Division. Washington, D.C., USA: National Academies Press.

Nelson, R. & S. Winter (1982) *An evolutionary theory of economic change*. Cambridge, MA, USA: Harvard University Press.

Neumayer, E. (2003) *Weak versus Strong Sustainability: Exploring the limits of two opposing paradigms*, Cheltenham, UK: Edward Elgar.

New Gen Coal (2008) *News, views and facts about low-emissions coal technology*. Online: http://www.newgencoal.com.au/ Accessed: 8/02/2009.

New Scientist (2008) *Special report: Life in a land without growth, Interview with Herman Daly*, 15/10/2008, Issue 2678. Online: http://www.newscientist.com/article/mg20026786.900-special-report-life-in-a-land-without-growth.html?full=true. Accessed: 29/01/2009.

New South Wales Department of Environment & Climate Change (DECC) (2007) *Ecological Impacts of Longwall Mining in the Southern Coalfields of NSW – A Review*. Report No: 0504/17-1c. Sydney, Australia: NSW DECC. Online: http://www.planning.nsw.gov.au/planningsystem/pdf/wyonginquiry_submissions_deccattach2.pdf. Accessed: 3/11/2008. ,

New South Wales Department of Environment & Climate Change (DECC) (2008) *What is a bioregion?* Online: http://www.environment.nsw.gov.au/bioregions/BioregionsExplained.htm. Accessed: 5/6/2008., New South Wales Department of Energy, Utilities & Sustainability (DEUS) (2006) *NSW Renewable Energy Target: Explanatory Paper.* Online: http://www.deus.nsw.gov.au/publications/nret%20explanatory%20paper%20final.pdf Accessed: 5/6/2008.

New South Wales Department of Infrastructure Planning & Natural Resources (DIPNR) (2005) Coal Mining Potential in the Upper Hunter Valley - Strategic Assessment. Sydney, Australia: NSW Government.

New South Wales Department of Mineral Resources (DMR) (1999) *Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW.* Sydney, Australia: NSW Government.

New South Wales Department of Mines (DoM) (Various years from 1875-2005) *Annual Reports.* Sydney, Australia: NSW Government.

New South Wales Department of Planning (DoP) (2005) *Coal Mining Potential in the Upper Hunter Valley – Strategic Assessment*. Sydney, Australia: NSW Government.

New South Wales Department of Primary Industries (DPI) (Various years from 2003-2006) *NSW Coal Industry Profile*. Maitland, NSW, Australia: New South Wales Department of Primary Industries Mineral Resources Division.

New South Wales Department of Primary Industries (DPI) (2005) *Environmental management of exploration, mining and petroleum*. Maitland, NSW, Australia: New South Wales Department of Primary Industries Mineral Resources Division. Online: http://www.dpi.nsw.gov.au/minerals/environment Accessed: 12/8/2007.

New South Wales Department of State & Regional Development (DSRD) (2006) *NSW Regional Profile: Hunter Region.* Sydney, Australia: NSW Government. Online: http://www.business.nsw.gov.au/region/profiles/Hunter.htm. Accessed: 1/5/2008.

New South Wales Department of State & Regional Development (DSRD) (2007) *Regional Development Board.* Sydney, Australia: NSW Government. Online: http://www.business.nsw.gov.au/region/rdb Accessed: 1/11/2008.

New South Wales Department of Urban Affairs & Planning (1997) *Upper Hunter Cumulative Impact Study and Action Plan*. Sydney, Australia: NSW Government.

New South Wales Department of Urban Affairs & Planning (DUAP) (2001a) *PlanFirst Review of Plan Making in NSW White Paper*. Sydney, Australia: NSW Government.

New South Wales Government (2009) Energy Reform Strategy: Defining an Industry Framework. Sydney, Australia: New South Wales Government.

New South Wales Legislative Assembly, various speakers (1997) *Newcastle Steelworks Closure,* 8/5/1997, NSW Parliamentary Hansard. Sydney, Australia. Online: http://www.parliament.nsw.gov.au/prod/PARLMENT/hansArt.nsf/V3Key/LA19970508004. Accessed: 21/08/2006.

New South Wales Legislative Assembly, various speakers (1999) *BHP Newcastle Steelworks Closure,* 22/9/1999, NSW Parliamentary Hansard. Sydney, Australia. Online:

http://www.parliament.nsw.gov.au/prod/PARLMENT/hansArt.nsf/V3Key/LA19990922028. Accessed: 21/08/2006.

New South Wales Legislative Council (2006) *Upper Hunter Coal Dust Air Pollution,* 28/09/2006, NSW Parliamentary Hansard. Sydney, Australia. Online: http://www.parliament.nsw.gov.au/Prod/Parlment/HansArt.nsf/V3Key/LC20060928017. Accessed: 2/09/2007.

New South Wales Minerals Council (1997) *Guidelines for Best Practice Community Consultation in the New South Wales Mining and Extractive Industries*. Sydney, Australia: NSW Minerals Council.

New South Wales Minerals Council (2006) Our *Principles of Sustainable Development.* Sydney, Australia: NSW Minerals Council. Online: http://www.nswmin.com.au/sustaining_nsw/our_principles_for_sustainable_development Accessed: 7/8/2007.

New South Wales Minerals Council (2007a) *State of the Industry Report 2007: Shedding Light on the Issues.* Sydney, Australia: NSW Minerals Council. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0007/8638/MIN101_IndRep_Text_FA63.pdf. Accessed: 10/6/2008.

New South Wales Minerals Council (2007b) *The Other Side: Brought To You By Mining*. Media release, 20/2/2007. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0017/7190/NSWMC_Media_Release_Campaign_Announcement_Illawarra.pdf Accessed: 2/6/2007.

New South Wales Minerals Council (2008) *Community Engagement in the NSW Minerals Industry.* Sydney, Australia: NSW Minerals Council. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0018/6624/NSWMC_Summary_Brochure_Comm_Engagement.pdf. Accessed: 4/10/2008.

New South Wales Minerals Council & CFMEU, Mining & Energy Division (2008) *Mining Industry and CFMEU Call for Fast Track on Low Emission Technologies*. Media Release, 02/04/08. Sydney, Australia: NSW Minerals Council. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0005/8897/07-08-2_FINAL_Otway_Release_-_for_Otway_Briefing.pdf. Accessed: 4/10/2008.

New South Wales Scientific Committee (2005) *Final determination: Lower Hunter Spotted Gum - Ironbark Forest in the Sydney Basin Bioregion - endangered ecological community listing*. Sydney, Australia: NSW Department of Environment, Climate Change and Water. Online: http://www.environment.nsw.gov.au/determinations/HunterGumIronbarkEndSpListing.htm. Accessed: 12/2/2010.

New South Wales Scientific Committee (2005) *Alteration of habitat following subsidence due to longwall mining: Key threatening processes Schedule 3 of the Threatened Species Conservation Act*. Sydney, Australia: NSW Government.

Newcastle City Council (1997) *Initiatives: Steps towards Sustainability in Newcastle and the Hunter Region.* Newcastle, Australia: Newcastle City Council.

Newcastle City Council (2006) Contribution to Climate Change, *Minutes of the Development Applications Committee Meeting held in the Council Chambers, 2nd Floor*

City Hall on Tuesday 7 November 2006 at 6.05pm. Newcastle, Australia: Newcastle City Council.

Newcastle City Council (2008) *State of the Environment Report 2007/2008.* Neewcastle, Australia: Newcastle City Council. Online: *http://www.ncc.nsw.gov.au/__data/assets/pdf_file/0005/51818/State_of_the_Environment_Report_2007_2008_SECURED_-_Adobe_Acrobat_Professional.pdf* Accessed: 29/3/2009.

Newcastle Herald (2005a) *Editorial: Living in the greenhouse,* 21/5/2005, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2005b) *Editorial: The costs of king coal,* 7/2/2005, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2005c) *Editorial: The climbing costs of coal,* 12/9/2005, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2006) *Editorial: Grandstanding,* 9/11/2006, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2007a) *Editorial: An ethical coal trust*, 17/4/2007, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2007b) *Editorial: Protest rights and wrongs,* 20/11/2007, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2008a) *Editorial: Upper Hunter air quality,* 17/11/2007, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2008b) *Editorial: The energy revolution*, 25/11/2008, *Newcastle Herald.* Newcastle, Australia.

Newcastle Herald (2009) Coal comfort for 10,000 Hunter mineworkers. *Newcastle Herald*, 12/03/2009. Newcastle, Australia.

Newcastle Morning Herald (1980) *Editorial,* 19/7/1980. Newcastle, Australia.

Newcastle Port Corporation (NPC), 2004. Annual Report 2003–2004, Newcastle, Australia. Online: http://www.newportcorp.com.au/images/uploaded/03-04%20Annual%20Report.pdf. Accessed: 30/5/2008.

Newcastle Port Authority (2006) *Two centuries of coal loading at the Port of Newcastle*. Newcastle, Australia. Online: http://www.newportcorp.com.au/page_default.aspx?pageID=105. Accessed: 1/5/2008.

Newell, P. (2005) River runs deep with environmental concerns, *Newcastle Herald*, 26/3/2005, Newcastle, Australia.

Newell, P. (2005) Towards a political economy of global environmental governance. In P. Dauvergne (ed) *Handbook of Global Environmental Politics*. Cheltenham, UK: Edward Elgar.

Newell, P. (2006) Creating community through conflict: How environmental issues can bring town and country together. *Hunter Valley Research Foundation 2006 Lecture Series,* Hunter Valley Research Foundation. Online:

http://www.hvrf.com.au/pages/design/links/uploaded/Patrice%20Newell%20transcript%202006.pdf. Accessed: 12/8/2007.

Newman, M. (1993) *The Third Contract. Theory and Practice in Trade Union Training*, Sydney, Australia: Stewart Victor Publishing.

Newman, M. (1994) *Defining the Enemy. Adult Education in Social Action*, Sydney, Australia: Stewart Victor Publishing.

Newman, P. & Jennings, I. (2008),*Cities as sustainable ecosystems: Principles and practices*, Washington, DC, USA: Island Press.

Noble, R. (2008) *Of Human Right and Human Gain*. Newcastle, Australia: Newcastle Trades Hall Council.

Norberg-Hodge, H. (1996) Shifting Direction: From Global Dependence to Local Interdependence. In J. Mander & E. Goldsmith (eds.) *The Case Against the Global Economy: and for a Turn Towards the Local, San Francisco, Sierra Club.* San Francisco, CA, USA: Sierra Club.

Norton, B. G. (1994),Environmental Ethics and Weak Anthropocentrism. In: S. Armstrong & R. Botzler (eds) *Environmental ethics: Divergence and convergence*. New York, NY, USA: McGraw Hill.,

Norton, P. (2004) *Accord, Discord, Discourse and Dialogue in the Search for Sustainable Development*, PhD thesis, Griffith University, Qld, Australia. Online: http://www4.gu.edu.au:8080/adt-root/uploads/approved/adt-QGU20040924.093047/public/02Whole.pdf Accessed: 28/2/2009,

Obach, B. (President of the USA), (2004) *Labor and the Environmental Movement: The Quest for Common Ground*. Cambridge, MA, USA: MIT Press.

Obama, B. (2009) Energy & the Environment. Speech by President Obama, 19/3/2009. Online: http://www.whitehouse.gov/issues/energy_and_environment/. Accessed: 11/5/2009.

Oels, A. (2005) Rendering Climate Change Governable: From Biopower to Advanced Liberal Government? *Journal of Environmental Policy & Planning* 7:3: 185-207.

Office of Greens MLC Lee Rhia*nnon* (2005) *NSW Coal Affected Communities: An overview of communities affected by coal issues*, as presented at the Greens NSW Coal Issues Forum held at Parliament House, April 2005. Sydney, Australia. Online: http://lee.greens.org.au/CoalCommunities.pdf Accessed: 10/12/2008.

Oil Drum- Europe (The) (2009).*CO2 Capture and Storage: The Energy Costs.*Online: http://www.theoildrum.com/node/2733 Accessed: 13/3/2009.

Ollis, T. (2008) *The 'circumstantial' activist: holistic practice, learning and social activism*, paper presented to SCUTREA Edinburgh, Scotland, 2 - 4 July, 2008. Online: http://www.thechangeagency.org/_dbase_upl/Coincid_activist_Ollis.pdf. Accessed: 8/10/2008.

Olsson, P., Folke, C. & Berkes, F. (2004) Adaptive Comanagement for Building Resilience in Socio-Ecological Systems. *Environmental Management,* 34: 75-90.

Olsson, P., Gunderson, L. H., Carpenter, S. R., Ryan, P., Lebel, L., Folke, C. & Holling, C.S. (2006) Shooting the rapids: navigating transitions to adaptive governance of social-ecological systems. *Ecology & Society* 11, 1. Online: http://www.ecologyandsociety.org/vol11/iss1/art18/. Accessed: 2/6/2007.

O'Meara, P., Mehlinger, H. & Krain, M. (2000) *Globalization and the challenges of a new century: A reader.* Bloomington, IN, USA: Indiana University Press. ,

O'Neill, M. (2007) Australian coal. *ABC Radio National Perspective*, 15/2/2007. Online: http://www.abc.net.au/rn/perspective/stories/2007/1845818.htm Accessed: 2/1/2009.

O'Neill, P. (2007) Currying favour as the big smoke bulges, 13/8/2007, *Newcastle Herald.* Newcastle, Australia.

O'Neill, P. & Green, R. (2000) Global economy, local jobs. In P. McManus, P. O'Neill & R. Loughran (eds.) *Journeys: The making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

O'Neill, P., McManus, P. & Loughran, R. (2000) The Hunter Region in the nation's spotlight. In P. McManus, P. O'Neill, & R. Loughran (eds.) *Journeys: The making of the Hunter Region.* St Leonards, Australia: Allen & Unwin.

Opschoor, J. (1996) Institutional change and development towards sustainability. In R. Costanza, O. Segura, J. Martinez-Alier (eds) *Getting Down To Earth: Practical Applications of Ecological Economics*. Washington DC, USA: Island Press.

Orchison, K. (2008) Efficiency gaining on production rise, 29/3/2008, *The Weekend Australian.* Sydney, Australia.

Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*. Cambridge, UK: Cambridge University Press.

O'Sullivan, E. (1999) *Transformative Learning: Educational Vision for the Twenty-First Century*. London & New York: Zed Books; Toronto: University of Toronto Press.

Owen, A.D. (2007) *Inquiry into electricity supply in NSW*. Sydney, Australia: NSW Government.

Paavola, J. (2007) Institutions and environmental governance: A reconceptualization, *Ecological Economics*, 63, 1: 93-103

Paehlke, R. (2003) *Democracy's dilemma: environment, social equity, and the global economy*. Cambridge, MA, USA: MIT Press.

Pahl-Wostl, C. & Hare, M. (2004) Processes of social learning in integrated resources management. *Community & Applied Social Pyschology* 14: 193–206.

Pahl-Wostl, C. (2006) The Importance of Social Learning in Restoring the Multifunctionality of Rivers and Floodplains. *Ecology and Society*, 11, 1.

Palley, T. (2003) Lifting the Natural Resource Curse, *Foreign Service Journal*, December 2003.

Palma, J. (2005) Four sources of 'de-industrialisation' and a new concept of the 'dutch disease'. In J. Ocampo (ed.) *Beyond reforms: structural dynamics of macroeconomic vulnerability,* Washington DC, USA: World Bank, UN-ECLA & Stanford University Press.

Paradice, W.E.J. (2009) *Paying for carbon in the Hunter Region. Media* release, 4/3/2009. Mayfield, Australia: Hunter Valley Research Foundation. Online: http://www.hvrf.com.au/pages/news/index.php?id=93Accessed: 17/3/2009.

Parker, A..R., Van Alstine, J., Gitsham, M., Dakin, R., (2008) *Managing Risk and Maintaining License to Operate: Participatory Planning and Monitoring in the Extractive Industries*. Report to the World Bank Group London, UK: Ashridge Business School. Online: http://www.ashridge.org.uk/website/IC.nsf/wFARATT/Managing%20Risk%20and%20Maintaining%20License%20to%20Operate:%20Participatory%20Planning%20and%20Monitoring%20in%20the%20Extractive%20Industries/$file/Managing%20Risk.pdf Accessed: 17/09/2008

Parliament of Australia (2005). Report *into Regional Partnerships and Sustainable Regions programs,* The Senate Finances & Public Administration References Committee, October 2005, Canberra. Online: http://www.aph.gov.au/Senate/committee/fapa_ctte/reg_partner_prog/report/report.pdf. Accessed: 5/6/2008.

Passmore, J. (1974) *Man's Responsibility for Nature: Ecological Problems and Western Traditions*. London, UK: Duckworth.

Paterson, M. (2000) *Understanding Global Environmental Politics: Domination, Accumulation, Resistance*. London, UK: Macmillan.

Peacock, K. (1999) Staying out of the Lifeboat: Sustainability, Culture, and the Thermodynamics of Symbiosis, *Ecosystem Health* 5, 2: 91-103.

Peacock, M. (2008) Solar takes off with US power supply deal, *ABC News*, 2/10/2007. Online: http://www.abc.net.au/news/stories/2007/10/02/2048420.htm Accessed: 16/3/2009.

Peake, T. (2006) *The Vegetation of the Central Hunter Valley, New South Wales – A Report on the Findings of the Hunter Remnant Vegetation Project*. Paterson, Australia: Hunter & Central Rivers Catchment Management Authority.

Pearce, D., Markandya, A., Barbier, E. (1989) *Blueprint for a Green Economy*. London, UK: Earthscan.

Pearce, D. & Atkinson, G. (1993) Capital Theory and the Measurement of Sustainable Development: An Indicator of Weak Sustainability. *Ecological Economics* 8: 103-8.

Pearce, D. W. & Atkinson, G. (1995) Measuring sustainable development. In: D. W. Bromley (ed.) *The Handbook of Environmental Economics*, Oxford, UK: Blackwell.

Pearse, G. (2007) *High and Dry: John Howard, Climate Change and the Selling of Australia's Future,* Camberwell, Australia: Viking.

Pearse, G. (2009) *Quarry Vision: Coal, climate change and the end of the resources boom.* Quarterly Essay, 33. Melbourne, Australia: Black Inc.

Peña, D. (2003) Identity, Place and Communities of resistance. In J. Agyeman, R. Bullard, B. Evans, *Just Sustainabilities: Development in an Unequal World*, London, UK, Earthscan.

Peoples, J. & Sugden, R. (2001). Divide and rule by transnational corporations. In C. N. Pitelis & R. Sugden *(eds) The Nature of the Transnational Firm*. London, UK: Routledge.

Pepper, D. (1993) *Eco-Socialism: From Deep Ecology to Social Justice*. London, UK: Routledge.

Pepperdine, S. (2000) Social Indicators of Rural Community Sustainability: An Example from the Woady Yaloak Catchment. Paper presented to *First National Conference on the Future of Australia's Country Towns: Practical Strategies for Sustainable Futures*, June 2000. Bendigo, Australia. Online: http://www.regional.org.au/au/countrytowns/strategies/pepperdine.htm. Accessed: 6/02/2009

Percy-Smith, B. (2006) From Consultation to Social Learning in Community Participation with Young People, *Children, Youth and Environments* 16(2): 153-179. Online: http://www.colorado.edu/journals/cye. Accessed: 7/10/2008.

Pereira, J. & Komoo, I. (2003) Addressing Gaps in Ecosytem Health Assessment: The Case of Mineral Resources. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Perelman, M. (2003) *The perverse economy: The impact of markets on people and the environment.* New York, NY, USA: Palgrave Macmillan, 2003.

Perl, M. (2009) How to be a successful lobbying organization, *Third Sector Magazine,* October 2009. Online: http://thirdsectormagazine.com.au/news/how_to_be_a_successful_lobbying_organisation/008062/ . Accessed: 29/09/2009.

Perrings, C. (2006) Resilience and sustainable development. *Environment & Development Economics,* 11: 417-427.

Perrings, C. (2007) Future Challenges, *PNAS*, 104,39:15179-15180.

Peterson, G. D., Allen, C. R. & Holling, C. S. (1998) Ecological resilience, biodiversity, and scale. *Ecosystems,* 1: 6–18.

Peterson, G. D., Cumming, G.S. & S. R. Carpenter, S. R. (2003) Scenario planning: a tool for conservation in an uncertain world. *Conservation Biology* 17:358–366.

Pettit, J. (2004) Climate Justice: A New Social Movement for Atmospheric Rights

Pew Center on Global Climate Change (2008) *Coal and Climate Change Facts*. Online: http://www.pewclimate.org/global-warming-basics/coalfacts.cfm. Accessed: 11/09/2009.

Pew Charitable Trusts (2009) *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America. Washington DC, USA:* Pew Charitable Trusts. Online: http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf. Accessed: 26/6/2009.

Phillips, B. & Ross, D. (1980) *Who Asked Us? Coal, Power, Aluminium - The Hunter Regions Only Future?,* Newcastle, Australia: Newcastle Ecology Centre.

Phillips, R. S. (n.d), *A History of Mining in the South Maitland Coalfield 1900 to 1930*, B.A. Thesis, Armidale, NSW, Australia, New England University College.

Phillips, S. (2005) Hunter coal at heart of greenhouse menace. *Newcastle Herald,* 25/2/2005, Newcastle, Australia.

Phillips, S. (2007a) Can't beat climate catastrophe without a grassroots movement. *Global Warming Day conference 2/3/2007, Sydney University, Australia.* Rising Tide. Online: http://www.risingtide.org.au/node/419. Accessed: 1/5/2008.

Phillips, S. (2007b) Clean coal spin fails climate change test. *Newcastle Herald.* Newcastle, Australia.

Pickering, C., Good, R. & Green, K. (2004) *Potential Effects of Global Warming on the Biota of the Australian Alps,* Canberra, Australia: Australian Greenhouse Office.

Pinderhughes. R. (2007) *Green Collar Jobs: An Analysis of the Capacity of Green Businesses to Provide High Quality Jobs for Men and Women with Barriers to Employment: A Case Study of Berkeley, California. Online:* http://bss.sfsu.edu/raquelrp/. Accessed: 11/6/2008.

Pittock, B.(2003) *Climate change - An Australian Guide to the Science and Potential Impacts*, Canberra, Australia: Australian Greenhouse Office.

Pittock, B. (2007) *Ten reasons why climate change may be more severe than projected.* Online: www.greeninnovations.asn.au/Risk-could-be-greater-Pittock-April07.doc. Accessed: 1/8/2006.

Plumwood, V. (1993) *Feminism and the Mastery of Nature*. London, UK; Routledge.

Plumwood, V. (2002) Environmental Culture: The Ecological Crisis of Reason, New York & London: Routledge.

Pohl, C., & Hirsch Hadorn, G. (2007). *Principles for designing transdisciplinary research*. Munich, Germany: Oekom.

Pollin, R, Garrett-Peltier, H., Heintz, J., Scharber, H. (2008) *Green Recovery – A Program to Create Good Jobs and Start Building a Low-Carbon Economy.* Amherst, MA, USA: Political Economy Research Institute & Center for American Progress. Online: http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/peri_report.pdf Accessed: 18/12/2008.

Ponting, C. (2007) *A New Green History of the World: The Environment and the Collapse of Great Civilizations*. Revised edition. New York, NY, USA. Penguin.

Porritt, J. (2005) *Capitalism as if the World Matters*. London, UK:,Earthscan.

Portes, A. (1997) *Globalization from below: the rise of transnational communities*, Transnational Communities Programme Working paper series, WPTC-98-01. Princeton University.

Postel, S., Daily, G. & Ehlich, P. (1996) Human appropriation of renewable fresh water. *Science*, 271: 785-788.

Power, M. 2002. *Digging to Development? A Historical Look at Mining and Economic Development.* Washington DC, USA: Oxfam America.

Pozon, I. & Mench, P. (2006) *Coming Clean: The truth and future of coal in the Asia Pacific.* Hong Kong: WWF International. Online: http://assets.panda.org/downloads/coming_clean.pdf. Accessed: 12/6/2007.

Princen, T. (2005) *The Logic of Sufficiency*. Cambridge, MA, USA: The MIT Press.

Prugh, T., Costanza, R. & Daly, H. (2000) *The local politics of global sustainability*., Washington, D.C., USA: Island Press.

Putnam, R. D. (1995) Bowling Alone: America's Declining Social Capital, *Journal of Democracy*, 6, 65-78.

Ramankutty, N., Evan, A.T., Monfreda, C., & Foley, J. A. (2008), Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000, *Global Biogeochemical Cycles*, 22, 1.

Ráez-Luna, E. (2008) Third World Inequity, Critical Political Economy, *and the Ecosystem Approach.* In D. Waltner-Toews, J. Kay & N-M. Lister (eds) *The Ecosystem Approach: Complexity, Uncertainty and Managing for Sustainability*. New York, NY, USA: Columbia University Press.

Rahman, A. (1993) *People's Self-Development: Perspectives on Participatory Action Research.* London, UK: Zed Books.

Ramachandra, G. & Martinez-Alier, J. (1997) *Varieties of Environmentalism: Essays North and South*, London, UK: Earthscan.

Ranis, G. (2006) Ownership, Dutch Disease and the World Bank. In G. Ranis *et al* (eds) *Globalisation and the nation state.* London, UK: Routledge.

Rantisi, N. (2004) The Ascendance of New York Fashion. *International Journal of Urban and Regional Research,* 28: 86 - 106.

Rapport, D. (1998a) The Need for a New Paradigm. In D. Rapport, P. R. Epstein, R. Levins, R. Costanza, & C. Gaudet (eds.) *Ecosystem Health.* Malden, MA, USA: Blackwell Science.

Rapport, D. (1998b) Defining Ecosystem Health. In D. Rapport, P. R. Epstein, R. Levins, R. Costanza, & C. Gaudet (eds.) *Ecosystem Health.* Malden, MA, USA,: Blackwell Science.

Rapport, D., Costanza, R. & McMichael, A. (1998) Assessing Ecosystem Health: Challenges at the Interface of Social, Natural, and Health Sciences. *Trends in Ecology & Evolution* 13, 10:397–401.

Rapport, D. (2003) Regaining Healthy Ecosystems: The Supreme Challenge of Our Age. In D. Rapport, W. Lasley, D. Rolston, N. O. Nielson, C. Qualset & A. Damania, (eds.) *Managing for Healthy Ecosystems.* Boca Raton, FL, USA: Lewis Publishers.

Rapport, D. (2007) Sustainability science: An ecohealth perspective, *Sustainability Science*, (2007) 2, 77-84.

Rapport, D., Costanza, R. & McMichael, A. J. (1998) Assessing ecosystem health: Challenges at the interface of social, natural, and health sciences. *Trends in Ecology & Evolution*, 13: 397-402.

Rapport, D., Epstein, P. R., Levins, R., Costanza, R. & Gaudet, C. (1998) *Ecosystem Health.* Malden, MA, USA: Blackwell Science.

Rapport, D. & Whitford, W. (1999) How Ecosystems Respond to Stress: Common responses of aquatic and arid systems, *Bioscience*, 49: 193-203.

Rapport, D., Böhm, G., Buckingham, G., Cairns, J., Costanza, R. Karr, J., de Kruijf, H., Levins, R.,. McMichael, A., Nielsen, N., Whitford, W. (2000) Ecosystem Health: The Concept, the ISEH, and the Important Tasks Ahead, *Ecosystem Health*, 5: 82-90.

Rapport, D. & Friend, A. (1979) *Towards a Comprehensive Framework for Environmental Statistics: A Stress-response Approach.* Statistics Canada Catalogue 11-510, Ottawa, ON, Canada: Minister of Supply & Services Canada.

Raskin, P., Banuri, T., Gallopín, G., Gutman, P., Hammond, A., Kates, R. & Swart, R. (2002) *The Great Transition: The Promise and the Lure of the Times Ahead*. Boston, MA: Stockholm Environment Institute/Tellus Institute.

Raskin, P. (2006) *World Lines: Pathways, Pivots, and the Global Future*. Boston, MA: Stockholm Environment Institute/Tellus Institute.

Raupach, M. (2007) *CO2 emissions increasing faster than expected*. Online: http://www.csiro.au/news/GlobalCarbonProject-PNAS.html. Accessed 9/9/09.

Raworth, K. (2008) *Climate Wrongs and Human Rights: Putting people at the heart of climate-change policy*. Oxfam Briefing Paper 117. Oxford, UK: Oxfam International. Online: http://www.oxfam.org/sites/www.oxfam.org/files/bp117-climate-wrongs-human-rights-summary-0809.pdf. Accessed; 23/2/2009.

Ray, G. (2005a) Carbon Valley: How the Hunter has become a greenhouse capital of Australia, 21/5/2005. *Newcastle Herald.* Newcastle, Australia.

Ray, G. (2005b) Valley's ' lunar landscape' prompts demand for…mine free zone. *Newcastle Herald*, 8/2/2005. Newcastle, Australia.

Ray, G. (2005c) How one Hunter mine left a farm dry as a bone, 9/2/2005. *Newcastle Herald.* Newcastle, Australia.

Ray, G. (2005d) Black hole: State to extract $300 million in Hunter royalties. *Newcastle Herald*, 7/2/2005, Newcastle, Australia.

Ray, G. (2005d) Villagers beset by mine blasts battle dust in homes, gardens. *Newcastle Herald,* 7/2/2005, Newcastle, Australia.

Ray, G. (2005e) $300 m royalties as Valley strains. *Newcastle Herald*, 7/2/2005. Newcastle, Australia.

Ray, G. (2005f) Streams at risk of vanishing. *Newcastle Herald,* 9/2/2005. Newcastle, Australia.

Ray, G. (2005g) Protest at loss of forest in mine expansion. *Newcastle Herald,* 9/2/2005. Newcastle, Australia.

Ray, G. (2005h). From historic homes to old slab huts, the voracious march of mines threatens our heritage. *Newcastle Herald,* 9/2/2005. Newcastle, Australia.

Ray, G. (2005i). Health concerns as fine dust flies. *Newcastle Herald,* 11/2/2005. Newcastle, Australia.

Ray, G. (2005j) A coal change is coming. *Newcastle Herald,* 12/2/2005, Newcastle, Australia.

Ray, G. (2007a) Fears coal dust is harming health. *Newcastle Herald,* 9/7/2007. Newcastle, Australia.

Ray, G. (2007b) Revealed: the Hunter towns choking on 50,000 tonnes of dust. *Newcastle Herald*, 9/7/2007. Newcastle, Australia.

Redefining Progress, Tyler Norris Associates, Sustainable Seattle (2006) *The community indicators handbook: Measuring progress toward healthy and sustainable communities.* 2nd ed. San Francisco, CA, USA: Redefining Progress**.**

Rees, W. & Westra, L., (2003) When Consumption Does Violence: Can There Be Sustainability and Environmental Justice in a Resource-limited World? In J. Agyeman, R. Bullard & B. Evans (eds) *Just Sustainabilities: Development in an Unequal World,* London, UK: Earthscan.

Regan, T. & Singer, P. (eds) (1976) *Animal Rights and Human Obligations*. Englewood Cliffs, NJ, USA: Prentice Hall

REN21 (2008a) *Renewables 2007 Global Status Report,* Paris & Washington DC, USA, REN21 Secretariat & Worldwatch Institute. Online: http://www.ren21.net/pdf/RE2007_Global_Status_Report.pdf. Accessed: 4/10/2008.

REN21 (2008b) *Renewable Energy Potentials: Opportunities for the Rapid Deployment of Renewable Energy in Large Economies, Its Impacts on Sustainable Development and Appropriate Policies to Achieve it,* Summary Report, August 2008. Paris & Washington DC, USA, REN21 Secretariat & Worldwatch Institute. Online: http://www.ren21.net/pdf/REN21_Potentials_Report.pdf. Accessed: 4/10/2008.

Renwick, C., Daly, M., Brown, J., A., A., Atkinson, W., March, D., McMahon, T. & Pattison, A. (1968) *The Hunter Valley Region,* Newcastle, Australia: Ell's Booksellers & Publishers.

Resilience Alliance (2005) *Resilience Alliance.* Online: http://www.resalliance.org/576.php. Accessed: 2/4/2007.

Reuters India (2008) *Update 1-U.S. power plant coal demand to slip in 2009 – EIA,* 12/11/2008. Online: http://in.reuters.com/article/oilRpt/idINN1229352820081112 Accessed: 2/1/2009.

Rey-Lesecure, O. (2009a) Hunter Valley and mining areas. GIS Laboratory, School of Environment & Life Sciences, University of Newcastle, Australia.

Rey-Lesecure, O. (2009b) *Remote Sensing Analysis of Mine Disturbed Land in the Upper Hunter Valley, NSW, Australia*. GIS Laboratory, School of Environment & Life Sciences, University of Newcastle, Australia.

Reynolds, A. (2001) *Heat on the land: Climate change and what it means for Australian farmers*. Online: http://www.cana.net.au/farmer/ Accessed: 21/12/2007

Reynolds, A. (2002) *Warnings from the Bush*. Sydney, Australia: Climate Action Network Australia. Online: http://www.cana.net.au/bush/default.htm. Accessed: 20/12/2007.

Reynolds, D. (ed) (2004) *Partnering for Change: Unions and Community Groups Build Coalitions for Economic Justice*, M.E. Sharpe, Armonk, NY.

Richardson, D. (2007) *The benefits of the mining boom: Where did they go?* Technical Brief No

3, May 2009. Canberra, Australia: The Australia Institute.

Richardson, K., Steffen, W., Schellnhuber, H.J., Alcamo, J., Barker, T. Kammen, D., Leemans, R., Liverman, D., Munasinghe, M., Osman-Elasha, B., Stern, N., Wæver, O. (2009) *Climate Change: Global Risks, Challenges, and Decisions: Synthesis Report*, 10-12/3/2009. Copenhagen, Denmark: University of Copenhagen. Online: http://climatecongress.ku.dk/pdf/synthesisreport/. Accessed: 19/6/2009.

Riedy, C. & Diesendorf, M. (2003) Financial subsidies to the Australian fossil fuel industry, *Energy Policy*, 31:125-137.

Riedy, C. (2007) *Energy and Transport Subsidies in Australia*. Sydney, Australia: Institute for Sustainable Futures.

Rising Tide, (2007a) *About Us.* Online: http://www.risingtide.org.au/. Accessed: 1/5/2008.

Rising Tide (2007b) *Global links: Rising Sea levels. Brought to you by mining*. Online: http://www.miningnsw.com.au/climate.php. Accessed: 2/10/2007.

Rising Tide (2008) *Shopping costs the Earth: Cheap imports fuel climate change*. Online: http://www.risingtide.org.au/shopping. Accessed: 2/7/2009.

Rochon, E., Bjureby, E., Johnston, P., Oakley, R., Santillo, D., Schulz, N. & Von Goerne, G. (2008) *False Hope: Why carbon capture and storage won't save the climate.* Amsterdam, The Netherlands: Greenpeace International.

Rootes, C. (2007) Acting locally: The character, contexts and significance of local environmental mobilisations, *Environmental Politics*, 16, 5: 722-741.

Rootes, C. (2008) The first climate change election? The Australian general election of 24 November 2007, *Environmental Politics*, 17, 3: 473-480.

Rose, B. (1995) *Land Management Issues: Attitudes and Perceptions Amongst Aboriginal People of Central Australia* (Alice Springs, Australia: Central Land Council.

Rose, D. B., (1996) Country. In *Nourishing Terrains: Australian Aboriginal Views of Landscape and Wilderness*, Canberra, Australia, Australian Heritage Commission.

Rose, D. B., (1996b). Ecological justice for the 21st century, *Northern Analyst*, 1: 9-10.

Rose, D. B. (1998) Exploring an Aboriginal Land Ethic, *Meanjin*, 47, 3: 378-386.

Rose, D. B. (1999) Indigenous ecologies and an ethic of connection, in N. Low, (ed) *Global Ethics and Environment*, London, Uk: Routledge: 175 – 187.

Rose, D. B. (2004) *Reports from a wild country: Ethics for decolonisation.* Sydney, Australia: UNSW Press.

Rose, F. (2000) Coalitions Across the Class Divide: Lessons from the Labor, Peace, and Environmental Movements. Ithaca, NY, USA: Cornell University Press, 2000

Rosenfield P. (1992) The potential of transdisciplinary research for sustaining and extending linkages between the health and social sciences. *Social Science & Medicine*, 35: 1343-57.

Ross, E. (1970) *A History of the Miners Federation of Australia.* Sydney, Australia: Australian Coal & Shale Employees Federation.

Ross, M. (1999) The political economy of the resource curse, *World Politics*, 51: 297-322.

Routledge, P. (1996). Critical geopolitics and terrains of resistance. *Political Geography* 15: 6/7, 509-531.

Routley R. & Routley V. (1995) *Against the inevitability of human chauvinism.* In Elliot R. (ed) Environmental ethics. Oxford, UK: Oxford University Press.

Rowell, A. (1996) *Green Backlash*: *Global Subversion of the Environment Movement.* London, UK: Routledge.

Rubin, E., Chen, C. & Rao, A. (2007) Cost and performance of fossil fuel power plants with CO_2 capture and storage. *Energy Policy, 35, 9, September 2007: 4444-4454*

Rubin, H. & Rubin, I. (2001) *Community Organizing and Development.* Boston, MA, USA: Allyn & Bacon.

Rucht, D. (1991) *Research in Social Movements: The State of the Art,* Boulder, CO, USA: Westview Press.

Rucht, D. (1999) The Impact of Environmental Movements in Western Societies. In M. Guigni, D. McAdam, & C. Tilly (eds). *How Social Movements Matter*, Minneapolis, MN, USA, & London, UK: University of Minnesota Press.

Rudd, K., Prime Minister of Australia (2007) *Labor TV - Climate change: the great moral challenge of our generation*. Online: http://www.alp.org.au/labortv/uKTHPU1yia Accessed: 13/3/2009.

Rudd, K., Prime Minister of Australia (2008a) *Global Carbon Capture and Storage Initiative*, Joint Media Release with the Minister for Resources, Energy & Tourism, Martin Ferguson, 19/9/2008. Canberra, Australia: Office of the Prime Minister of Australia. Online: http://www.pm.gov.au/media/Release/2008/media_release_0484.cfm. Accessed: 27/9/2008.

Rudd, K., Prime Minister of Australia (2008b) *$4.7 Billion Nation Building Package*. Media Release, 12/12/2008. Online: http://www.pm.gov.au/media/Release/2008/media_release_0687.cfm Accessed: 24/12/2008.

Rudd, K., Prime Minister of Australia (2009a) The Global Financial Crisis, *The Monthly*, 42, February 2009. Online: http://www.themonthly.com.au/monthly-essays-kevin-rudd-global-financial-crisis--1421?page=0%2C4. Accessed: 21/9/2009.

Rudd, K., Prime Minister of Australia (2009b) *A New Target for Reducing Australia's Carbon Pollution*, Joint Media Release with the Treasurer Wayne Swan & the Minister for Climate Change & Water, Penny Wong. 4/5/2009. Online: http://www.pm.gov.au/media/Release/2009/media_release_0966.cfm. Accessed: 12/5/2009.

Rudd, K., Prime Minister of Australia (2009c) *Speech at the launch of the Global Carbon Capture and Storage Institute*, 16/4/2009. Canberra, Australia. Online: http://www.pm.gov.au/media/Speech/2009/speech_0914.cfm Accessed: 14/5/2009.

Russell, W., Wickson, F. & Carew, A. (2007) Transdisciplinarity: Context, contradictions and capacity. *Journal of Futures*, 40, 5: 460-47.

Rutovitz, J & Passey, R. (2004) *NSW bioenergy handbook.* Sydney, Australia: NSW Department of Energy Utilities & Sustainability.

Rutovitz, J & Dunstan, C. (2009) *Meeting NSW Electricity Needs in a Carbon Constrained World: Lowering Costs and Emissions with Distributed Energy*. Prepared as part of Project 4 of the CSIRO Intelligent Grid Research Program. Sydney, Australia: Institute for Sustainable Futures, University of Technology Sydney.

Sachs, J. & Warner, A. (1997) *Natural Resource Abundance and Economic Growth*, Updated and extended version of NBER working paper 5398 (October 1995), Cambridge, MA, USA: Harvard University, Harvard Institute for International Development.

Saddler, H. (2008) *Energy Security: The real story: Australia's Options: Setting the scene*, lecture presented at Whitlam Institute, University of Western Sydney, 13/5/2008. Online: http://www.whitlam.org/whitlam/images/stories/whitlam/hugh_saddler_speech.pdf Accessed: 12/3/2009.

Saddler, H., Riedy, C. & Passey, R. (2004) *Geosequestration: What is it and how much can it contribute to a sustainable energy policy for Australia?* Discussion Paper 72. Canberra, Australia: The Australia Institute.

Saddler, H, Diesendorf, M., Denniss, R. (2004) A *Clean Energy Future for Australia.* Sydney, Australia: Clean Energy Future Group. Online: http://wwf.org.au/publications/clean_energy_future_report/ Accessed: 24/3/2006

Saddler, H., Diesendorf, M. & Denniss, R. (2007) Clean energy scenarios for Australia. *Energy Policy*, 35, 2: 1245-1256.

Sale, K. (1991) *Dwellers in the Land: The Bioregional Vision.* Philadelphia, USA: New Society Publishers.

Sale, K. (1996) Principles of Bioregionalism. In J. Mander & E. Goldsmith (eds.) *The Case Against the Global Economy: And for a Turn Towards the Local.* San Francisco, USA: Sierra Club.

Salusinszky, I. (2008) Michael Costa: the free radical. *The Australian*, 5/9/2008. Online: http://www.theaustralian.news.com.au/story/0,,24298034-5013945,00.html. Accessed: 2/2/2009.

Sampat, P. (2003),Scrapping Mining Dependence. In *State of the World 2003.* New York, NY, USA: Worldwatch Institute/Norton.

Sandweiss, S. (1998) The social construction of environmental justice. In D. Camacho, (ed), *Environmental Injustices, Political Struggles: Race, Class and the Environment.* Durham & London, UK: Duke University Press.

Sassoon, A. (2000) *Gramsci and Contemporary Politics: Beyond Pessimism of the Intellect*, London, UK: Routledge.

Sassson, A. (2001) Globalisation, Hegemony and Passive Revolution, *New Political* Economy, 6,1: 5-17.

Save Our Cumberland Mountains (SOCM) (2008) *People working together for social, economic and environmental justice in Tennessee: Strip Mine Committee*. Online: http://www.socm.org/ . Accessed: 22/12/2008

Scanlon, M. (2005) Coal baron forged empire with iron fist, *Newcastle Herald,* 17/12/2005. Newcastle, Australia.

Schapiro, R. (1995) Liberatory pedagogy and the development paradox. *Convergence,* 28, 2: 28.

Scheffer, M., Carpenter, S., Foley, J., Folke, C. & Walker, B. (2001) Catastrophic shifts in ecosystems. *Nature,* 413: 591-596.

Scheffer, M. & Carpenter, S. (2003) Catastrophic regime shifts in ecosystems: linking theory to observation, *Trends in Ecology & Evolution* 18, 12:648-656.

Schellnhuber. H. J., Cramer. W., Nakicenovic. N., Wigley, T. & Yohe, G. (eds) (2006) *Avoiding Dangerous Climate Change.* Cambridge, UK: Cambridge University Press.

Schmid, G. (2002) Towards a theory of transitional labour markets. In G. Schmid & B Gazier (eds) *The Dynamics of full employment: social integration through transitional labour market.* Cheltenham UK: Edward Elgar.

Schnaiberg, A. & Gould, K. (1994) *Environment and society: The enduring conflict.* New York, NY, USA: St Martins Press.

Schofield, S. (2006) Cash for No Comment, *ABC TV Stateline,* 26/05/2006. Sydney, Australia. Accessed: 1/5/2008.

Schrader-Frechette, K. (1999) Chernobyl, environmental justice and mutagenic threats. In N. Low (ed) *Global Ethics and the Environment.* London, UK: Routledge.

Schrader-Frechette, K. (2002) *Environmental Justice: Creating Equality, Reclaiming Democracy.* New York: Oxford University Press.

Schumacher, E. F. (1973) *Small is Beautiful: Economics as if people mattered*. New York, NY, USA: Harper & Row.

Schugurensky, D. (2000) Adult Education and Social Transformation: On Gramsci, Freire, and the Challenge of Comparing Comparisons, *Comparative Education Review*, 44, 4: 515-522.

Schwartz, H. (2006) Explaining Australia's Economic Success: Good Policy or Good Luck? *Governance: An International Journal of Policy, Administration and Institutions,* 19, 2: 173-205

Science Clarified (2006) *Ecosystem Concept*. Online: http://www.scienceclarified.com/everyday/Real-Life-Chemistry-Vol-8/Ecosystems.html. Accessed: 26/7/2009.

Seed, J., Macy, J., Flemming, P., Næss, A. (1988) *Thinking like a mountain: towards a council of all beings*. Philadelphia, USA: New Society Publishers.

SEI, WWF & CURE (2006). *Counting Consumption - CO2 emissions, material flows and Ecological Footprint of the UK by region and devolved country*, Godalming, Surrey, UK, WWF UK. Online: http://www.ecologicalbudget.org.uk. Accessed: 26/8/2008.

Sen, A. (1999) *Development as Freedom.* Oxford, UK: Oxford University Press.

Sen, R. (2003) *Stir It Up: Lessons in community organising and advocacy.* San Francisco, USA: Jossey-Bass.

Senier, L., Mayer, B., Brown, P., Morello-Frosch, R. (2007). School Custodians and Green Cleaners: New Approaches to Labor-Environment Coalitions. *Organization & Environment*, 20(3), 304-324.

Sessions, G. (ed) (1995). *Deep Ecology for the 21st Century*, Boston, MA, USA: Shambhala

Schusler,T. M., Decker, D.J., Pfeffer M. J. (2003) Social learning for collaborative natural resource management, *Society & Natural Resources*, 15: 309–326.

Shackley, S., Waterman, H., Godfroij, P., Reiner, D., Jason Anderson, J., Draxlbauer, K., Flach, T. (2007) Stakeholder perceptions of CO2 capture and storage in Europe: Results from a survey, *Energy Policy*, 35:5091–5108

Shah, A. (2003) Climate justice and equity, Global Issues, http: www.globalissues.org. Accessed: 22/6/2004

Shiva, V. (1989) *Staying Alive: Women, Ecology and Development*. London, UK: Zed Books.

Shiva, V. (2005) *Earth democracy: justice, sustainability and peace.* Cambridge, MA, USA: South End Press

Shinnick, P. (2008) Mining benefits all, *Newcastle Herald*, 9/6/2008. Newcastle, Australia.

Sidaway, J. (2000) Postcolonial Geographies: An Exploratory Essay, *Progress in Human Geography*, 24, 4: 591-612.

Siegmann, H. (1985). *The conflicts between labor and environmentalism in the Federal. Republic of Germany and the United States.* Aldershot, UK: Gower Publishing

Sierra Club (2006) *Sierra Club, United Steelworkers Announce 'Blue-Green Alliance: Good Jobs, Clean Environment, Safer World Cited as Uniting Principles*. Media release, 7/6/2006. Online: http://www.sierraclub.org/pressroom/releases/pr2006-06-07.asp Accessed: 28/2/2009.

Simon, J. (1998) *Ultimate Resource*, Princeton, NJ, USA: Princeton University Press.

Sims R.E.H, Schock R.N., Adegbululgbe A., Fenhann J., Konstantinaviciute I., Moomaw W., Nimir H.B., Schlamadinger B., Torres-Martínez J., Turner C., Uchiyama W., Vuori S.J.V., Wamukonya N., Zhang X., (2007) *Energy supply*. In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge UK; NY USA.

Singer, P. (1974),*Animal Liberation.* New York, NY, USA: New York Review/Random House

Singer P. (1977) *Not for humans only: The place of non-humans in environmental issues.* In: K.E. Goodpaster & K. K. Sayre (eds) Ethics and the problems of the 21st century. London, UK: University of Notre Dame.

Singer, P. (1993) *Practical Ethics.* Cambridge, UK: Cambridge University Press.

Singh, V. S. & Fehrs, J. (2001) The Work That Goes Into Renewable Energy. Renewable Energy Policy Project. Report 14, November 2001. Washington DC, USA: REPP.

Singleton Argus (2004) Balance Needed For Coal Industry: Minewatch Said Environment Pays. *Singleton Argus.* 14/12/2004, Singleton, NSW, Australia.

Singleton Argus (2005) Forest battle: Mt Owen Mine seeks to reduce forest to 10 hectares. *Singleton Argus.* 11/2/2005, Singleton, Australia.

Singleton Argus (2009a) Health study gains support. *Singleton Argus.* 9/01/2009. Singleton, Australia. Online: http://singleton.yourguide.com.au/news/local/news/general/health-study-gains-support/1403424.aspx. Accessed: 17/3/2009.

Singleton Argus (2009b) Strong response to Dr's research, *Singleton Argus*, 20/2/2009. Singleton, Australia.

Singleton Shire Council (2006) *Council Minutes, Proposed Anvil Hill Open Cut Coal Mine, Corporate and Development Services Committee.* Singleton, Australia: Singleton Shire Council.

Smart, R. (2006) Global warming: the biggest challenge to face the Australian wine sector. *Wine Industry Journal,* 21: 14-15.

Smit, B. & Wandell, J. (2006) Adaptation, adaptive capacity and vulnerability. *Global Environmental Change,* 16: 282–292.

Smith, M. (1998) *Ecologism: Towards Ecological Citizenship*. Milton Keynes, UK: Open University Press.

Smith, A. & Munro, C. (2007) Water woes could doom huge open-cut mine. *Sydney Morning Herald.* 8/5/2007. Sydney, Australia.

Smith, K. (2008) Hegemony Subalternity and Subjectivity in Early Industrial Sydney. In R. Howson & K. Smith (eds) *Hegemony: Studies in consensus and coercion*. London, UK: Routledge: 107-125

Smith, M. P., & Guarnizo, L. E. (eds.) (1998). *Transnationalism from below*, New Brunswick, NJ, USA: Transaction Publishers.

Smits, R. & Kuhlmann, S. (2004) The rise of systemic instruments in innovation policy. *International Journal of Foresight & Innovation,* 1**,** 4-32.

Smyth, P., Reddel, T. & Jones, A., (eds) (2005) *Community and Local Governance in Australia,* Sydney, Australia: UNSW Press.

Snow, D., Soule, S. & Kreisi, H. (2004) *The Blackwell Companion to Social Movements.* Oxford, UK: Blackwell.

Sohn, J., Herz, S., La Vina, A. (2007) *Development without Conflict: The Business Case for Community Consent*, Washington DC, USA: World Resources Institute.

Solomon, F., Schiavi, P., Horowitz, L., Rouse, A. & Rae, M., (2006) *Mining Certification Evaluation Project (MCEP): Final Report.* Melbourne, Australia: WWF-Australia. Online: http://www.minerals.csiro.au/certification. Accessed: 20/5/2007.

Solow, R. (1993) Sustainability: An economist's perspective. In R. Dorfman & N. Dorfman (eds.), *Economics of the environment*. New York, USA: W. W. Norton.

Solow, R. (1956) A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70: 65-94.

Solow, R. (1974) Intergenerational Equity and Exhaustible Resources, *The Review of Economic Studies*, 41: 29-45.

Solow, R. (1978) Resources and economic growth. *American Economic Review*, 2: 5-11.

Solow, R. (1993), Sustainability: an economist's perspective. In R. Dorfman, & N. Dorfman (eds), *Economics of the Environment*. New York, NY, USA: W.W. Norton.

Somerville, M.A. & Rapport, D. (eds) (2000) *Transdisciplinarity*: *Re-creating Integrated Knowledge*. Oxford, UK: EOLSS Publishers.

Souris, G. (2006) *Anvil Hill and Bickham Coalmine: Statement to NSW Legislative Assembly*, 17/10/2006. Sydney, Australia: NSW Parliament Hansard. Online: http://www.parliament.nsw.gov.au/prod/parlment/hanstrans.nsf/V3ByKey/LA20061017. Accessed: 29/11/2007.

Spies-Butcher, B. & Wilson, S., (2008) Election 2007: Did the union campaign succeed? *Australian Review of Public Affairs*, February 2008. Online: http://www.australianreview.net/digest/2008/02/spies-butcher_wilson.html. Accessed: 22/12/2008.

Spratt, D. & Sutton, P. (2008) *Climate Code Red: The case for emergency action.* Carlton North, Australia: Scribe.

Stake, R. (1995) *The Art of Case Study Research.* Thousand Oaks, CA, USA: SAGE.

Stake, R. (2003) Case Studies. In N. Denzin & Y. Lincoln (eds.) *Strategies of Qualitative Inquiry.* Thousand Oaks, CA, USA: SAGE.

Standing, G.2(002) *Beyond the new paternalism: basic security as equity*. London, UK: Verso.

Starr, G., Langley, A., & Taylor, A. (2000) *Environmental Health Risk Perception in Australia*. South Australia: Centre for population studies in epidemiology, South Australian Department of Human Services.

Stauber, J. & Rampton, S. (1995) *Toxic Sludge Is Good For You: Lies, Damn Lies and the Public Relations Industry.* Monroe ME, USA: Common Courage Press.

Steele, D. (2008) Globalization and Cooperative Activity among National Labor Unions and National Environmental Organizations in the United States, *International Journal of Social Inquiry*, 1, 2: 179-200.

Steenhof, P. & Fulton, W. (2007) Factors affecting electricity generation in China: Current situation and prospects, *Technological Forecasting and Social Change*, 74, 5: 663-681.,

Steffen, W. (2006) *Stronger Evidence but New Challenges: Climate change science 2001-2005,* Canberra, Australia: Australian Greenhouse Office.

Sterba, J. (1994) Reconciling Anthropocentric and Nonanthropocentric Environmental Ethics, *Environmental Values* 3: 229-244.

Sterba, J. (2006) Justice. In A. Dobson & R. Eckersley (eds) *Political theory and the ecological challenge*. Cambridge, UK: Cambridge University Press: 148-164.

Sterling, S. (2007) Riding the storm: towards a connective cultural consciousness. In A. Wals (ed.) *Social learning: Towards a sustainable world,* Wageningen, The Netherlands: Wageningen Academic.

Stern, P. & Fineberg, H. (eds) (1996) *Understanding Risk: Informing Decisions in a Democratic Society*, Commission on Behavioral & Social Sciences & Education, Washington DC, USA: National Academy Press.

Stern, N. (2006) *The Economics of Climate Change.* London, UK: HM Treasury.

Stevens, P. & Dietsche, E. (2008) Resource curse: An analysis of causes, experiences and possible ways forward, *Energy Policy*, 36, 1: 56–65.

Stewart, H. (2004) Germany's silicon valley. *The Observer.* London, UK. Online: http://www.guardian.co.uk/business/2004/oct/10/germany.theobserver. Accessed 25/8/2008.

Street, B. (2001) *Literacy and Development*. London, UK: Routledge.

Sturgis, S. (2007) Cancer cluster confirmed near coal-burning power plant in Delaware, *Hometown Hazards: A rural Pennsylvania community fights for environmental justice*, 10/8/2007. Online: http://www.hometownhazards.com/2007/08/cancer-cluster-confirmed-near-coal.html Accessed: 10/12/2008.

Stutz, J. (2006) *The Role of Well-being in a Great Transition*, GTI Paper No. 10. Boston, MA, USA: Tellus Institute.

Suchet, S. 'Totally Wild'? Colonising discourses, indigenous knowledges and managing wildlife. *Australian Geographer*, 33, 2: 141-157.

Sullivan, F. (2006) Green groups launch alliance to fight spread of coalmining, *Sun-Herald*, 15/3/2006, Sydney, Australia.

Sutton, J. (2008) Harness mining boom so we are all winners. *Newcastle Herald,* Newcastle, Australia.

Sutton, P. (2000). *Sustainability: Woolly, feel-good & unachievable? Or a vital goal for practical action?* Online: http://www.greeninnovations.asn.au/sustainability-unachievable-or-practical.htm. Accessed: 6/12/2008.

Suzuki, D. & McConnell, A. (1997). *The sacred balance: Rediscovering our place in nature*. Vancouver, BC, Canada: Greystone Books.

Tainter, J. (1988) *The Collapse of Complex Societies*. Cambridge, UK: Cambridge University Press.

Tainter, J. (1996) Complexity, Problem Solving, and Sustainable Societies. In R. Costanza, O. Segura & J. Martinez-Alier (eds) *Getting Down To Earth: Practical Applications of Ecological Economics*. Washington DC, USA: Island Press.

Tainter, J., Allen, T.F.A., Little,A. & Hoekstra, T. W. (2003) Resource transitions and energy gain: contexts of organization. *Conservation Ecology*, 7, 3: 4. Online: http://www.consecol.org/vol7/iss3/art4. Accessed: 12/1/2009

Talberth, J., Cobb, C. & Slattery, N. (2006) *The Genuine Progress Indicator 2006: A Tool for Sustainable Development*. San Francisco, CA, USA: Redefining Progress.,

Tame, T. (2003) *Vegetation of the Hunter Valley*. Newcastle, Australia: Hunter Region Botanci Gardens. Online: http://www.huntergardens.org.au/vegetation1.htm. Accessed: 12/2/2010.,

Tarrow, S. (1994) *Power in Movement: Social Movements, Collective Action and Politics.* Cambridge, UK: Cambridge University Press.

Tattersall, A. (2004). From union ‐ community coalitions to community unionism? A look at the pattern of recent union relationships with community organisations in NSW. *Community & Unions 2004*. Trades Hall, Victoria, Monash University.

Tattersall, A. (2005) 'There is power in coalition: a framework for assessing how and when union-community coalitions are effective and enhance union power', *Labour & Industry*, 16**:** 97–112.

Tattersall, A. & Reynolds, D. (2007) The shifting power of labor-community coalitions: Identifying common elements of powerful coalitions in Australia and the USA, *WorkingUSA*, 10: 77-102.

Tattersall, A. (2008) Coalitions and community unionism: Using the term community to explore effective union-community collaboration, *Journal of Organizational Change Management*, 21, 4: 415-432.

Taylor, P. (1981) The Ethics of Respect for Nature, *Environmental Ethics* 3: 197-218.

Taylor, P. (1993) *The Texts of Paulo Freire*, Buckingham, UK: Open University Press.

Taylor, P., Deak, A., Pettit, J. & Vogel, I. (2006) *Learning for Social Change: Exploring concepts, methods and practice.* Brighton, UK: Institute of Development Studies, University of Sussex.

Teske, S., Zervos, A., Schäfer, O. (2007a) *Energy [R]evolution: A Sustainable World Energy Outlook*. Amsterdam, The Netherlands: Greenpeace International (GPI) & European Renewable Energy Council (EREC).

Teske, S., Zervos, A., Schäfer, O. (2007b) *Energy [R]evolution: A Sustainable China Energy Outlook*. Amsterdam, The Netherlands: Greenpeace International (GPI) & European Renewable Energy Council (EREC).

Teske, S., Vincent, J. (2008) *Energy [R]evolution: A Sustainable Australia Energy Outlook*. Sydney, Australia: Greenpeace Australia Pacific & European Renewable Energy Council (EREC).

Thackway, R & Cresswell, I.D. (1995) *An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program*, Version 4.0. Canberra, Australia: Australian Nature Conservation Agency.

Thomas, P. (1983) *Miners in the 1970s: A Narrative History of the Miners Federation.* Sydney, Australia: Miners Federation.

Thomashow, M. (1995) *Ecological identity: Becoming a reflective environmentalist.* Cambridge, MA, USA: MIT Press.

Thompson, A. (1981) *Education and Development in Africa*. London, UK: Macmillan

Thompson, F. (2005) Ripe for royalties: Councils write wish list for mine contributions, *Newcastle Herald.* 16/2/2005. Newcastle, Australia.

Thompson, F. (2006a) Alarm over noise impact as Hunter mine plan hits...Sound barrier, *Newcastle Herald*, 20/10/2006. Newcastle, Australia.

Thompson, F. (2006b) Anvil Hill raises heat on Hunter eco concerns. *Newcastle Herald.* 10/10/2006, Newcastle, Australia.

Thompson, F. (2006c) Councillors join dispute: Anvil sustainability queried, *Newcastle Herald*, 11/10/2006. Newcastle, Australia.

Thompson, F. (2007a) Mine fails to dilute growing disquiet. *Newcastle Herald,* 10/5/2007. Newcastle, Australia.

Thompson, F. (2007b) Strain on health of family, *Newcastle Herald.* Date unknown Newcastle, Australia.

Thoreau, D. (1893) Walden: Or, Life in the Woods. Boston, MA, USA: Houghton Mifflin Co.

Tilbury, D. (2007) Learning based change for sustainability: perspectives and pathways. In A. Wals (ed.) *Social Learning Towards a Sustainable World.* Wageningen, The Netherlands: Wageningen Academic.

Tilbury, D., Stevenson, R.B., Fien, J., Schreuder, D. (eds.) (2002) *Education and Sustainability: Responding to the Global Challenge*. Gland, Switzerland & Cambridge, UK: Commission on Education & Communication, IUCN.

Tomago Aluminium (2008) *Comments on Discussion Paper Design Options for the Expanded National Renewable Energy Target Scheme,* 31/7/2008. Online: http://www.climatechange.gov.au/renewabletarget/consultation/pubs/069tomagoaluminium.pdf. Accessed: 9/1/2009.

Toman, M., Pezzey, J. & Krautkraemer, J. (1994) Neoclassical economic growth theory and sustainability. In: Bromley, D. (Ed) *Handbook of Environmental Economics*. Oxford, UK: Blackwell.

Torres, C. A. (1990) *The Politics of Nonformal Education in Latin America*. New York, USA: Praeger.

Total Environment Centre, (2007) *Impacts of Longwall Coal Mining on the Environment in New South Wales*. Sydney, Australia: Total Environment Centre.

Online:
http://www.tec.org.au/index.php?option=com_docman&task=doc_view&gid=201Accessed: 2/1/2009.

Trades Union Council (UK) (2008a) *A Green and Fair Future: For a Just Transition to a Low Carbon Economy.* London, UK: TUC.

Trade Unions Council (UK) (2008b) *Go Green at Work: A handbook for union green representative.* London, UK: TUC. Online: http://www.tuc.org.uk/extras/gogreenatwork.pdf. Accessed: 14/5/2009.

Trainer, T. (1996) *Towards a Sustainable Economy: The Need for Fundamental Change.* Sydney, Australia: Envirobooks.

Transgrid. (2007) Annual Planning Report 2007. Sydney South: Transgrid.

Triebswetter, U. & Wackerbauer, J. (2008). Integrated environmental product innovation and impacts on company competitiveness: a case study of the automotive industry in the region of Munich, *European Environment*, 18: 30-44

Trigwell, K. (2000) Phenomenography: Variations and Discernment. In C. Rust (ed.) *Improving Student Learning. Proceedings of the 1999 7th International Symposium,* Oxford, UK: Oxford Centre for Staff & Learning Development.

Turner, J. & Blyton, G. (1985) *The Aboriginals of Lake Macquarie: A Brief History.* Speers Point, Australia: Lake Macquarie City Council.

Turner, W. (1979) Brown, John (1850 - 1930), *Australian Dictionary of Biography.* Melbourne, Australia: Melbourne University Press.

United Nations (2008) *The Millennium Development Goals Report 2008*. New York, NY, USA: United Nations Department of Economic & Social Affairs.

United Nations Department of Economic & Social Affairs (1998) *From Theory to Practice: Indicators of Sustainable Development*. New York, NY, USA: United Nations. Online: http://www.un.org/esa/sustdeve/indi6.htm. Accessed: 2/5/2007.

United Nations Department of Economic & Social Affairs, Division of Sustainable Development (1992) *Agenda 21*. New York, NY, USA. Online: http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm. Accessed: 23/11/2008.

United Nations Economic Commission for Europe (UNECE) (1998) *Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.* http://www.unece.org/env/pp/documents/cep43e.pdf. Accessed: 2/10/2008.

United Nations Environment Program (UNEP) (1992) *Rio Declaration: Declaration of the Conference on Environment & Development*. Online: http://www.unep.org/Documents/Default.asp?DocumentID=78andArticleID=1163. Accessed: 2/2/2006.

United Nations Environment Programme (UNEP) (2002) *Global environment outlook 3: past, present and future perspectives.* London, UK: Earthscan.

United Nations Environment Programme (UNEP) (2008) *Background paper on Green jobs.* Nairobi, Kenya: UNEP. Online: http://www.unep.org/labour_environment/pdfs/green-jobs-background-paper-18-01-08.pdf. Accessed: 1/7/2009.

United Nations Environment Program (2007) *Labour and the Environment: A Natural Synergy.* Nairobi, Kenya: United Nations Environment Programme, the International Labour Organisation, the World Health Organisation & the International Trade Union Confederation.

United Nations General Assembly (1983) *Process of preparation of the Environmental Perspective to the Year 2000 and Beyond*, Resolution A/38/161 19/12/1983. New York, NY, USA: United Nations. Online: http://www.un.org/documents/ga/res/38/a38r161.htm

United States Mayors Climate Protection Center (2008) *U.S. Conference of Mayors Climate Protection Agreement.* Washington, DC, US: The United States Conference of Mayors. Online: http://usmayors.org/climateprotection/agreement.htm. Accessed: 2/2/2009.

University of Newcastle (2008a) *Priority Research Centre for Energy*. Online: http://livesite.newcastle.edu.au/energy/. Accessed 4/8/2008.

University of Newcastle (2008b) *CRC for Coal in Sustainable Development.* Online: http://www.newcastle.edu.au/research/centres/blackcoal.html. Accessed 4/8/2008.

University of Newcastle (2008c) *Priority Research Centre for Energy*. Online: http://livesite.newcastle.edu.au/energy. Accessed 4/8/2008.

Upper Hunter Country Tourism (2006) *Submission to NSW Department of Planning regarding the proposed Anvil Hill open-cut coal mine.* Scone, Australia.

Upper Hunter Winemakers Association (2006) *Submission to NSW Department of Planning regarding the proposed Anvil Hill open-cut coal mine,* October 2006. Denman, NSW, Australia: Upper Hunter Winemakers.

Upper Hunter Winemakers Association (2007) *Statement from Upper Hunter Winemakers Association to Public Meeting on Anvil Hill*, 22/6/2007. Marrickville Town Hall, Sydney: Greenpeace Australia Pacific, Nature Conservation Council of NSW.

Uren, T. (1995) *Straight Left.* Milsons Point, Australia: Random House.

US Board on Earth Sciences & Resources (2007) *Coal: Research and Development to Support National Energy Policy*. Washington, DC, USA: National Academy of Sciences. Online: http://www.nap.edu/openbook.php?record_id=11977&page=4. Accessed: 12/6/2009.

US EPA (2008) *Environmental Justice*. Online: www.epa.gov/compliance/environmentaljustice/index.html. Accessed 30/5/2008.

US National Climatic Data Center (2009) *Climate of 2009 June in Historical Perspective*, 16/7/2009. Online: http://www.ncdc.noaa.gov/oa/climate/research/2009/jun/jun09.html. Accessed: 7/8/2009.

Van Alphen K., Van Voorst Q., Hekkert M.P., Smits R.E.H.M. (2007) Societal acceptance of carbon capture and storage technologies, *Energy Policy*, 35: 4368-4380.

Van Matre, S. (1990). *Earth education: A new beginning*. Greenville, WV, USA: Institute for Earth Education.

Vertovec, S. (2001) *Transnational Social Formations: towards a conceptual cross-fertilization*, Transnational Communities Programme, Working Paper series WPTC-01-16, Oxford.

Victorian Department of Natural Resources & the Environment (2002) *Forestry Industry Transition Program*. Melbourne, Australia: Government of Victoria. Online: http://www.dse.vic.gov.au/dse/nrenfor.nsf/FID/-D84F947FDA337503CA256C2A000A6FEA?OpenDocument. Accessed: 12/6/2006.

Victorian Environment Protection Authority (EPA) (2008) *Victoria's Ecological Footprint.* Melbourne, Australia: Online: http://www.epa.vic.gov.au/ecologicalfootprint/ausFootprint/default.asp. Accessed: 5/02/2009.

Vié, J.C., Hilton-Taylor, C., Pollock, C., Ragle, J., Smart, J., Stuart, S.N. & Tong, R. (2008) *The 2008 Review of The IUCN Red List of Threatened Species*. IUCN: Gland, Switzerland.

Vinetz, J., Wilcox, B., Aguirre, A., Gollin, L. (2005) Beyond Disciplinary Boundaries: Development of Novel Methodologies to Study Leptospirosis as Transdisciplinary Model of Understanding Infectious Disease Emergence *EcoHealth*, 2: 1-16.

Vitousek, P. M., Ehrlich, P. Ehrlich, A. & P. A. Matson, P. (1986) Human appropriation of the products of photosynthesis, *BioScience* 36: 368-373.

Vitousek, P.M., Mooney, H.A., Lubchenco, J., Melillo, J.M. (1997) Human domination of earth's ecosystems, *Science*, 277: 464 499.

Von Holdt, K. (2002). Social movement unionism: The case of South Africa. *Work, Employment & Society*, *16*, 285–304

Waters, M. (1994) *Globalisation.* London, UK: Routledge.

Vormedal I., (2008) The influence of Business and Industry NGOs in the negotiation of the Kyoto Mechanisms: the case of Carbon Capture and Storage in the CDM, *Global Environmental Politics*, 8,.4:36-65.

Wackernagal, M. & Rees, W. (1996) *Our Ecological Footprint.* Gabriola Island, BC, Canada: New Society Publishers.

Wackernagel, M.,Onisto, I., Bello, P. Linares, A., Falfán, I., Garcia, J., Guerrero, A. & Guerrero, M. (1999) National natural capital accounting with the ecological footprint concept, *Ecological Economics*, 29: 375-90.

Wackernagel M, Schulz NB, Deumling AC, Linares AC & 7 others (2002) Tracking the ecological overshoot of the human economy, *Proceedings of the National Academy of Science,* 99, 14:9266–9271.

Wagner, P. A. (1998) Popular Education in the Philippines: To make ready to risk, *Popular Education Notebook,* 4: 20-22.

Waldrop, M. M. (1994) *Complexity: The emerging science at the edge of order and chaos*. London, UK: Penguin Books.

Walker, B., Holling, C. S., Carpenter, S. R. & Kinzig, A. (2004) Resilience, adaptability and transformability in social–ecological systems. *Ecology & Society* 9, 2. Online: http://www.ecologyandsociety.org/vol9/iss2/art5. Accessed: 8/6/2007.

Walker, B. H. & Meyers, J.A. (2004) Thresholds in ecological and social-ecological systems: a developing database. *Ecology & Society* 9(2):3 Online: http://www.ecologyandsociety.org/vol9/iss2/art3/. Accessed: 19/6/2008.

Walker, B., Gunderson, L. H., Kinzig, A., Folke, C, Carpenter, S. R. & Schultz, L. (2006) A handful of heuristics and some propositions for Understanding resilience in social-ecological systems. *Ecology & Society* 11(1): 13. Online: http://www.ecologyandsociety.org/vol11/iss1/art13/. Accessed: 8/6/2007.

Walker, B. & Salt, D. (2006) *Resilience Thinking: Sustaining Ecosystems and People in a Changing World.* Washington DC, USA: Island Press.

Walker, B. H., Abel, N., Anderies, J. M. & Ryan, P. (2009) Resilience, adaptability, and transformability in the Goulburn-Broken Catchment, Australia. *Ecology & Society* 14(1): 12. Online: http://www.ecologyandsociety.org/vol14/iss1/art12/. Accessed: 19/9/2009.

Wallace, R. (2008) Developmental disorders as pathological resilience domains. *Ecology & Society,* 13, 1. Online: http://www.ecologyandsociety.org/vol13/iss1/art29/. Accessed: 29/6/2009.

Wals, A. & Van Der Leij, T. (2007) Introduction to Social Learning Towards a Sustainable World: Principles, Perspectives and Praxis. In A. Wals (ed.) *Social Learning Towards a Sustainable World.* Wageningen, The Netherlands: Wageningen Academic.

Walker, A. (1945) *Coaltown – a Social Survey of Cessnock*. Melbourne , Australia: Melbourne University Press.

Walters, S. & Manicom, L. (eds.) (1996) *Gender in Popular Education. Methods for empowerment.* London, UK: Zed Books.

Waltner-Toews, D., Kay, J., Lister, N-M. (eds) (2008) *The Ecosystem Approach: Complexity, Uncertainty and Managing for Sustainability*, New York, NY, USA: Columbia University Press.

Wang, T. & Watson, J., (2008) *Carbon Emissions Scenarios for China to 2100,* Tyndall Working Paper No. 121, September 2008. Brighton, UK: Sussex Energy Group & Tyndall Centre, SPRU, University of Sussex, UK. Online: http://www.tyndall.ac.uk/publications/working_papers/twp121.pdf . Accessed: 12/12/2008

Warhurst, A. & Naronha, L. (1999) (eds) *Planning for Closure: Towards Best Practice in Public Policy and Corporate Strategy in Managing the Environmental and Social Effects of Mining*. Boca Raton, FL, USA: CRC Press.

Waring, P., Macdonald, D. & Burgess, J. (2000) Globalization and Confrontation: The Transformation of the Australian Coal Industry, *Asia Pacific Business Review,* 7: 21-33.

Waterman, P. (1991) *'Social Movement Unionism': Beyond 'Economic' and 'Political' Unionism.* Amsterdam: The Netherlands, International Institute for Research & Education, Working Paper No. 19.

Watson, I, Buchanan, J, Campbell, I & Briggs, C. (2003) *Fragmented futures: new challenges in working life*. Sydney, Australia: The Federation Press.

Watson, R., Dixon, J., Hamburg, S., *et al.*(eds) (1998) *Protecting Our Planet, Securing Our Future: Linkages Among Global Environmental Issues and Human Needs*, Washington, DC: UNEP/USNASA/World Bank.

Webb, L. (2006) Potential impacts of projected greenhouse gas-induced climate change on Australian viticulture, *Wine Industry Journal,* 21**,** 4: 16- 20.

Webb, L., Barlow, S. & Whetton, P. (2005) Impact on Australian Viticulture from Greenhouse Induced Climate Change. In A. Zerger & R. Argent (eds.) *International Congress on Modelling and Simulation.* Melbourne, Australia: The Modelling & Simulation Society of Australia & New Zealand Inc. (MSSANZ).

Weiss, H., & Bradley, R. S. (2001). What Drives Societal Collapse? *Science*, 291, 5504: 609 - 610

Welford, R. (1995). *Environmental strategy and sustainable development: The challenge for the 21st century*. London, UK: Routledge.

Welford, R. J. (ed). (1997) *Hijacking environmentalism: Corporate responses to sustainable development.* London, UK: Earthscan.

Welford, R. (1998) *Corporate environmental management Systems and strategies.* London, UK: Earthscan.

Welford, R. (ed) (2000) *Corporate environmental management 3: Towards sustainable development.* London, UK: Earthscan.

Welford, R. & Starkey, R. (eds) (2001) *The Earthscan reader in business and sustainable development*.,London, UK: Earthscan

Wendt, G. (2006) MP Takes stand for new coal, *Newcastle Herald*, 13/10/2006, Newcastle, Australia.

Whelan, J. (2002) Popular Education for the Environment: Restoring confidence in education as a strategy for social and environmental change. *Third International Education & Social Action conference.* Sydney, Australia: University of Technology, Sydney.

Whelan, J. & La Rocca, S. (2003). Towards a Scholarship of Advocacy Paper presented at *Ecopolitics*, Melbourne, 29/11/2003.

Whelan, J., Flowers, R. & Guevara, R. (2004) Popular and informal environmental education: The need for more research in an 'emerging' field of practice, paper presented to the *Effective Sustainability Education Conference: 'What works? Why? Where next? Linking research. and practice'.* UNSW, Sydney, Australia: NSW EPA & NSW Council for Environmental Education.

Wiedmann T, Wood R, Lenzen M, Tovey J & Moloney S. (2007) Modelling Ecological Footprints for sub-regional Levels: A Detailed Footprint of Consumption in Melbourne & Local Areas of Victoria, *Second International Ecological Footprint Conference*, Cardiff, UK, 8-10 May 2007.

Wiedmann, T. & Minx, J. (2007) *A Definition of 'Carbon Footprint'*, ISAUK Research Report 07-01. Durham, UK: ISAUK Research & Consulting. Online: http://www.isa-research.co.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf. Accessed: 12/6/2008.

Wilcox, B. (2001) Ecosystem Health in Practice: Emerging Areas of Application in Environment & Human Health, *Ecosystem Health* 7 (4): 317-325.

Wilcox, B., & Kueffer, C. (2008). Editorial: Transdisciplinarity in EcoHealth: Status and Future Prospects. *EcoHealth, 5*(1): 3-5.

Wildemeersch, D., Jansen, T., J. Vandenabeele, J. & Marc Jans, M.,(1998) Social Learning: A New Perspective on Learning in Participatory Systems, *Studies in Continuing Education* 20, 2: 251-265.

Wildemeersch, D. (2007) Social learning revisited: Lessons learned from North and South. In A. Wals (ed.) *Social Learning Towards a Sustainable World: Principles, perspectives and praxis.* Wageningen, The Netherlands: Wageningen Academic Publishers.

Wilkinson, M. (2008) Coal-fired generators escape the black-list, *Sydney Morning Herald*, 19/12/2008. Sydney, Australia.

Wilkinson M. & Cubby, B. (2009) Coal-fired power gets boost, *Sydney Morning Herald*, 17/6/2009. Sydney, Australia

Williams, C. (1981) *Open Cut: the Working Class in an Australian Mining Town*, Studies in Society, 8:18–20. Sydney, Australia: Allen & Unwin.

Williams, C. & Millington, A. (2004) The diverse and contested meanings of sustainable development, *The Geographical Journal,* 170, 2: 99-105.

Williams, L. (2006) Awabakal Dreaming: How coal was made, Introduction and Welcome to Country in the *Program of the 2006 Cultural Stomp Festival.* Newcastle, Australia: Cultural Stomp Festival Committee.

Williams, N. (2007a) *Speech to Newcastle Business Club*. Newcastle, Australia: NSW Minerals Council. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0019/7183/070227_Newcastle_Business_Club_Nikki_Williams.pdf. Accessed: 28/9/2008.

Williams, N. (2007b) No easy solutions. *Newcastle Herald,* 22/12/2007, Newcastle Australia.

Williams, N. (2008) Mining and farming: how and why they can coexist. Sydney, Australia, NSW Minerals Council. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0010/9298/FARMING_AND_MINING_OP_ED.pdf. Accessed: 1/10/2008

Williams, R. (1977) Marxism and Literature, Oxford, UK: Oxford University Press

Wilkenfeld, G., Hamilton, C. & Saddler, H. (2007) 'Clean coal' and other greenhouse myths. Canberra, Australia, The Australia Institute.

Wilkinson, M. (2007) Water crisis 'may hit energy supply next year', *Sydney Morning Herald,* 25/5/2007. Online: http://www.smh.com.au/news/environment/water-crisis-may-hit-energy-supply-next-year/2007/05/24/1179601579582.html . Accessed; 12/6/2007.

Wilson, P. (2008) Brazilians kill off Aussie led proposal on carbon capture at Poznan climate summit, *The Australian*, 11/12/2008. Online: http://www.theaustralian.news.com.au/story/0,25197,24782914-5013871,00.html. Accessed: 5/1/2009.

Winchester, H., McGuirk, P. & Dunn, K. (2000) Material and symbolic identities of Newcastle: continuity and change. In P. McManus, P. O'Neill & R. Loughran (eds), *Journey: The making of the Hunter.* St Leonards, Australia: Allen & Unwin.

Winchester, H. (2005) Qualitative research and its place in human geography. In I. Hay (ed.) *Qualitative Research Methods in Human Geography.* South Melbourne, Australia: Oxford University Press.

Wong, F. (2008) Global thermal coal demand seen to grow at slower pace - ABARE, *Reuters UK,* 22/9/2008. Online: http://uk.reuters.com/article/oilRpt/idUKSYD7830720080922. Accessed: 25/2/2009.

Wong, Senator P., Minister for Climate Change & Water (2009a) Cap and Trade in Australia: Lessons on the path to a low carbon economy, Speech to Pew, 30/3/2009. Washington DC, USA. Online:

http://www.environment.gov.au/minister/wong/2009/sp20090330.html. Accessed: 12/5/2009.

Wong, Senator P., (2009b) Minister for Climate Change & Water, *Address to the National Emissions Trading Summit*, 7/5/2009. Sydney, Australia. Online: http://www.environment.gov.au/minister/wong/2009/sp20090507.html. Accessed: 12/5/2009.

Wong, Senator P., Minister for Climate Change & Water (2009c) *Building confidence toward an effective global climate change agreement - an Australian perspective,* Address to the Peace Institute, 27/3/2009. New York, NY, USA. http://www.environment.gov.au/minister/wong/2009/sp20090327.html. Accessed: 12/5/2009.

Wong, Senator P., Minister for Climate Change & Water. *Australia's contribution to a global agreement on climate change,* Address to the Lowy Institute for International Policy, 20/4/2009. Sydney, Australia. Online: http://www.environment.gov.au/minister/wong/2009/sp20090420.html . Accessed: 12/5/2009.

Woodruff, R., Hales, S., Butler, C., McMichael, A. (2005) *Climate Change Health Impacts in Australia.* Melbourne, Australia & Barton, Australia: Australian Conservation Foundation & Australian Medical Association. Online: http://www.ama.com.au/web.nsf/doc/WEEN-6HA6MS/$file/Climate_Change_Impacts_Health_Report.pdf. Accessed: 21/8/2007.

World Bank (2004) *Striking a Better Balance - The World Bank Group and Extractive Industries: The Final Report of the Extractive Industries Review, World Bank Group Management Response.* Washington DC, USA: World Bank.

World Coal Institute (2005) *Coal: Secure* Energy. Richmond, UK: WCI. Online: http://www.worldcoal.org/assets_cm/files/PDF/wci_coal_secure_energy_2005.pdf. Accessed: 9/9/2008.,

World Coal Institute (2006a),*Coal: Meeting Global Challenges,* Richmond, UK. Online: http://www.worldcoal.org/assets_cm/files/PDF/coal_meeting_global_challenges.pdf. Accessed: 9/9/2007.

World Coal Institute (2006b),*Clean Coal – Building a Future through Technology.* Richmond, UK. Online: http://www.nswmin.com.au/__data/assets/pdf_file/0017/6524/WCICleanCoalReport.pdf. Accessed: 4/10/2008.

World Coal Institute (2007),*Coal Meeting the Climate Challenge: Technology to Reduce Greenhouse Gas Emissions,* Richmond, UK. Online: http://www.worldcoal.org/assets_cm/files/PDF/coal_meeting_the_climate_challenge.pdf. Accessed: 19/9/2008.

World Coal Institute (2009) *On the Road to Copenhagen*. Online: http://www.worldcoal.org/news/coal-news/on-the-road-to-copenhagen/. Accessed: 2/6/2009.

World Commission on Environment & Development (1987) *Our Common Future.* Oxford, UK: Oxford University Press.

World Wildlife Fund (WWF) (2007a) *Climate Solutions: WWF's Vision for 2050.* Gland, Switzerland: World Wildlife Fund.

World Wildlife Fund (WWF) (2007b) *Are the costs of using coal higher than the cost of cleaning it up?* Bangkok, Thailand: World Wildlife Fund. Online: http://assets.panda.org/downloads/ipcc_wg3___coal_costs_briefing.pdf . Accessed: 2/1/2009

World Wildlife Fund (WWF) (2008) *Living Planet Report 2008.* Gland, Switzerland: World Wildlife Fund.

World Wildlife Fund (2009) *Time to move on climate action and the low carbon economic recovery*. Media release on behalf of Southern Cross Alliance, 4/5/2009. Online: http://wwf.org.au/news/time-to-move-on-climate-action/ . Accessed: 6/5/2009.

Worldwatch Institute (2007) *Vital Signs 2007-2008.* Washington DC, USA: Worldwatch Institute

Wright, B. (1995) Environmental Equity Justice Centres: A Response to Inequity. In B. Bryant (ed) *Environmental Justice: Issues, Policies and Solutions.* Washington DC, USA: Island Press.

Wright, G. & J. Czelusta (2004). The myth of the resource curse, *Challenge*, 47, 2: 6-38.

Wright, G. & Czelusta, J. (2007) Resource-based growth, past and present. In D. Lederman & W. Maloney, W. (eds) (2007*) Natural resources: neither curse nor destiny.* Palo Alto, CA, USA: World Bank & Stanford University Press.

Yin, R. (2002) *Case study research: Design and Methods*.,Thousand Oaks, CA, USA: SAGE.

Young, J.E. & Sachs, A. (1994),*The Next Efficiency Revolution: Creating a Sustainable Materials Revolution.* Washington, D.C, USA: Worldwatch Institute.

Young, J. (2003). Green Collar Workers, *Sierra Magazine,* July August 2003. San Francisco, CA, USA: Sierra Club.

Young, K. (2006) Greenland ice cap may be melting at triple speed, *New Scientist*, 10/8/2006. Online: http://www.newscientist.com/article/dn9717.html. Accessed: 12/6/2007.

Young, O. (2005) Why is there no unified theory of environmental governance? In P. Dauvergne (ed) *Handbook of Global Environmental Politics*. Cheltenham, UK: Edward Elgar.

Yushi, M., Hong, S. & Fuqiang, Y. (2008) *The true costs of coal*. Beijing, China: Greenpeace. Online: http://act.greenpeace.org.cn/coal/report/TCOC-Final-EN.pdf . Accessed: 12/12/2008.

Ziguras, S., Considine, M., Hancock, L. & Howe, B. (2004) *From Risks to Opportunity: Labour Markets in Transition, Background Paper*. Melbourne, Australia: Centre for Public Policy, University of Melbourne. Online: http://www.public-policy.unimelb.edu.au/research/TLMs_background_paper.pdf

Zittel, W. & Schindler, J. (2007) *Coal: Resources and Future Production*, EWG-Series No 1/2007, Berlin, Germany: Energy Watch Group. Online:

http://www.energywatchgroup.org/fileadmin/global/pdf/EWG_Report_Coal_10-07-2007ms.pdf. Accessed: 20/9/2008

Interviews cited:

Bowman, Wendy (2004) President of Minewatch, farmer. Interviewed on 18/8/2004, at 'Gran Galang', near Singleton, NSW.

Brown, Graham (2004) Coal miner, resident of Merriwa. Interviewed on 18/8/2004 at the Merriwa Bottle Museum in Merriwa, NSW.

Campbell, Deborah (2004) Anvil Hill Project Watch member. Interviewed on 02/09/04 at Wybong Hall, Wybong, NSW.

Collins, Gail (2004) Secretary of Minewatch, resident of Muswellbrook. Interviewed on 17/8/2004 at her residence in Muswellbrook, NSW.

Fallding, Martin (2004) Land use planner, resident of Singleton, convenor of Hunter Environment Lobby. Interviewed 18/8/2004, at his residence in Singleton, NSW.

Fitzgibbon, Joel (2005) Member of Parliament (Hunter electorate). Interviewed on 20 September 2005, Electorate Office Cessnock, NSW.

Phelps, Christine (2004) Anvil Hill Project Watch member. Interviewed on 02/09/04 at Wybong Hall, Wybong, NSW.

Smiles, Bev (2004) Farmer on the Goulburn River, Western Midlands Project Officer, National Parks Association, Western Regional Representative on the Executive of the NSW Nature Conservation Council. Interviewed on 1/9/2004 at Munghorn Gap Nature reserve, near Wollar, NSW.

Appendix 1
Social Movement Mapping

The development of a social movement for a *Future Beyond Coal* in the Hunter Valley can be mapped using the Moyer (2001) Movement Action Plan (MAP). The phases of the MAP can be correlated with the adaptive cycle of Holling's (1986), and the correlation suggests that the Hunter Valley is in the process of shifting from Moyer's Stage 5 *Stalemate* into Stage 6 *Winning Majority Public Support,* which correlates with a shift from Holling's *Conservation* phase into the *Release* or *Collapse* phase.

The following examines the development of the Hunter Valley social movement for a shift to a *Future Beyond Coal* with respect to the processes discussed above. The section summarises the characteristics of public debate in the Hunter Valley in each stage and the movement building challenges. The campaign is not a simple whole but has many different elements, with different aspects of the campaign moving forward at different stages.

For the purposes of simplicity the Hunter Valley campaign for a shift to a *Future Beyond Coal* is broken up into two main themes that correspond to the two main foci of campaigns: *Phasing out the coal export industry*, and *Shifting investment to renewable energy*. Following Moyer (2001), the analysis in Table 24 below, identifies challenges for the movement, powerholders (governments, corporations, media, etc) and the public. It identifies the status of the regional social movement at different stages, including the social learning challenges movement activists need to focus on to move their campaign forward from one stage to the next.

Table 24: Mapping the success of the *Future Beyond Coal* campaign

(Based on Moyer *et al*, 2001)

Table 24: Mapping the success of the *Future Beyond Coal* campaign
STAGE 1: HIDDEN PROBLEM, NORMAL TIMES · A critical social problem exists that violates widely held values. · The general public is unaware of this problem. · Only a few people are concerned. **Movement:** Uses official channels, demonstrations are small and rare. **Powerholders:** Chief goal is to keep issue off social and political agenda. **Public:** Is unaware of the problem and supports powerholders. Only 10-15% of public support change. **Movement goals of Stage 1:** · Build organisations, vision, and strategy. · Document problems and powerholders' roles. Become informed. **Social learning challenges of Stage 1:** · Learn how to work with others on issues of common concern, · Learn how to map power and the role of powerholders involved in the issue · Learn how to research and document problems and articulate visions **Hunter Situation, Community Learning and Organising:** **(1) Phasing out coal mine expansion:** Prior to the late 1970s/early 1980s, and again during the 1980s and early 1990s after the 'first wave' of resistance was rebuffed the issue of mine expansion lacked public profile. However the situation was changing by the late 1990s (as local mining issues again became prominent) and the local scene moved to the next stage. **(2) Shift to renewable energy economy:** The climate change issue was not a prominent part of local campaigns around coal with community concerns focused on local mining impacts rather than broader issues. Research on climate change impacts was not widely known. While national and international groups were formed in the late 1980s and 1990s, local activist groups focused on climate change issues were formed only in 2005.
STAGE 2: INCREASING TENSIONS, EFFORTS TO CHANGE THE PROBLEM DEMONSTRATE THE FAILURE OF OFFICIAL REMEDIES · A variety of small and scattered opposition groups do research, educate others. · New wave of grassroots opposition begins. · Official mechanisms are used to address the problem: hearings, the courts, legislature; if these work, the problem is resolved. But often, official approaches don't work. This shows how entrenched the problem is and demonstrates the failure of institutions to solve it. **Movement:** Uses official system to prove it violates widely held values. **Powerholders:** Chief goal is to keep issue off social and political agenda and maintain routine bureaucratic functioning to stifle opposition. **Public:** Still unaware of issue and supports status quo. 15-20% of the public support change. **Movement goals of Stage 2:** · Prove and document the failure of official institutions and powerholders to uphold public trust and values. · Begin legal cases to establish legal and moral basis for opposition.

Table 24: Mapping the success of the *Future Beyond Coal* campaign

- Build opposition organizations, leadership, expertise.

Social learning challenges of Stage 2:

- Identify how to document the failure of official institutions and powerholders to uphold public trust and values.
- Develop skills of legal system and strategic opportunities for interventions.
- Develop skills and knowledge of effective opposition and leadership.

Hunter Situation, Community Learning and Organising:
(1) Phasing out coal mine expansion:
Minewatch and other resident groups formed in 1990s in response to threats from local mine proposals, and as community members sought support and advice from each other and develop local networks of support.

Locals began learning about the impacts of coal mines, and developed skills in local organising and organisation building. Locals develop expertise in researching and documenting the cumulative impacts of coal mining and participate in government processes (including court action and Commissions of Inquiry) to stop new mine proposals but find the 'dice is loaded':

The Hunter *No New Coal* campaign became a broad regional campaign, uniting many local campaigns against individual mines (Bickham, Glendonbrook, Wilpinjon). Links with global climate change issues become more to the foreground. New links made with larger national and global NGOs strengthen local capacities.

(2) Shift to renewable energy economy:
The Australian climate change movement forms and engages with international forums and processes, such as the Kyoto Protocol negotiations, and attempts to engage with domestic politicians (but with little impact).

Limited engagement with local communities fighting coal mines or much focus on 'grassroots' climate campaigns in local communities.

Climate Action Network Australia begins to engage with naturalists, farmers, and publishes *Warnings from the Bush* on impacts on ecosystems (Reynolds, 2002), *Heat on the land: Climate change and what it means for Australian farmers* (Reynolds, 2002), and the ACF and AMA produces a report on related issues (Woodruff *et al,*2005).

State and federal governments fully committed to coal-fired power as the major energy choice for the future. Industry and government promote clean coal technologies as a technological fix to climate change from coal. Howard Liberal Government cuts funds to renewable energy programs.

CSIRO Energy Centre established in Newcastle, following closure of BHP steelworks (researching clean coal and renewables).

STAGE 3: RIPENING CONDITIONS

- Recognition by the public of the problem and its victims slowly grows.
- Pre-existing institutions and networks (churches, peace and justice organizations) lend their support.
- Tensions build. Rising grassroots discontent with conditions, institutions, powerholders, and "professional opposition organizations" (e.g., large lobbying groups).
- Upsetting events occur, including ones which "personify" the problem.
- Perceived or real worsening conditions.

Movement: Grassroots groups grow in number and size. Small non-violent actions begin. Parts of progressive community won over, pre-existing networks join new cause.
Powerholders: Still favour existing policies and control official decision-making channels.
Public: Still unaware of problems and supports powerholders. 20-30% oppose official policies.

Table 24: Mapping the success of the *Future Beyond Coal* campaign

Movement goals of Stage 3:
- Educate/win over progressive community.
- Prepare grassroots for new movement.
- More local non-violent actions.

Social learning challenges of Stage 3:
- Identify how to frame issues so that the progressive community sees common ground and mutual benefits.
- Develop skills of grassroots movement organising, decision-making and action planning.
- Analyse the political landscape for potential sites for effective local non-violent actions.

Hunter Situation, Community Learning and Organising:
(1) Phasing out coal mine expansion:
Regional organisations (e.g. Hunter Environment Lobby, Anvil Hill Alliance) raise regional sustainability threats related to coal mining and coal-fired power generation in the Region.

Local campaigns link with larger scale regional and national networks as Hunter Valley mine-affected residents develop new partnerships beyond the region. Well resourced organisations (such as Greenpeace, the NSW Greens) help get regional concerns heard in the media and 'corridors of power' outside the region.

Cross-sectoral alliances (e.g. between farmers, unionists, environmentalists, local government leaders) are recognised as an essential tool for building local power.

Media interest grows locally and in metropolitan centres (Sydney), and even internationally about the effects of local mines on the river health, and about the health and welfare of citizens threatened by new mines. Media is beginning to personalise the problem by putting faces to the statistics and the 'victims'.

A new wave of individuals and groups become involved, as local climate action groups formed in many localities and take up Hunter Valley coal impacts as a campaign.

Peaceful but disruptive protests are held at public events attended by key powerbrokers (e.g. the Premier), at mining industry forums (e.g. in Mudgee) and in the annual general meetings of some financial institutions. Messages to the media and powerholders that local residents and industries regard protecting the Hunter as a healthy ecosystem and community is of far greater value to their long-term interests than short-term financial returns from new mines.

(2) Shift to renewable energy economy:
Local organisations specifically focused on climate change issues formed (e.g. Rising Tide, Climate Action Newcastle). Linkage of coal mining, climate change and renewable energy shift in campaign work and media commentary (Evans, 2006; Ray, 2006). Demand for investment shift to renewable energy becomes prominent in local campaign policy (Anvil Hill, 2005) and local government policies (Newcastle City Council, 2006).

STAGE 4: TAKE-OFF
- A catalytic (trigger) event occurs that starkly and clearly conveys the problem to the public (e.g. social or ecological disaster affecting society).
- Building on the groundwork of the first three stages, dramatic non-violent actions and campaigns are launched.
- These activities show how this problem violates widely held values.
- The problem is finally put on 'society's agenda'.
- A new social movement rapidly takes off.

Movement: Enacts or responds to trigger event, holds large rallies and demonstrations and many non-violent actions. A new 'movement organisation' is created, characterized by informal organizational style, energy, and hope for fast change (e.g. 'grassroots climate change'

Table 24: Mapping the success of the *Future Beyond Coal* campaign

movement). 'Professional opposition organizations' sometimes oppose 'rebel' activities.
Powerholders: Shocked by new opposition and publicity, fail to keep issue off social agenda, reassert official line, and attempt to discredit opposition.
Public: Becomes highly aware of problem. 40-60% oppose official policies.

Movement goals of Stage 4:

- Put issue on social agenda. Create a new grassroots movement.
- Alert, educate and win public opinion.
- Legitimize movement by emphasizing and upholding widely held societal values.

Social learning challenges of Stage 4:

- Identify how to frame issues so that the progressive community sees common ground and mutual benefits.
- Develop skills of grassroots movement organising, decision-making and action planning.
- Analyse the political landscape for potential sites for effective local non-violent actions.

Hunter situation, learning and organizing strategies:
(1) Phasing out coal mine expansion:
On-going drought highlights potential collapse of the Hunter ecosystems and social dislocation, particularly to the politically powerful horse-breeding community. Proposed coal mining projects in the Gunnedah Basin draws hundreds of farmers into protest

Hunter activists strengthen local power, including organising with key regional industries and local governments (Newcastle, Singleton, Wyong, Gosford) to call for a moratorium on particular mines and/or mine expansion, on climate change and calling for transitional arrangements to an alternative economy.

(2) Shift to renewable energy economy:
The storms in June 2007 (including the grounding of the coal- ship the *Pasha Bulker* on Nobbys Beach, Newcastle) and the dramatic reduction in water allocations to farmers in 2007 were the two regional Trigger Events, while Cyclone Katrina was a global Trigger Event. The grounding of the *Pasha Bulker*, in particular, highlighted the linkage of catastrophic weather events, Hunter coal and climate change.

Debate in local media about energy pathway options increases, e.g. about viability of renewable energy shift or 'clean coal' and CCS technologies.

Election of Australian Labor Party (ALP) Government with climate change policy a significant issue: the world's first climate change election (Rootes, 2008).

STAGE 5: STALEMATE, MOVEMENT IDENTITY CRISIS — A SENSE OF FAILURE AND POWERLESSNESS

- Those who joined the movement when it was growing in Stage 4 expect rapid success. When this doesn't happen there is often hopelessness and burn-out.
- It seems that this is the end of the movement; in fact, *it is now that the real work begins.*

Movement: Numbers down at demonstrations, less media coverage, long-range goals not met. Unrealistic hopes of quick success are unmet. Many activists despair, burn out, and drop out. 'Negative rebel' and 'naive citizen' activities gain prominence in movement.
Powerholders: Use media to discredit movement (e.g. promoting climate sceptic science, 'Greenies' threaten jobs) and encouraging 'negative rebel' activities, sometimes through agents provocateurs.
Public: Alienated by negative rebels. Risk of movement becoming a sub-cultural sect that is isolated and ineffective.

Movement goals of Stage 5:

Table 24: Mapping the success of the *Future Beyond Coal* campaign

- Recognize movement progress and success. Counter 'negative rebel' tendencies.
- Recognize that movement is nearing Stage Six and pursue goals appropriate to that stage.

Social learning challenges of Stage 5:

- How to evaluate and celebrate success and deal with frustration, how to support people through hard times
- How to gain new allies and communicate with new audiences
- How to reframe issues to win wider support
- How to redefine timeframes and reframe indicators of success

Hunter situation, social learning and organising:

(1) Phasing out coal mine expansion:

Movement is in this stage, possibly moving out of it as Global Financial Crisis and climate change crisis grow. Massive industry expansion continues. Anvil Hill mine approved by NSW Government, approval of third coal loader in 2007, and funding to double coal export infrastructure in 2008-09 are setbacks (though not unexpected).

Miners' union (CFMEU M&E) and NSW Minerals Council declare 'common cause' to oppose moratorium on mine expansion and make joint calls for expansion of Hunter Valley coal industry, and funding for CCS.

Activists deal with the sense of failure and frustration and seek to build new allies. Continue to engage in peaceful civil disobedience to maintain profile of concerns and engage communities (e.g. Newcastle Climate Camp in July 2008).

Pressure steadily grows on key powerholders in governments, industry, financial institutions and the public. Changing public opinion about costs and benefits of mining in affected communities (HVRF, 2007 and 2008).

(2) Shift to renewable energy economy:

Modest support for renewable energy. Large scale expansion of public investment in clean coal and CCS technologies is the major energy investment in ALP and Coalition policies at state and federal government levels.

The ALP Federal Government commits $105 million to climate change initiatives in the Hunter Valley since the campaign, including a $55 million for clean coal research and $50 million for establishment of a solar thermal research centre.

Greenpeace-commissioned CofFEE research on 'Just Transitions to a Clean Energy Economy in the Hunter' shows potential for new Green jobs, to counter jobs v environment argument of powerholders.

'Greenhouse Mafia' mounts successful PR scare campaign for strong Carbon Pollution Reduction Scheme.

Climate Action Newcastle (CAN) and Lake Macquarie Climate Action grow in community outreach. Second annual Clean Energy Expo organized by CAN gains major local media sponsorship. CAN Household Solar Refit program gains wide support.

Climate Camp protest action in July 2008 in Newcastle draws strong local and national support, and inspires local and national campaign.

STAGE 6: WINNING MAJORITY PUBLIC OPINION

- The movement deepens and broadens.
- The movement finds ways to involve citizens and institutions from a broad perspective to address this problem.
- Growing public opposition puts the problem on the political agenda; the political price that some powerholders have to pay to maintain their policies grows to become an untenable

Table 24: Mapping the success of the *Future Beyond Coal* campaign

liability.

- The consensus of the powerholders on this issue fractures, leading to proposals from the powerholders for change (often these proposals are for cosmetic change).
- The majority of the public is now more concerned about the problem and less concerned about the movement's proposed change.
- Often there is a new catalytic event (re-enacting Stage 4).

Movement: Transforms from protest in crisis to long-term struggle with powerholders to win public majority to oppose official policies and consider positive alternatives. Movement broadens analysis, forms coalitions. Many new groups involved in large-scale education and involvement. Official channels used with some success. Non-violent actions at key times and places. Many sub-goals and movements develop. Movement promotes alternatives, including paradigm shift.
Powerholders: Try to discredit and disrupt movement and create public fear of alternatives. Promote bogus reforms and create crises to scare public (e.g. potential loss of jobs, 'carbon leakage' and vulnerability in Global Financial Crisis). Powerholders begin to split.
Public: 60-75% of the public oppose official policies, but many fear alternatives. However, support for alternatives is increasing. Backlash can occur and counter-movements may form.

Movement goals:

- Keep issue on social agenda.
- Win over and involve majority of the public.
- Activists become committed to the long haul.

Social learning challenges of Stage 6:

- Develop capacity to respond quickly to changing circumstances
- Develop skills of engaging diverse communities around common goals.
- Develop capacity to sustain and nurture activists and organisations over long timeframes.

Hunter situation, social learning and organising:
(1) Phasing out coal mine expansion:
Movement is moving into this stage. Coal mine expansion continues. Community health impacts become public. Community protest actions (e.g. Caroona Blockade, Gloucester Community Protest, demand for public health inquiry) grow in size and breadth of participation (e.g. involving grain farmers).

Movement policy reports get extensive media coverage. Regular newspaper opinion pieces on coal, energy and climate change policy. Mainstream media seeks out activists for comment on government policies, but maintains advocacy for coal dependency.

(2) Shift to renewable energy economy:
Proposed solutions to Global Financial Crisis include investment in renewable energy projects, and Green jobs, though few proposed. Renewable energy policies stuck on 20% MRET by 2020 target.

AMWU and other trade unions propose Just Transition policies including shift in investment to renewable energy. AMWU, NSW Nature Conservation Council and Unversity of Newcastle research collaboration on *Blueprint for a Low-carbon Economy for the Hunter Valley.*

Federal Government announces that the National Solar Institute and Clean Energy Innovation Centre to be established in Newcastle.

STAGE 7: SUCCESS: ACCOMPLISHING ALTERNATIVES

- Majority now opposes current policies and no longer fears the alternative.
- Many powerholders split off and change positions.
- Powerholders try to make minimal reforms, while the movement demands real social change.
- The movement finally achieves one or more of its demands.

Table 24: Mapping the success of the *Future Beyond Coal* campaign

- The struggle shifts from opposing official policies to choosing alternatives.
- More costly for powerholders to continue old policies than to adopt new ones. More "re-trigger" events occur.

Movement: Counters the powerholders' bogus alternatives. Broad-based opposition demands change. Non-violent action, where appropriate.
Powerholders: Some powerholders change and central, inflexible powerholders become increasingly isolated. Central powerholders try last gambits, then have to change policies, have the policies defeated by vote, or lose office.
Public: Majority demands for change are bigger than its fears of the alternatives. Majority no longer believe powerholders' justifications of old policies and critiques of alternatives.

Movement goals:
- Recognize movement's success and celebrate, follow up on the demands won, raise larger issues, focus on other demands that are in various stages, and propose better alternatives and a true paradigm shift.
- Create ongoing empowered activists and organizations to achieve other goals.

Social learning challenges of Stage 7:
- How to celebrate success
- Develop skills to see linkages between immediate gains and larger goals
- Analyse the political landscape for new sites of intervention

Hunter situation, social learning and organising:
(1) Phasing out coal mine expansion and **(2) Shift to renewable energy economy:** The local campaign has not achieved this stage. Governments continue to approve coal mine expansions, and make some efforts towards renewable energy but are still strongly committed to expanding coal mining and maintaining reliance on coal-fired power generation.

STAGE 8: CONTINUING THE STRUGGLE
- The struggle to achieve a more humane and democratic society continues indefinitely. This means defending the gains won as well as pursuing new ones.
- Building on this success, we return to Stage 1 and struggle for the next change.
- *Key:* The long-term impact of the movement surpasses the achievement of its specific demands.

Movement: Takes on 'reform' role to protect and extend successes. The movement attempts to minimize losses due to backlash, and circles back to the sub-goals and issues that emerged in earlier stages. The long-term focus is to achieve a paradigm shift.
Powerholders: Adapt to new policies and conditions, claim the movement's successes as their own, and try to roll back movement successes by not carrying out agreements or continuing old policies in secret.
Public: Adopts new consensus and status quo. New public beliefs and expectations are carried over to future situations.

Movement goals:
- Retain and extend successes.
- Continue the struggle by promoting other issues and a paradigm shift.
- Recognize and celebrate success. Build ongoing grassroots organizations and power bases.

Social learning challenges of Stage 8:
- Nurture activists
- Evaluate lessons from both successes and from failures
- Revitalise energies and knowledge for on-going struggles

Table 24: Mapping the success of the *Future Beyond Coal* campaign
Hunter situation, social learning and organising: ∞ **Phasing out coal mine expansion** and **(2) Shift to renewable energy economy:** In this stage there would be a *Hunter Beyond Coal* and a *Post-carbon society*, and campaigns for other features of a desirable society continue.

It is apparent that the regional social movement has made some progress. There has been a steady building of regional networks, and an extending of local concerns to national and global advocacy networks. There is a high level of regional and even global awareness about the costs and benefits of coal-dependency in the Hunter Valley.

The prolonged drought and the grounding of the coal ship, the *Pasha Bulker,* on Newcastle's Nobby's Beach was a regional Trigger Point, while global climate change events such as Cyclone Katrina have been global scale Trigger Events that have driven local responses. The regional movement has, in response to these events, moved beyond the *Take-off* stage but arguably has been stuck in a *Stalemate* stage as initiatives towards and away from a coal economy have both been happening simultaneously.

Disturbances that push towards a *Future Beyond Coal* include Newcastle being identified as the National Solar Energy Centre, making the region a hub for renewable energy research. The region has also been identified as a Clean Energy Enterprise Connect Centre, potentially facilitating renewable energy market development.

However, disturbances locking the region into its *Carbon Valley* status far outweigh the investment in renewable energy, and include the federal government allocating large amounts of funds for expanding rail infrastructure to enable a doubling of coal exports, new mines being approved, and no apparent effort being made to phase out local coal-fired power stations.

However, the situation may be about to shift into a new phase, particularly as governments respond to the growing global-scale disturbances of economic crisis and climate change. These pressures will arguably move the regional situation beyond *Stalemate* into the *Winning Majority Public Opinion* and *Accomplishing Alternatives* stages of Moyer's Movement Action Map. Regional disturbances, particularly, growing alarm about the health impacts of coal mining and coal-fired power generation, and intensive efforts for a health inquiry to be undertaken may be powerful regional-scale constraints on coal industry expansion. Studies of the potential for a boost in regional Green jobs from a shift from coal-fired power generation to renewable energy (Bill *et al,* 2008), and advocacy by some key trade unions for public investment in renewable energy might also push the situation into a new stage.

Appendix 2
Schedule of Interview Questions

<Attachment 3: Schedule of Questions>

Centre for Urban and Regional Studies
University of Newcastle
University Drive, Callaghan
NSW 2308 Australia

Telephone: 02 4921 5095
Facsimile: 02 4921 5877

SCHEDULE OF INTERVIEW QUESTIONS

Project Title: Just Transitions to Sustainability in the Hunter Region of NSW: Community visions and strategies

It is intended to ask interviewees to talk about:

- stories about their experiences with development in the Hunter Region, and particularly developments associated with the coal mining and related industries (e.g coal-fired power stations and the aluminium industry);
- their understanding of the concept of 'sustainability';
- how, why, when and where they and others in the Hunter Region are learning about sustainability;
- their vision of what a sustainable Hunter Region would look like from environmental, economic and social perspectives; and
- strategies they think are needed to facilitate a transition to sustainability.

The questions are quite complex, and use some terms which require definition, **but** the interviews will be informal and of about 1 hour duration.

……………………………...

Questions are below, including some background information/definitions:

1. Development in the Hunter Region

Tell me about how you, your family, your business and/or community have been affected (positively and/or negatively) by economic, social and ecological change and developments in the Hunter Region over the last 20 years.

Possible prompt: Considering environmental, social and economic aspects of development, comment on what your story/stories say about the distribution of the costs or the benefits of development in the Hunter Region.

2. Sustainability in the Hunter Region

Consider the following definitions of sustainability and sustainable development:

"Development that improves the total quality of life, both now and in the future that maintains the ecological processes on which life depends" (Commonwealth of Australia, 1992)

Comment on how this definition fits with your understanding of sustainability or sustainable development in the Hunter, and (if possible) refer to the stories discussed in the previous question and/or developments associated with the coal mining and related industries?

3. Learning and education for sustainability in the Hunter Region

Consider the following definition of 'learning' and 'education for sustainability':

"Learning is a process in which people develop ways to see and interact with the world around them"

and

"Education for sustainability aims to empower people of all ages and different backgrounds to contribute to a better future. It encourages people to ask lots of questions, challenge underlying assumptions, and to think for themselves. It looks at individual and systemic changes that are needed to resolve unsustainable practices" (both from *See Change: Learning and Education for Sustainability,* NZ Government, 2004).

How, why, where, and from who, have you have learnt about sustainability? What is needed to help you, and others in the Hunter, to do this better?

4. Vision of a Sustainable Hunter

With respect to environment, economy and community – what is your vision of how a sustainable Hunter Region would look like in 20–50 years time?

Comment, if you can, on how you see the Hunter coal industry (and its related coal-fired power generation and/or aluminium industries) contributing to, or holding back, your vision of a sustainable Hunter Region.

5. Transitions to Sustainability

Comment, if you can, on how you see the skills and assets of the Hunter coal industry (and its related coal-fired power generation and/or aluminium industries) – or other current or potential industries in the Region – contributing to your vision of a sustainable Hunter Region.

Comment on how you see the role of different community organisations, businesses and governments in working for, or against, your vision of a sustainable Hunter Region.