

## Chapter 1: Setting the Context

Even a cursory overview of human history will conclude that the last few centuries have witnessed remarkable change. The first industrial revolution has enabled significant change to occur. During the industrial revolution, much of the world, in large measure, shifted from local agrarian economies to an increasingly urbanised, globalised, industrial and service economy with international financial capital flows worth trillions of dollars daily. During the first industrial revolution, innovations in new technologies spurred and made possible still greater economic growth. Throughout the first industrial revolution, the economy faced factors limiting development and economic growth. In the past, economic development has periodically faced one or more limiting factors, such as skilled people, energy resources and financial capital. At such times, industrial nations sought to optimise the productivity and increase the supply of the limiting factor. Technological innovation enabled labour productivity to increase over one hundred fold in just three hundred years. A lack of financial capital was addressed by the formation of central banks, credit, stock exchanges and currency exchange mechanisms. A lack of cheap energy was overcome with the discovery of oil and coal. Governments and business working together have created remarkable material prosperity and economic growth for many living today. (See Figure 1.1)

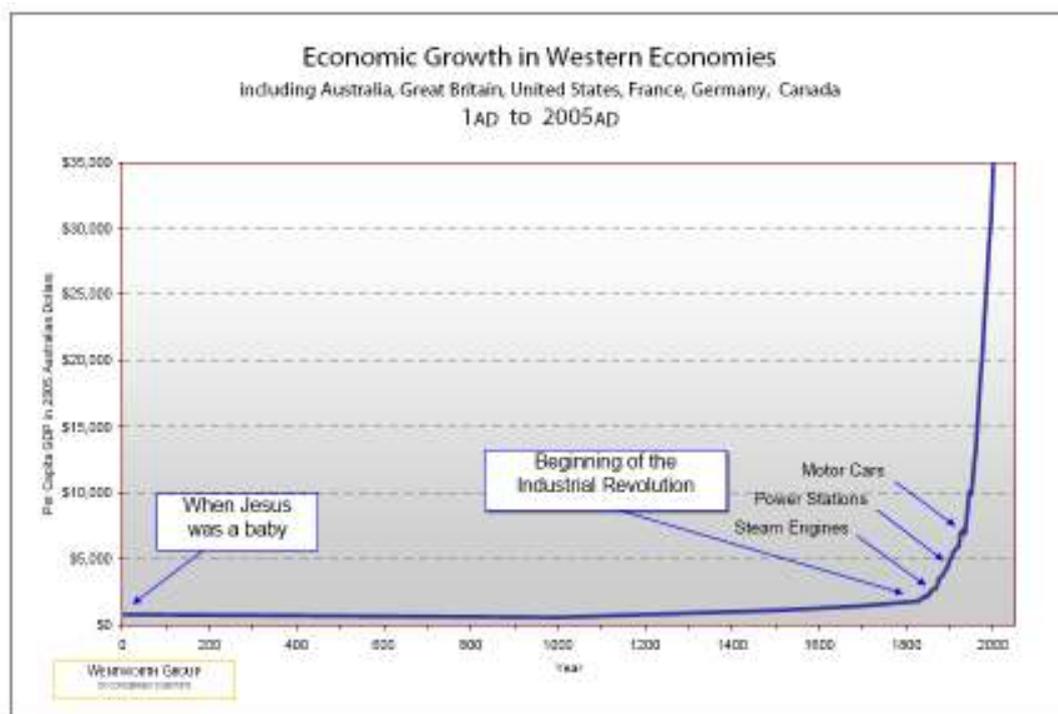


Figure 1.1 Economic Growth in Western Economies (Source, Cosier.P<sup>1</sup>, 2006)

<sup>1</sup> Cosier, P (2006) *Will Climate Change Cost the Earth*. Wentworth Group of Concerned Scientists. Available At. [http://www.wentworthgroup.org/docs/Will\\_climate\\_change\\_cost\\_us\\_the\\_Earth2.pdf](http://www.wentworthgroup.org/docs/Will_climate_change_cost_us_the_Earth2.pdf) Accessed 8.01.08

Considering the last 30 years, according to the OECD,

“Life expectancy has risen by more than 20 years, infant mortality rates have been halved and primary school enrolment rates have doubled. Food production and consumption have increased around 20 per cent faster than population growth. Improvements in income levels, health and educational attainment have sometimes closed the gap with industrialised countries. Advances have been made in the spread of democratic, participatory governance, and there have been forward leaps in technology and communication. New means of communication support opportunities for mutual learning about sustainable development processes and for joint action over global challenges.”

### **1.1 What are the Current and Future Limiting Factors on Economic Prosperity?**

Whilst these successes are significant, today many experts argue that there are new limiting factors on economic growth and prosperity.<sup>2</sup> As the World Bank outlined in 2003,

“The next 50 years could see a fourfold increase in the size of the global economy and significant reductions in poverty but only if governments act now to avert a growing risk of severe damage to the environment and profound social unrest. Without better policies and institutions, social and environmental strains may derail development progress, leading to higher poverty levels and a decline in the quality of life for everybody. Some problems of sustainability are already urgent and require immediate action; another category of issues unfolds over a longer time horizon. These problems may not be urgent, but the direction of change is unmistakable. For these it is essential to get ahead of the curve and prevent a worsening crisis before it becomes too costly. Biodiversity loss and climate change are in this category. What is clear is that almost all of the challenges of sustainable development require that action be initiated in the near term.”<sup>3</sup>

This thesis will show that the majority of the world’s scientists, The World Bank<sup>4</sup>, the OECD<sup>5</sup>, the UK Stern Review<sup>6</sup>’s, and many Nobel Prize winning economists argue that these negative trends present new and significant pressing constraints on future economic prosperity and pose a risk to the well being of future generations. This thesis will investigate whether there are material grounds for their concerns<sup>7</sup>

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<sup>2</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

<sup>3</sup> World Bank (2003) *World Bank Development Report 2003: Sustainable Development in a Dynamic World*, Oxford University Press, Oxford

<sup>4</sup> Ibid.

<sup>5</sup> OECD (2002) *Sustainable Development Strategies: A Resource Book*. OECD. Paris

<sup>6</sup> Stern, N et al. (2006) *The Stern Review: The Economics of Climate Change*, Cambridge University Press, Cambridge. Available at [www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/Sternreview.index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/Sternreview.index.cfm) Accessed 14 April 2007

<sup>7</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B. (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

Whether or not development is environmentally sustainable is contested by some economists who claim that, just as earlier generations invested in capital goods, research and education to bequeath to current generations the ability to achieve high levels of consumption, current generations are making the investments that are necessary to assure higher real living standards in the future, despite stresses on the natural resource base.<sup>8</sup> Indeed, historical trends in the prices of marketed natural resources and the recorded growth in conventional indices of economic progress in currently rich countries suggest resource scarcities have not bitten as yet.<sup>9</sup> Since whether or not current development paths are ecologically and socially sustainable indefinitely is still a contested and debated proposition, firstly, we need to investigate the empirical data to address this debate in detail.<sup>10</sup>

The OECD in 2002 suggested that the following negative trends represented unsustainable aspects of current economic development

“Economic disparity and poverty, population growth, the impact of diseases such as HIV-AIDS and malaria, over-consumption of resources in the industrialised countries, contributing to climate change, and environmental deterioration and pollution of many kinds, including the impacts of intensive farming, depletion of natural resources and loss of forests, other habitats and biodiversity.”<sup>11</sup>

Hence we next consider each of these in detail plus a number of other issues to consider whether or not current development pathways are indefinitely sustainable or if they do indeed risk compromising the quality of life and economic possibilities of future generations? It is important to clarify a key point before considering the evidence of whether or not current development pathways are sustainable. Much of the following evidence outlined in this chapter references studies which investigate scenarios and trends in resource and energy use. These trends are often assumed to be linear. Such assumptions tend to be made to enable modeling to be done. Ideally, it would be better to be able to describe future trends with dynamical models to both show the potential for non-linear effects and how variables in the model interact in a dynamical fashion. However, such a dynamical study is beyond the scope of this present inquiry.

In the following we consider whether or not key resources such as oil and water are being used sustainably and whether or not ecosystem sources and sinks can cope with rising levels of different types of pollution such as greenhouse gases and nitrogen from fertilisers.

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<sup>8</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

<sup>9</sup> Barnett, Harold and Chandler Morse. (1963) *Scarcity and Growth*. Johns Hopkins University Press. Baltimore: Johnson, D. G. (2000) *Population, Food, and Knowledge*. American Economic Review. 90:1, pp. 1-14.

<sup>10</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

<sup>11</sup> OECD (2002) *Sustainable Development Strategies: A Resource Book*. OECD. Paris

### 1.1.1 The Threat of Peak Oil to Economic Growth and Global Security

There is concern from many experts (See Table 1.1) that the 2006-2008 high oil price is a sign of the possibility of world oil production peaking soon or at least in the coming decades. An increasing number of industry and academic experts are concerned that the age of cheap oil may be over. Why is this the case? Peaking of oil refers to the point when production in any oil well, field or region begins to decline. Typically, this point is reached when between one-third and one-half of the oil in a reserve has been extracted. The decline is the inevitable result of the loss of pressure in the oil reserve and despite the advanced drilling and extraction techniques now in use, it is irreversible once passed. Once world oil production hits the peak then prices of oil are likely to remain high and increase.

The price of oil has and will have a significant effect on short and long term prosperity. Alan Greenspan has pointed out that “All economic downturns in the US since 1973 have been preceded by sharp increases in the price of oil.”<sup>12</sup> There is concern that a peaking of world oil production has already arrived and that, unless significant changes are made, will have negative economic effects. Oil production has already peaked in over 60 countries around the world. A number of CEO’s of major oil companies and a number of experts argue that world oil production is peaking now. (See Table 1.1)

**Table 1.1: Predictions of Timing of World Oil Production Peak**

<b>Prediction of World Oil Production Peak</b>	<b>Experts</b>
2006-2007	Bakhtari, A.M.S. Oil Executive <sup>13</sup> (Iran)
2006-2007	Simmons, M.R. Investment banker <sup>14</sup> (US)
2006-2008	Newman, P. Professor, Murdoch University.
2007-2008	ConocoPhillips (COP) Chief Executive James Mulva
2007-2008	CEO of Total, the French oil company, Mr de Margerie
2007-2008	CEO of General Motors, Rick Wagoner. <sup>15</sup>
2008-2015	CEO of Shell Major oil company (UK), Jeroen van der Veer <sup>16</sup>

<sup>12</sup> Porritt, J (2005) *Capitalism As if The World Matters*. Earthscan Publishing

<sup>13</sup> Bakhtari, A.M. (2004) *World Oil Production Capacity Model Suggests Output Peak by 2006-07*, Oil and Gas Journal, 2 May 2004.

<sup>14</sup> Simmons, M.R. (2005) *Twilight in the Desert – The Coming Saudi Oil Shock and the World Economy*, Wiley Publications, UK.

<sup>15</sup> Dowling, J (2008) *Time's up for petrol cars, says GM chief*. Sydney Morning Herald. January 15, 2008. Available At: <http://www.smh.com.au/news/environment/times-up-for-petrol-cars-says-gm-chief/2008/01/14/1200159363527.html> Accessed 29.01.08

<sup>16</sup> van der Veer, J. (2008) *Two Energy Futures: Jeroen van der Veer on Shell's new Energy Scenarios to 2050, Scramble and Blueprints*. Shell Available At [http://www.shell.com/home/content/media-en/news\\_and\\_library/speeches/2008/jvdv\\_two\\_energy\\_futures\\_25012008.html](http://www.shell.com/home/content/media-en/news_and_library/speeches/2008/jvdv_two_energy_futures_25012008.html) Accessed 29.01.08

2008-2015	International Energy Agency (IEA) <sup>17</sup>
After 2007	Skrebowski, C. Petroleum journal editor <sup>18</sup> (UK)
Before 2009	Deffeyes, K.S. Oil company geologist. <sup>19</sup> (retired., US)
Before 2010	Goodstein, D. Vice Provost, Cal Tech <sup>20</sup> (US)
Around 2010	Campbell, C.J. Oil geologist <sup>21</sup> (retired., Ireland)
After 2010	.World Energy Council <sup>22</sup> World Non-Government Org
2012	Pang Xiongqi <sup>23</sup> Petroleum Executive (China)
2012	Laherrere, J <sup>24</sup> Oil geologist (retired., France)
2013	Queensland Government Oil Vulnerability Taskforce
2020	Thierry Desmarest, former CEO Total (France's main oil company)
After 2020	CERA Energy consultants <sup>25</sup> (US)
Between 2020 and 2050	US Energy Information Administration
2025 or later	Shell Major oil company (UK)

*Adapted and Updated from Source: Hirsch, R.L. (2005)<sup>26</sup>*

The International Energy Agency's 2007 World Energy Outlook appears to confirm this. The Chief Economist of the International Energy Agency, Fatih Birol, stated in late 2007

"I can tell you that we, in the next seven to eight years, need to bring about 37.5 million barrels per day of oil into the markets, for two reasons. One, the increase in the demand, about one third of it, and two thirds, there is a decline in the existing fields [and there is a need] to compensate for the decline. What

<sup>17</sup> EIA (2007) (2007) *World Energy Outlook*. EIA. Mortished, C. (2007) *World facing oil 'supply crunch' as demand soars, agency warns*. The Times. Available At:

[http://business.timesonline.co.uk/tol/business/industry\\_sectors/natural\\_resources/article2051253.ece](http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article2051253.ece) Accessed 29.01.08

<sup>18</sup> Skrebowski, C. (2004) 'Oil Field Mega Projects – 2004,' Petroleum Review, January 2004.

<sup>19</sup> Deffeyes, K.S. (2003) *Hubbert's Peak-The Impending World Oil Shortage*, Princeton University Press.

<sup>20</sup> Goodstein, D. (2004) *Out of Gas – The End of the Age of Oil*, W.W. Norton.

<sup>21</sup> Campbell, C.J. (2003) 'Industry Urged to Watch for Regular Oil Production Peaks, Depletion Signals,' Oil and Gas Journal. July 14, 2003.

<sup>22</sup> World Energy Council (2003) *Drivers of the Energy Scene*, World Energy Council. Available at [www.worldenergy.org/documents/drivers.pdf](http://www.worldenergy.org/documents/drivers.pdf). Accessed 4 September 2007.

<sup>23</sup> Xiongqi, P. (2005) *The Challenges Brought by Shortages of Oil and Gas in China and Their Countermeasures*, ASPO Lisbon Conference, May 19-20, 2005.

<sup>24</sup> Laherrere, J. (2003) Seminar, Center of Energy Conversion, Zurich, May 7, 2003.

<sup>25</sup> Jackson, P. et al (2004) 'Triple Witching Hour for Oil Arrives Early in 2004 – But, As Yet, No Real Witches', CERA Alert, April 7, 2004.

<sup>26</sup> Hirsch, R.L (2005) 'The Inevitable Peaking of World Oil Production', The Atlantic Council of the US Bulletin. Available at [http://www.acus.org/docs/051007-Hirsch\\_World\\_Oil\\_Production.pdf](http://www.acus.org/docs/051007-Hirsch_World_Oil_Production.pdf). Accessed 4 September 2007

we expect [to be put in production] is 25 million barrels per day, and this is in the case of no slippages, no delays in the projects, and everything goes on time, which is very rare . So, there is a gap of 13.5 [sic] million barrels per day”.<sup>27</sup>

The main reasons an increasing number of experts now argue that world oil production will peak sooner than later are:

- Demand for oil is forecast to keep growing rapidly as China and Indian economies grow rapidly. As the Australian Senate Inquiry into Australia’s reported

“The US Energy Information Administration in 2000 estimated a peak between 2020 and 2050 depending on assumptions about demand growth and the size of the ultimately recoverable resource. The US Energy Information Administration study found that widely differing estimates of the ultimately recoverable resource (URR) make surprisingly little difference to the timing of the peak. The exponential growth of demand is the dominating factor.”<sup>28</sup>

- There are few, if any, large oil fields left to find. The last year that more oil was discovered than was consumed was 25 years ago. The last time a big oil field was discovered was in the 1970s. The peak of oil discovery was in 1965. The Australian Senate commented that

“New field oil discoveries have declined greatly since the 1960s. US Geological Survey estimates of future discoveries (which forecast increases), to be realised, would require a drastic turnaround of this declining trend. Peak oil commentators argue that the declining trend of oil discovery reflects geological fundamentals and should be expected to continue.”<sup>29</sup>

- There is not a lot of oil in storage relative to oil demand. Modern economies work on just-in-time delivery. After the world’s first OPEC oil crisis in 1972, the International Energy Agency was set up. Member nations of the IEA agreed to all ensure that they maintain 90 day stockpiles of oil supplies. Australia is the only member of the IEA who does not do this. Peak oil commentators argue that estimates of remaining reserves are unreliable and most probably overstated, especially in the Middle East. In some OPEC countries, it is believed that reserve estimates were artificially inflated in the 1980s to maximise production under the OPEC quota arrangements in place at that time – the so-called “paper barrels”. National oil reserves estimates in the Middle East are not subject to the audit and disclosure requirements of publicly-listed international oil companies. Thus there may be considerably less conventional oil than previously anticipated.

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<sup>27</sup> Parliament of Australia, Senate (2007) *Australia’s Future Oil Supply and Alternative Transport Fuels: Executive Summary*. Available At [http://www.aph.gov.au/senate/committee/rtrat\\_ctte/oil\\_supply/report/a02.htm](http://www.aph.gov.au/senate/committee/rtrat_ctte/oil_supply/report/a02.htm). Accessed 4 September 2007

<sup>28</sup> Ibid.

<sup>29</sup> Ibid.

- Forty nine of the sixty five oil producing nations have already passed their peak oil production topping point and are in decline. Sixty out of sixty five have passed their discovery topping point. The world biggest oil fields were discovered more than fifty years ago.

- Oil reserves are finite.

Higher oil prices are also negatively affecting the poor and poorer nations who also depend on oil and petroleum by-products like kerosene for lighting. Currently the global market for kerosene for lighting is worth ~(\$US)\$40 Billion.<sup>30</sup> This is a significant percentage of the weekly expenditure of the world's poor. Higher oil prices usually correlate with higher kerosene prices for the poor.

### 1.1.2 Risks of Dangerous Climate Change

The remarkable economic growth of the last few hundred years has been assisted by cheap and plentiful energy supplies significantly based on the burning of fossil fuels. The International Panel on Climate Change (IPCC), building on from the work of many scientists like Hansen et al<sup>31</sup>, declared in 2007<sup>32</sup> that the debate over whether or not climate change is human induced (from the burning of fossil fuels) is over. Thanks to the IPCC process, to avoid dangerous climate change, there is now broad international consensus that global warming needs to be kept to no more than 2 degrees Celsius above pre-industrial levels. A 2 degree rise will not be easy to avoid. So far global temperatures have gone up 0.8 degrees Celsius. There is another 0.6 degree Celsius of global warming already in the pipeline. The IPCC argues that to avoid dangerous climate change global emissions need to start to decline no later than 2012-13 and that by 2020 global cuts of 25-40 per cent are needed. By 2050, at least 80 per cent cuts are needed.

The Stern Review,<sup>33</sup> published in 2007, demonstrates that rising greenhouse gas emissions and the climate change, which is caused by the burning of such fuels, now threaten the very economic growth which they have helped to foster. The Stern Review states that

“We estimate the total cost of business as usual climate change to equate to an average reduction in global per capita consumption of 5 per cent at a minimum now and for ever.”<sup>34</sup>

The Stern Review describes how the cost would increase were the model to take into account direct impacts on the environmental and human health, the effects of positive feedbacks and the disproportionate burden of climate change on the poor and vulnerable globally. Taking these three

<sup>30</sup> Mills, E. 2005. *The specter of fuel-based lighting*. Science 308(May 27):1263-1264. Summary available at <http://www.sciencemag.org/cgi/content/summary/308/5726/1263> Accessed 8.01.08

<sup>31</sup> Hansen, J., R. Nazarenko, et al. (2006) *Earth's energy imbalance: Confirmation and implications*, Science 308: 1431-1435, doi:10.1126/science.1110252

<sup>32</sup> IPCC (2007) *Global climate projections, Climate Change 2007: The Physical Sciences Basis*, Available at <http://ipccwg1.ucar.edu/wg1/wg1-report.html> Accessed 8.01.08

<sup>33</sup> Stern, N et al. (2006) *The Stern Review: The Economics of Climate Change*, Cambridge University Press, Cambridge. Available at [www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm). Accessed 14 April 2007

<sup>34</sup> Ibid.

factors into account takes the cost of climate change up to as much as 20 per cent of global GDP. The Stern Review predicts that, if fast and dramatic action is not taken on climate change, then climate change could cause an economic recession to rival the great economic recession of the 1930s.

As the Stern Review argues, if humanity fails to rapidly mitigate climate change, climate change will increase more rapidly due to positive feedback effects. Respected scientists like NASA's James Hansen argue that if rapid mitigation does not occur these "tipping points", once unleashed, will cause global catastrophe.<sup>35</sup> Such tipping points occur when positive feedbacks from existing global warming lead to a jump in global average temperatures without any additional anthropogenic greenhouse gas emissions. A number of these positive feedbacks<sup>36</sup> are now already occurring at a faster rate<sup>37</sup> than scientists had previously predicted<sup>38</sup> increasing the risks of dangerous climate change. These include:

- The weakening of the natural ocean carbon sinks. From the mid-1990s to 2005, measurements taken of the North Atlantic found that the amount of CO<sub>2</sub> in the water had reduced by half. It has been suggested that the quantity of CO<sub>2</sub> being carried down into the deep ocean was being reduced by the warmer surface water.<sup>39</sup> Further, as reported in a recent study of the Southern Ocean, there are signs that there has been an additional relative weakening of oceanic sinks as result of changes in other atmospheric factors (wind, surface air temperatures and water fluxes).<sup>40</sup>
- The weakening of the natural land carbon sinks.<sup>41</sup> As a result of human activity and higher temperatures, it is expected that there will be a decrease in the capacity of the earth's carbon sinks.<sup>42</sup> The slow increase over time of the fraction of total anthropogenic CO<sub>2</sub> emissions remaining in the atmosphere implies a slight weakening of carbon sinks relative to emissions.<sup>43</sup> New research released in October 2007 confirmed that significant contributions to the growth of atmospheric CO<sub>2</sub> arise from the slow-down of natural sinks, "a decrease in the planet's ability to absorb carbon emissions due to human activity." According to lead author and Executive Director of the Global Carbon Project, CSIRO's Dr Pep Canadell. "Fifty years ago, for every tonne of CO<sub>2</sub> emitted, 600kg

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<sup>35</sup> Hansen, J., M. Sato, *et al.* (2007), *Climate change and trace gases*, Phil. Trans. Royal Soc. 365: 1925-1954, doi:10.1098/rsta.2007.2052, Available At [http://pubs.giss.nasa.gov/abstracts/2007/Hansen\\_etal\\_2.html](http://pubs.giss.nasa.gov/abstracts/2007/Hansen_etal_2.html) Accessed 8.01.08

<sup>36</sup> Ibid.

<sup>37</sup> Pearman, G. *et al* (2007) *Evidence of Accelerated Climate Change Prepared by the Climate Adaptation Science and Policy Initiative*, The University of Melbourne for the Climate Institute. Available at [http://www.climateinstitute.org.au/images/stories/CI056\\_EACC\\_Report\\_v1.pdf](http://www.climateinstitute.org.au/images/stories/CI056_EACC_Report_v1.pdf) Accessed 8.01.08

<sup>38</sup> Pittock, B. (2006) *Are Scientists Underestimating Climate Change?* EOS, Transactions American Geophysical Union 87, no. 34: 340-341.

<sup>39</sup> Woodcock, A. (2007) *Scientists fear climate change speed-up as oceans fail to hold greenhouse gases*, The Scotsman, 21 October 2007, <http://news.scotsman.com/scitech.cfm?id=1678172007> Accessed 8.01.08

<sup>40</sup> Le Quere, C. *et al* (2007) *Saturation of the Southern Ocean CO<sub>2</sub> Sink Due to Recent Climate Change*. Science 316

<sup>41</sup> Cox, P., Betts, R., Jones, C., Spall, S. and Totterdell, I. (2000) *Acceleration of Global Warming Due to Carbon-Cycle Feedbacks in a Coupled Climate Model*, Nature, 408, pp184-187.

<sup>42</sup> Jones, C. D., Cox P. M. *et al.* (2003), *Strong carbon cycle feedbacks in a climate model with interactive CO<sub>2</sub> and sulphate aerosols*, Geophysical Research Letters 30(9): 1479

<sup>43</sup> Raupach, M., *et al.* (2007) "Global and regional drivers of accelerating CO<sub>2</sub> emissions", PNAS, Available at <http://www.pnas.org/cgi/content/abstract/0700609104v1> Accessed 8.01.08

were removed by land and ocean sinks. However, in 2006, only 550kg were removed per tonne and that amount is falling.”<sup>44</sup>

- The release of methane<sup>45</sup> from peat deposits, wetlands and thawing permafrost.<sup>46</sup> Siberia’s thawing wetlands have been identified in a recent study as a significant, so far underestimated, source of atmospheric methane. The lakes in the region have been growing in number and size. Emission rates appear to be five times higher than previous estimates. The melting of permafrost is now another "slow" positive, feedback in climate warming.<sup>47</sup>
- The melting of reflective sea ice which is replaced by dark heat absorbing water. The Arctic Sea Ice melt of 2007 lead to a 20 per cent reduction in the volume of sea ice. Previous years arctic ice melts had only involved a loss of sea ice of 2-3 per cent. Some scientists now warn that the Arctic’s floating sea ice is headed towards a complete summer disintegration by as early as 2013, a century ahead of what the IPCC was recently predicting. The rapid loss of Arctic sea ice will speed up the disintegration of the Greenland Ice Sheet<sup>48</sup>, meaning that a rise in sea levels by even as much as 1.4 metres is now possible by the end of this century.<sup>49</sup>

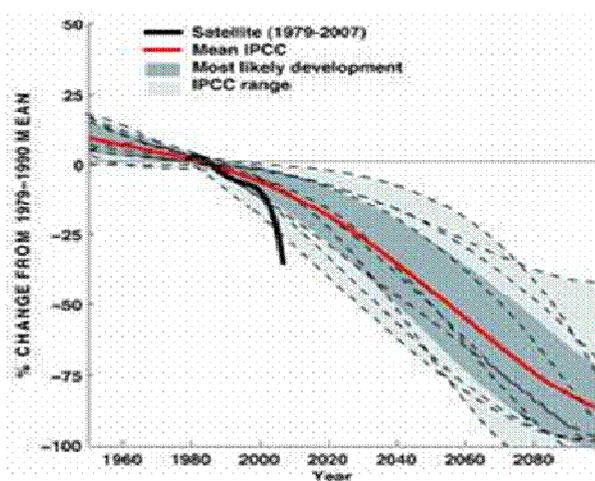


Figure 1.2 Actual Arctic Summer Sea Ice Loss Compared to IPCC Predictions. (Source. Spratt, D<sup>50</sup>, 2008)

<sup>44</sup> Canadell, J. G., LeQuere, C. *et al.* (2007) *Contributions to accelerating atmospheric CO<sub>2</sub> growth from economic activity, carbon intensity, and efficiency of natural sinks*, Proceedings of the National Academy of Sciences.

<sup>45</sup> Wickland, K.P., Striegl, R.G. Neff, J.C Sachs. T. (2006) “Effects of Permafrost Melting on CO<sub>2</sub> and CH<sub>4</sub> Exchange of Poorly Drained Black Spruce Lowland.” *Journal of Geophysical Research* 111, no. G02011.

<sup>46</sup> Walter, K. M., Zimov S. A., *et al.* (2006) *Melting Lakes in Siberia Emit Greenhouse Gas*, *Nature* 443: 71 - 75, <http://www.nature.com/news/2006/060904/full/060904-10.html> Accessed 8.01.08

<sup>47</sup> Ibid.

<sup>48</sup> Gregory, J. M., P. Huybrechts, *et al.* (2004) *Climatology: Threatened loss of the Greenland ice-sheet*, *Nature* 426(616), 8 April 2004, doi:10.1038/428616a

<sup>49</sup> Rahmstorf, S., Cazenave, A. Church, J.A. Hansen, J.E. Keeling, R.F. Parker, D.E. and Somerville. R.C.J. (2007) *Recent Climate Observations Compared to Projections*. *Science* 4 May 2007: Vol. 316. no. 5825, p. 709 DOI: 10.1126/science.1136843

<sup>50</sup> Spratt, D (2007) *The Big Melt: Lessons from the Arctic Summer of 2007*. Carbon Equity. Available At: <http://www.carbonequity.info/PDFs/Arctic.pdf> Accessed 7 November 2007

The prognosis is serious indeed. As the Stern Review states,

“it is the countries with the fewest resources which are most likely to bear the greatest burden of climate change in terms of loss of life, adverse effect on income and growth and damage to living standards generally. Developing countries – and especially the low-income countries in tropical and sub-tropical regions – are expected to suffer most, and soonest, from climate change. Their poverty reduces their capacity to adapt. Millions potentially will be pushed deeper into poverty.”<sup>51</sup>

### 1.1.3 Climate Change and Reductions in Water Availability

Climate change threatens to significantly reduce water availability and lead to greater frequency of droughts in many countries. This will threaten agricultural production and subsistence farming upon which a significant percentage of the world’s population still depends. Already one third of the world’s population lives in countries that are experiencing moderate to high levels of water shortage. According to the OECD that number could rise to two thirds within 30 years unless serious efforts are made to conserve and use water more efficiently.<sup>52</sup> The IPCC Chair Dr Pauchari has stated in 2007 that

‘Glaciers in the Himalayas provide the water source for one-sixth of humanity. Their decline threatens the water supply of billions...The gross per capita water availability in India is projected to decline from 1820 cubic meters per year in 2001 to 1140 cubic meters per year in 2050.’<sup>53</sup>

Figure 1.3 shows that climate change is leading to a significant loss of glaciers and snow in the Asian High Mountains, North West USA and South West California. Figure 1.3 shows to what extent the glaciers of the Himalayas are already melting. And at the same time global demand for water continues to rise in most regions of the world.

Changes in precipitation and, subsequently water availability and run off into rivers, are particularly critical factors affecting the future farming productivity of the landscape. Already significant change in the climate and water availability is occurring around the world and in Australia.<sup>54</sup> For instance, the Australian Bureau of Meteorology’s September 2007 Drought Statement stated that, ‘*This is the first time in the record dating from 1900 that an El Niño-drought in the MDB has not been followed by at least one three-month period with above normal rainfall (basin average) by the end of the following*

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<sup>51</sup> Stern, N et al. (2006) *The Stern Review: The Economics of Climate Change*, Cambridge University Press, Cambridge . Available at [www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm) . Accessed 14 April 2007

<sup>52</sup> OECD (2002) *Sustainable Development Strategies: A Resource Book*. OECD

<sup>53</sup> Pachauri, R. (2007) *Coping with Climate Change: Is Development in India and the World Sustainable?* 2007 K R Narayanan Oration, ANU. Available At <http://rspas.anu.edu.au/papers/narayanan/2007oration.pdf> Accessed 16 November 2007

<sup>54</sup> Pearman, G., Hennessy, K., Jones, R. and Maheepala, S. (2003) *Climate Change and its Projected Effects on Water Resources*, ATSE Water Symposium. Available at <http://www.dar.csiro.au/information/docs/atsewatersymposium03122003.pdf>. Accessed 16 November 2007.

winter.’<sup>55</sup> Former Prime Minister John Howard<sup>56</sup> announced on 19 April 2007 that unless there was substantial rain soon no water will be allocated to irrigators in the Murray-Darling basin for the coming year.

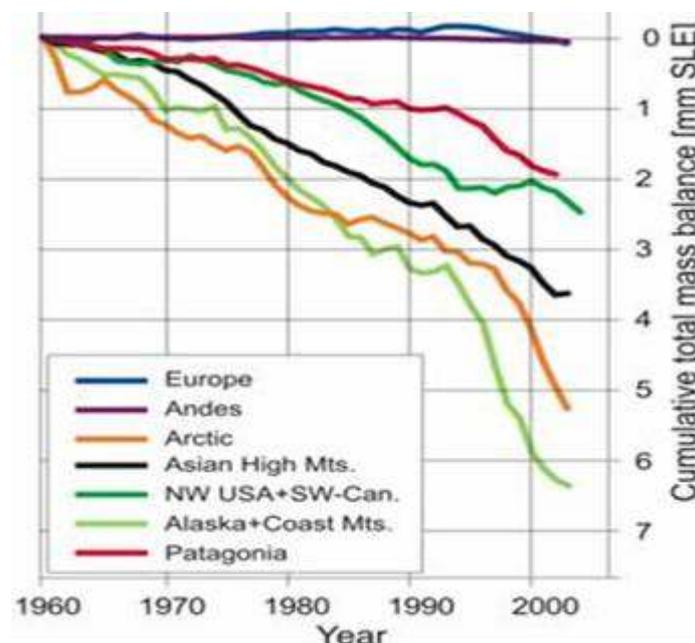


Figure 1.3 Loss of glaciers and snow in the Asian High Mountains, NW USA and South West California. (Source: Pachauri, R.K, 2007<sup>57</sup>)

Currently most farmers in the Murray Darling Basin of Australia are on less than 20 percent of their normal water allocations. The result is directly affecting the 50,000 farmers of the Murray Darling Basin and the economy with the price of food in Australia rising. Already farmers in the Murray Darling Basin are pruning and cutting down significant parts of their orchards to try to survive the drought. Food production is down dramatically in water affected sectors such as cotton, wine and dairy. The Australian government estimates the current drought in Australia shaved 0.75 points from Australia's economic growth in 2006. This drought, the worst ever in Australia's history, is being made worse by the higher average temperatures due to climate change that further dry out the land.<sup>58</sup> Lack of water availability also has implications for the sustainability of cities and towns. According to the OECD

<sup>55</sup> Bureau of Meteorology (2007) *Very dry since late Autumn in parts of southern Australia*, Drought Statement - Issued 3rd September 2007, Australian Government. Available at [http://www.bom.gov.au/announcements/media\\_releases/climate/drought/20070903.shtml](http://www.bom.gov.au/announcements/media_releases/climate/drought/20070903.shtml). Accessed 16 November 2007.

<sup>56</sup> Coorey, P. (2007) 'For millions the water will stop midyear', Sydney Morning Herald April 20<sup>th</sup> 2007. Available at [http://www.smh.com.au/news/environment/for-millions-the-water-will-stop-midyear/2007/04/19/1176697003182.html?s\\_cid=rss\\_smh](http://www.smh.com.au/news/environment/for-millions-the-water-will-stop-midyear/2007/04/19/1176697003182.html?s_cid=rss_smh). Accessed 16 November 2007.

<sup>57</sup> Ibid.

<sup>58</sup> Karoly, D., Risbey, J. and Reynolds, A. (2003). *Global warming contributes to Australia's worst drought*, Report by University of Okalahoma, Monash University and World Wildlife Fund. Available at [http://www.wwf.org.au/downloads/WWF\\_2002\\_Drought\\_web.pdf](http://www.wwf.org.au/downloads/WWF_2002_Drought_web.pdf). Accessed 16 November 2007.

“Some 30-60 per cent of the urban population in low-income countries still lack adequate housing with sanitary facilities, drainage systems and piping for clean water. Continuing urbanisation and industrialisation, combine with a lack of resources and expertise, and weak governance, is increasing the severity of environmental and social problems, which reinforce one another in densely populated areas. Air-pollution, poor solid-waste management, hazardous and toxic wastes, noise pollution and water contamination combine to turn these urban areas into environmental crises zones.”<sup>59</sup>

#### 1.1.4 Loss of Diversity

An estimated 40 per cent of the global economy comprises biological processes and biologically derived products. Much of this production is based on the cultivation of an increasingly narrow range of species and genes, with many of these large scale processes in agriculture and forestry dependant on eliminating biodiversity. At the same time there is a growing awareness of the value of biodiversity, both in providing intellectual property to help develop new uses (foods, pharmaceuticals, water and air purification) and in the ecosystem services nature provides to the global economy free of charge. Ecological economists are increasingly identifying the costs to the mainstream economy if ecological thresholds are not avoided as this will lead to a loss of ecosystem services. When one group calculated the value of nature's ecosystem services they found it was worth a combined value of at least US\$36 trillion annually<sup>60</sup>. That figure is close to the annual gross world product of approximately US\$39 trillion—a striking measure of the value of natural capital to the economy. Ecosystem Services in Australia have been valued by CSIRO at AUD\$1327 million per annum<sup>61</sup>.

Whilst there is considerable debate over the rate of extinction<sup>62</sup>, most biologists do not hesitate to say that the earth's sixth mass extinction is underway.<sup>63</sup> Most species' extinction occurs in those regions richest in biodiversity such as coral reefs, wetlands and rainforests. Most coral and climate scientists predict that, unless there is dramatic and fast climate change mitigation, most of the world's coral reefs will be bleached by the end of this century having significant impacts on the biodiversity of oceans. Also the damage to coral reefs would devastate many nations fishing and tourism industries which depend on coral reefs.<sup>64</sup> Wetlands are even more endangered. Only 6 per cent of the world's surface is wetlands. About half the wetlands have been lost to dredging, draining and ditching.<sup>65</sup> Similarly

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<sup>59</sup> OECD (2002) *Sustainable Development Strategies: A Resource Book*. OECD. Paris

<sup>60</sup> Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R. and Paruelo, J. (1997) *The Value of the World's Ecosystem Services and Natural Capital*, *Nature*, 387, 15 May, pp253–260

<sup>61</sup> See CSIRO Ecosystems Project at [www.ecosystemservicesproject.org](http://www.ecosystemservicesproject.org)

<sup>62</sup> Mann, C (1991) *Extinctions: Are Ecologists Crying Wolf*. *Science* 16 August 1991: Vol. 253. no. 5021, pp. 736 – 738  
DOI: 10.1126/science.253.5021.736

<sup>63</sup> Warrick, J (1998) *Mass Extinction Underway: Majority of Biologists Say*. *Washington Post*, April 21, 1998, A4.

<sup>64</sup> Stout DK, Cesar H. & Timmermann A., (2000), *Pacific in Peril. Biological, economic and social impacts of climate change on Pacific coral reefs*. Greenpeace. See at <http://www.ecoworld.com/home/articles2.cfm?tid=146> Accessed 8.01.2008

<sup>65</sup> Meadows, D. et al (2002) *Limits to Growth: The Thirty Year Update*. Earthscan Publishing

many of the world's rainforests have already been cleared and new pressures from the demand for land for biofuels and soybeans is driving still more rainforest clearing. The estimated rates of extinction are now 1000 times what they would be without human impact.<sup>66</sup> Unfortunately human activities tend to try to simplify nature's ecosystems such as monoculture modern farming methods. Also the intensive nature of farming which utilises significant levels of nitrogen fertilisers puts further environmental pressure on the ecosystems downstream from the farm. According to the OECD current intensive farming methods are not sustainable. The OECD states that

“Intensive agriculture, dependant on high levels of fossil fuel combustion and the widespread cultivation of leguminous crops, is releasing huge quantities of nitrogen to the environment, exacerbating acidification, causing changes in the species composition of ecosystems, raising nitrate levels in freshwater supplies above acceptable limits for human consumption, and causing eutrophication in freshwater and marine habitats.”<sup>67</sup>

The evidence suggests that ecosystem services are currently being used at unsustainable rates. This point was made strongly by 1700 of the world's leading scientists in a statement in 1992 entitled “World Scientists Warning to Humanity”, which included the majority of Nobel laureates in the sciences.

“Our massive tampering with the world's interdependent web of life – coupled with the environmental damage inflicted by deforestation, species loss, and climate change – could trigger effects, including unpredictable collapses of critical biological systems whose interactions and dynamics we only imperfectly understand. Uncertainty over the extent of these effects cannot excuse complacency or delay in facing the threats.”<sup>68</sup>

At the same time that there is significant loss of biodiversity occurring, cultural diversity is also decreasing. Globalisation is leading to a loss of local indigenous knowledge and culture that could be crucial for helping local communities be resilient to economic, social and environmental changes.

### 1.1.5 Economic Disparity and Political Instability

Many of these environmental trends discussed so far further increase the vulnerability of the world's poor. Over the last 30 years globally there has been significant progress on reducing poverty. Economic development in Asia has seen the largest ever number of people move out of poverty over such a short period. At the same time, progress has not been sufficient. According to the respected economic advisory organisation, the OECD in 2002

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<sup>66</sup> Ibid.

<sup>67</sup> Ibid.

<sup>68</sup> International Union of Concerned Scientists (1992) *World Scientists Warning to Humanity*. Available at <http://www.ucsusa.org/ucs/about/1992-world-scientists-warning-to-humanity.html> Accessed 8.01.08

“Even in prosperous times, extreme poverty still ravages the lives of one out of every five persons in the developing world...The social ills associated with poverty are on the rise in many countries with high rates of poverty. These include, disease, family breakdown, endemic crime and the use of narcotic drugs.”<sup>69</sup>

Insufficient progress has also been made on reducing global economic inequality. One of the most respected annual reports on economic disparity is the UNDP Human Development Report. Each year it investigates the issue of global development. According to the 1997 UNDP Human Development report<sup>70</sup>, in 1960 the share of global income enjoyed by the wealthiest 20% of the world’s people was thirty times larger than the amount shared by the lowest 20%. It reached sixty one to one by 1991 and seventy-eight to one in 1994. This trend is seen by many experts as unsustainable.

By 2005, the UNDP Human Development Report (HDR) showed that

Only 9 countries (4% of the world’s population) had reduced the wealth gap between rich and poor, whilst 80% of the world’s population have recorded an increase in wealth inequality. The report stated that ‘the richest 50 individuals in the world have a combined income greater than that of the poorest 416 million. The 2.5 billion people living on less than US\$2 a day – 40% of the world’s population – receive only 5% of global income, while 54% of global income goes to the richest 10% of the world’s population.’<sup>71</sup>

Many developing countries are struggling currently under the combined pressures of a heavy external debt burden, violent conflict, AIDS-HIV and malaria epidemics, and a lack of investment. Some experts also argue that these problems are exacerbated by trade protectionism from the North.<sup>72</sup> Many of the citizens of these countries suffer from a lack of access to social services, education, energy and basic water sanitation. At best, some become refugees or economic migrants. As a result of these processes, poor countries and poor people are marginalised from the opportunities presented by global economic growth and development.

The UN’s Report on the World’s Social Situation 2005 ‘The Inequality Predicament’, identifies

Non-economic aspects of global inequality (such as inequalities in health, education, employment, gender and opportunities for social and political participation), as causing and exacerbating poverty. These institutionalised inequalities result in greater marginalisation within society.

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<sup>69</sup> OECD (2002) *Sustainable Development Strategies: A Resource Book*. OECD. Paris.

<sup>70</sup> UNDP (1997) *Human Development Report 1997- Human Development to Eradicate Poverty*. UNDP. Available At <http://hdr.undp.org/en/reports/global/hdr1997/> Accessed 8.01.08

<sup>71</sup> UNDP (2005) *Human Development Report*. UNDP Available At <http://hdr.undp.org/reports/global/2005/> (Accessed June 2007)

<sup>72</sup> Stiglitz, J. Charlton, A. (2005) *Fair Trade for All: How Trade Can Promote Development*, Oxford University Press.

The report emphasises the inevitable social disintegration, violence and national and international terrorism<sup>73</sup> that this inequality fosters.

There is significant literature showing correlations between inequality, poverty and conflict. In particular, the results in Alesina et al<sup>74</sup> suggest that poor economic conditions increase the probability of political coups. Collier and Hoeffler<sup>75</sup> show that economic variables are powerful predictors of civil war, while political variables have low explanatory power. Miguel, Satyanath, and Sergenti<sup>76</sup> show that, for a sample of African countries, negative exogenous shocks in economic growth increase the likelihood of civil conflict. The likelihood of armed conflict correlates strongly with a decline in the UNDP's human development ranking (See Figure 1.4) As Figure 1.4 illustrates, 5.5 per cent of the countries ranked as High Human Development states by the UN Human Development Index (HDI) 2004 experienced one or more armed conflicts during the ten-year period 1995-2004. This figure rises to 29.1 per cent of those ranked as Medium Human Development states. For Low Human Development states, there was almost as much likelihood (47.2 per cent) that they were at war during the decade as not.

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<sup>73</sup> New empirical studies dispute the correlation between economic inequality and terrorism see Abadie, A. (2004) *Poverty, Political Freedom, and the Roots of Terrorism*. NBER Working Paper 10859. Cambridge: Oct. 2004 Available At <http://ksghome.harvard.edu/~aabadie/povterr.pdf> Accessed 8.01.08

<sup>74</sup> Alesina, A., Ä Ozler, S., Roubini, N., and Swagel, P. (1996) *Political Instability and Economic Growth*. Journal of Economic Growth, vol. 1, pp. 189-211, 1996.

<sup>75</sup> Collier, P. and A. Hoeffler (2004) *Greed and Grievance in Civil War*, Oxford Economic Papers, vol. 56, pp. 563-595, 2004

<sup>76</sup> Miguel, E., Satyanath, S., and Sergenti, E. (2004) *Economic Shocks and Civil Conflict: An Instrumental Variables Approach*, Journal of Political Economy, vol. 112(4), pp.725-753

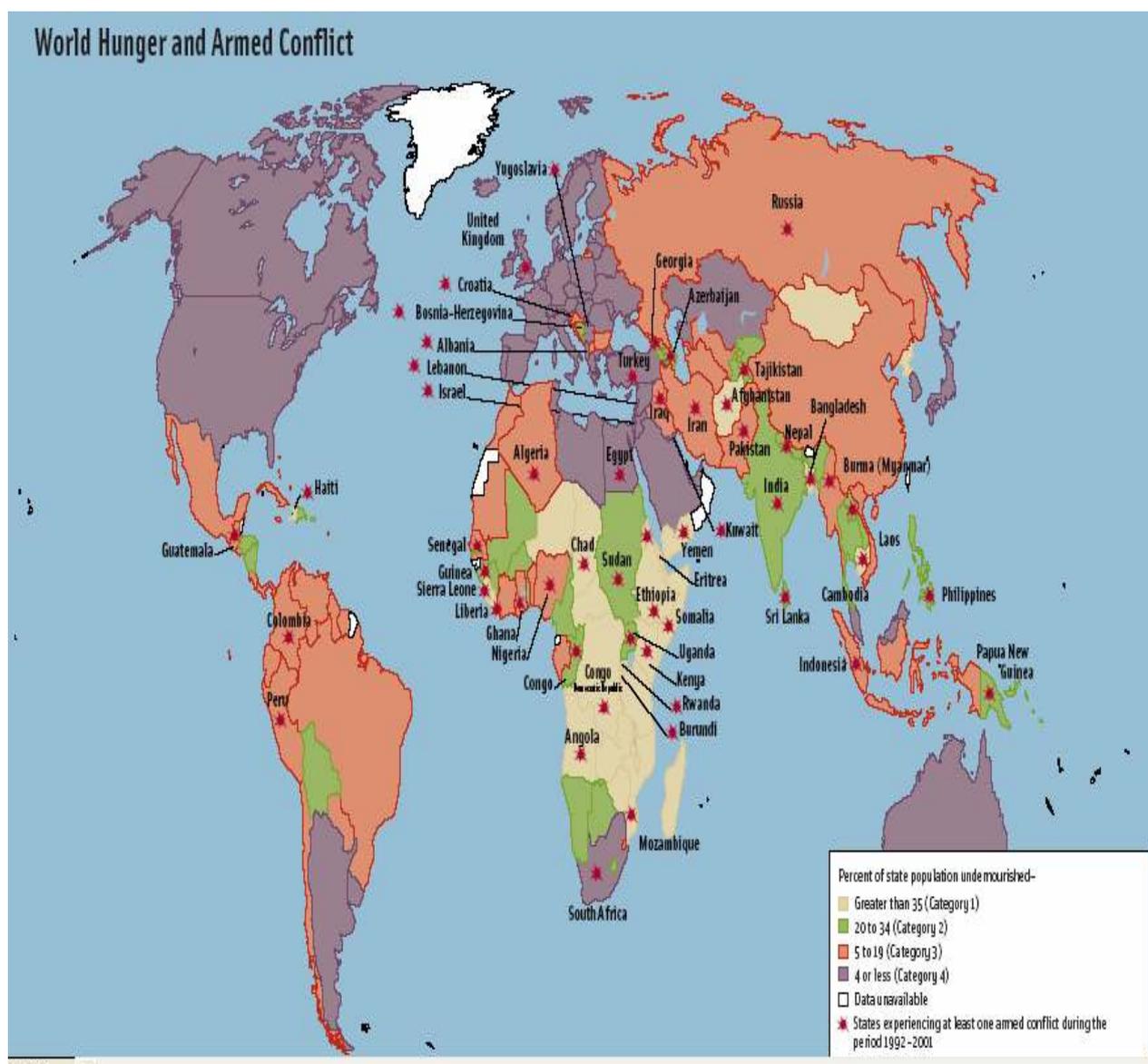


Figure 1.4: Correlation between Human Development Index and likelihood of conflict. (Source:PloughShares<sup>77</sup>,2004)

### 1.1.6 The Impact of Diseases such as HIV-AIDS and Malaria

HIV-AIDS and Malaria are crippling diseases that devastate both the productive capacity and the social fabric of the world's poorest nations. Approximately 500 million people suffer from acute malaria every year, of whom, one million die.<sup>78</sup> HIV has had a profound effect on communities around the world often killing those adults upon which the elderly and children depend. Numerous publications<sup>79</sup> have outlined how

<sup>77</sup> See Ploughshares at [www.ploughshares.ca/images/articles/ACR05/3%20Hum.Dev.graph.page.pdf](http://www.ploughshares.ca/images/articles/ACR05/3%20Hum.Dev.graph.page.pdf) Accessed 8.01.07

<sup>78</sup> OECD (2002) *Sustainable Development Strategies: A Resource Book*. OECD, Paris.

<sup>79</sup> Barnett, T. Whiteside, A. (2003) *AIDS in the 21st Century: Disease and Globalization*, Palgrave Macmillan.

Ilfie, J. (2006) *The African AIDS Epidemic: A History*, James Currey, Oxford.

Nattrass, N. (2003) *The Moral Economy of AIDS in South Africa*, Cambridge University Press.

Fourie, P (2006) *The Political Management of HIV and AIDS in South Africa: One burden too many?* Palgrave Macmillan.

“The AIDS epidemic sweeping Africa is not only killing millions of people and tearing apart families -- it is also crippling economic growth in a continent that is already the world's poorest...cost of treating AIDS patients, the loss of experienced workers to the disease and subsequent restrictions on investment will all hamper economic growth in the decades ahead. That will undercut Africa's efforts to prevent the gap between itself and the rest of the world from getting even wider. Governments will have to spend more of their limited resources on health spending, and ordinary families will have to move money away from food and education to caring for the sick.”<sup>80</sup>

As UNAIDS stated in 2004

“Although prevention is the mainstay of the response to AIDS, fewer than one in five people worldwide have access to HIV prevention services. Comprehensive prevention could avert 29 million of the 45 million new infections projected to occur this decade. Although antiretroviral treatment is bringing hope to millions, without sharply reducing the number of new HIV infections, expanded access to treatment becomes unsustainable.”<sup>81</sup>

### 1.1.7 Over-Consumption of Resources in the industrialised countries.

The demands of people in high-consumption OECD economies have significantly more environmental impact than poorer countries with low levels of per capita resource consumption. This is significant, from a sustainability point of view, because, if global inequality and poverty is to be addressed, then business as usual economic development is no longer an option because it will be physically impossible for all developing nations to achieve Western material living standards. The global ‘ecological footprint’ (the equivalent land and water area required to produce a given population’s material standard, including resources appropriated from other places) is already greater than the carrying capacity of our planet. Since 1963, for instance, there has been a 2.4-fold increase in the material throughput of the global economy<sup>82</sup> and in 2001, humanity’s ecological footprint exceeded the global bio-capacity by 21%.<sup>83</sup> (Figure 1.5)

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<sup>80</sup> See Reuters (2000) *AIDS epidemic crippling Africa's economies* at <http://archives.cnn.com/2000/HEALTH/AIDS/11/28/aids.africa.economy.reut/> Accessed 8.01.2008

<sup>81</sup> UNAIDS (2004) *UNAIDS 2004 Report on the Global AIDS Epidemic - Executive Summary*. UNAIDS. Available At: [www.unaids.org/bangkok2004/GAR2004\\_html/ExecSummary\\_en/ExecSumm\\_en\\_03.htm](http://www.unaids.org/bangkok2004/GAR2004_html/ExecSummary_en/ExecSumm_en_03.htm) Accessed 8.01.08

<sup>82</sup> Gardner, G., Sampat, P. (1998). *Mind over Matter: Recasting the Role of Materials in our Lives*. World Watch Paper 144. Washington, D.C. World Watch Institute.

<sup>83</sup> World Wildlife Fund (2004) *Living Planet Report*. Available at [www.panda.org/news\\_facts/publications/key\\_publications/living\\_planet\\_report/index.cfm](http://www.panda.org/news_facts/publications/key_publications/living_planet_report/index.cfm) Accessed 8.01.2008

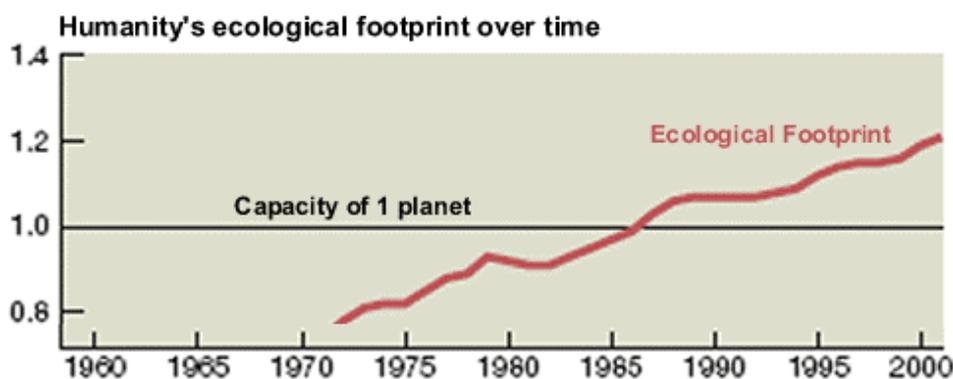


Figure 1.5: Ecological Footprint of Humanity over Time (Source:World Wildlife Fund<sup>84</sup>, 2004)

Research has shown that the scale of the human economy now overwhelms many of the Earth's natural material cycles, such as nitrogen<sup>85</sup>, sulphur<sup>86</sup>, carbon<sup>87</sup>, water<sup>88</sup> and trace metals<sup>89</sup>. Consequently, if the emerging economies of developing countries were also to be based on such intensive use of resources, this would put extreme environmental pressure on the world's resource base and the world's ecosystem's sources and sinks. As the UNEP 2002 Sustainable Consumption Status report stated

"If China were to consume seafood at the per capita rate of Japan, it would need 100 million tonnes, more than today's total catch. If China's beef consumption was to match the USA's per capita consumption and if that beef was produced mainly in feedlot, this would take grain equivalent to the entire US harvest."

### 1.1.8 Population Growth

All of these problems are exacerbated by population growth, although it is their resource consumption patterns or people's localised concentrations that effect ecological and social sustainability more than their mere numbers. World population stands at 6.7 billion and is forecast to rise to 8-9 billion before levelling off. UN Environment Program, in its fourth Global Environmental Outlook, stated that

<sup>84</sup> Ibid.

<sup>85</sup> Vitousek, P. M. (1994) *Beyond Global warming: Ecology and Global Change*. Ecology 75:1861-1876. Vitousek, P.M., et al. (1997) *Human alteration of the global nitrogen cycle: Causes and consequences*. Ecological Applic. 7:737-750

<sup>86</sup> MacKenzie, J.J. (1997). *Oil as a Finite Resource: When is Global Production Likely to Peak?*

World Resources Institute, Washington, D.C.

<sup>87</sup> Houghton, J.T., Filho, L.G.M., Callander, B.A., Harris, N., Kattenberg, A., Maskell, K., (eds.) Climate Change (1995): *The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, p. 572

<sup>88</sup> Postel, S., Daily, G.C., Erlich, P.R., (1996). *Human Appropriation of Renewable Fresh Water*. Science, 271, p. 785-88.

<sup>89</sup> Nriagu, J.O. (1990). *Global Metal Pollution: Poisoning the Environment?* Environment, 32, p. 7-11.

Over the past two decades the world population has increased by almost 34 percent to 6.7 billion from 5 billion; similarly, the financial wealth of the planet has soared by about a third. But the land available to each person on earth had shrunk by 2005 to 2.02 hectares, or 5 acres, from 7.91 hectares in 1900 and was projected to drop to 1.63 hectares for each person by 2050. The result of that population growth combined with unsustainable consumption has resulted in an increasingly stressed planet where natural disasters and environmental degradation endanger millions of humans, as well as plant and animal species. Current demand for resources was close to 22 hectares per person, a figure that would have to be cut to between 15 and 16 hectares per person to stay within existing, sustainable limits.<sup>90</sup>

### 1.1.9 Natural Resource Depletion and Loss of Ecosystem Services

When different environmental pressures on the world's ecosystems from different sources – unsustainable consumption, population growth, climate change, water shortages, pollution, eutrophication, loss of biodiversity - combine they have a compound effect on each other.<sup>91</sup> The impacts of the greenhouse effect alone may be significantly mitigated, but when these are combined with deforestation and biodiversity loss, the conversion of vast land mass to freshwater intensive modern agriculture, increasing urban waste streams, then the stress on our remaining natural ecosystems can no longer be ignored. In many cases, the cost of destroying ecosystem services becomes apparent only when the services start to break down.<sup>92</sup> In late March 2005, the United Nation's (UN) Millennium Ecosystem Assessment<sup>93</sup>, conducted by 1360 experts in 95 nations, reported that approximately 60 percent of the ecosystem services that support life on Earth are being seriously degraded or used unsustainably. The UN Millenium Ecosystem Assessment documents several “accelerating, abrupt, and potentially irreversible changes.” These include:

- Fishery collapses, illustrated by the collapse of the Newfoundland cod fishery off the coast of Canada.

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<sup>90</sup> UNEP (2007) *Global Environment Outlook: environment for development (GEO-4)*. UNEP. Available At <http://www.unep.org/geo/geo4/media/> Accessed 8.01.08

<sup>91</sup> Myers, M. (1995) *Environmental Unknowns*, Science, vol 21, July: 358-360. DOI: 10.1126/science.269.5222.358

Myers, N. (1996) *Key Challenges for Biodiversity: Discontinuities and Synergisms*, Biodiversity and Conservation, 5: 1025–1034.

<sup>92</sup> Bright, C. (2000) *State of the World Report, Anticipating Environmental Surprise*, Worldwatch Institute, Washington, DC, Ch 2, pp22-38.

<sup>93</sup> Millennium Ecosystem Assessment (2005): *Ecosystems and Human Well-being: Opportunities and Challenges for Business and Industry*, World Resources Institute, Washington, DC.

Millennium Ecosystem Assessment, (2005). *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC

Millennium Ecosystem Assessment, (2005). *Ecosystems and Human Well-Being: Wetlands and Water Synthesis*. World Resources Institute, Washington, DC.

Millennium Ecosystem Assessment, (2005) *Ecosystems and Human Well-being: Biodiversity Synthesis*. World Resources Institute, Washington, DC.

Millennium Ecosystem Assessment: (2005) *Ecosystems and Human Well-being: Desertification Synthesis*. World Resources Institute, Washington, DC.

- Algal blooms, caused by the increased use of nitrogen based fertilisers globally, which have led to massive fish loss and the creation of dead zones such as in the Gulf of Mexico.
- The replacement of corals by algae in many locations caused by eutrophication and the decline in population of fish that feed on algae and with a consequent long term decline in the reefs fish population and overall productivity.
- Desertification, as land degradation worsens due to climate change and loss of biomass leading to the collapse of grasslands, moisture retention and soil structure.
- Increased vulnerability due to climate change and destruction of natural habitat which provides resilience and protection from extreme weather events leading to increased flooding, landslides and coastal storm surges.
- Crop failures, caused by pests, pathogens, lack of diversity, destruction of biodiversity (such as the loss of pollinators), soil erosion, water pollution and increased low level ( tropospheric) ozone.

The serious risks posed by such tipping points mean that humanity has just decades to rapidly reduce these environmental pressures to ensure irreversible decline of ecosystem resilience is avoided. Such an assessment of the world's ecosystems is in accord with previous assessments. For instance, according to an analysis of the world's ecosystems prepared by the United Nations, the World Bank and the World Resources Institute in 2000, *'There are considerable signs that the capacity of ecosystems, the biological engines of the planet, to produce many of the goods and services we depend on is rapidly declining'*<sup>94</sup>. In 2007, the fourth Global Environment Outlook<sup>95</sup> (GEO-4), published by the United Nations Environment Program (UNEP), came to similar conclusions. It stated that *"Humanity is changing the Earth's climate so fast and devouring resources so voraciously that it is poised to bequeath a ravaged planet to future generations."* The fourth Global Environment Outlook (GEO-4), was compiled by 390 experts from observations, studies and data garnered over two decades. The 570-page report says world leaders must propel the environment "to the core of decision-making" to tackle a daily worsening crisis

"The need couldn't be more urgent and the time couldn't be more opportune, with our enhanced understanding of the challenges we face, to act now to safeguard our own survival and that of future generations."<sup>96</sup>

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<sup>94</sup> World Resources Institute (2000) *World Resources: People and Ecosystems: The Fraying Web of Life*, World Resources Institute, Washington, DC

<sup>95</sup> UNEP (2007) *Global Environment Outlook: Environment for Development (GEO-4)*. UNEP. Available At <http://www.unep.org/geo/geo4/media/> Accessed 8.01.08

<sup>96</sup> Ibid.



In the early 1980s the World Conservation Strategy and subsequently from 1984-1987 the World Commission on Environment and Development – the Brundtland Commission’s – *Our Common Future (OCF)* were developed in response to increasingly informed analyses of the links between environment, social issues and economic development. The publication of the Brundtland Commission *Our Common Future* is one of the most influential publications ever on these issues, addressing in detail the challenges of poverty, global inequality and threats to environmental sustainability. Since the publication of *OCF*, worldwide acceptance of the importance of and the interlinked nature of environmental, social and economic issues has grown significantly. The World Bank, the OECD, even the IMF all endorsed *Our Common Future*, helping to build significant momentum and political will for the 1992 Earth Summit attended by 189 countries.

### 1.2.1 Definitions of Sustainable Development

The Brundtland Commission’s publication *Our Common Future* is famous for its definition of sustainable development - “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” But there were other definitions of sustainable development also outlined in *Our Common Future* that have since had relatively less attention such as

- ‘*consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire.*’

- Or development that, ‘*at a minimum ... must not endanger the natural systems that support life on Earth: the atmosphere, the waters, the soils and the living beings.*’

In addition to defining sustainable development, the Brundtland Commission recommended a series of policy changes and strategies needed to achieve sustainable development such as ensuring a sustainable level of population, to increasing equity within and between nations, to reducing poverty, reducing the energy and resource content of growth, re-orienting technology, and merging environment and economics in decision-making.

In taking the idea and desirability of intergenerational equity seriously, the Brundtland Commission provided some very profound challenges to some little discussed assumptions about our society and ourselves. It was also significant because it challenged our beliefs about what makes us better off and it challenged our perceptions of responsibility for others and future generations. We should at the outset define what we mean by intergenerational equity. One broadly acceptable definition<sup>106</sup> is this:

“The principle of intergenerational equity means that decisions taken today should ensure that at least an equivalent set of opportunities for human welfare is available to succeeding generations.”

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<sup>106</sup> Harding, Ronnie, Young, Michael and Fisher, Elizabeth (1994) *Sustainability: Principles to practice*, Background paper for the Fenner Conference on the Environment (ANZECC, Canberra)

Since *Our Common Future* was published many have worked together to help better define in detail what sustainable development and intergenerational equity means. For instance, a number of economists and ecologists published a significant paper *Are We Consuming Too Much?*<sup>107</sup> in 2004 which they argued that sustainable development is development where the inclusive wealth – natural resources, ecosystems, and economic, financial, and manufactured capital, human welfare and human knowledge - of a society does not decline over time.

Their methodology is an attempt to measure the change in value over time of all the critical capital stocks in an economic system, at constant prices. Inclusive Wealth is "inclusive" for two reasons: one, because it tries to include everything that actually matters to human welfare and quality of life and two, because it includes the interests of future generations.

The important distinguishing feature of this method is the use of accounting prices, or what is the "shadow price".<sup>108</sup> Such shadow prices reflect the actual cost of replacing the asset, and do not vary with changes in valuation by the market. They are looking for the value of changes in assets and not for the changes in the value of assets. The authors note that

“Current estimates of genuine wealth depend crucially on the values assigned to shadow prices, yet the empirical basis for these prices is very weak. Numerical growth models can be used to project growth paths of economies and the sensitivity of these paths to changes in capital stocks. In this way, they can generate much better assessments of the critical shadow prices.”<sup>109</sup>

The inclusive wealth framework also seeks to measure to what extent different forms are actually substitutable. There are two main lines of thought on the ability to both aggregate different forms of capital and in turn substitute them. One is the ‘Weak’ or ‘Narrow’ definition, which assumes that all forms of capital are substitutable. The other is the ‘Strong’ or ‘Broad’ definition, where the ability to transform one form of capital into another is not assumed; rather great efforts are made to determine whether substitutability is in fact possible. The limitation of the Weak definition is that both human and manufactured capital are complemented by nature and will struggle to find cost effective substitutes for many of its services. Also nature has an intrinsic right to exist. As we described earlier, there is mounting evidence that our ecosystems are more fragile than first thought, suggesting that nature (natural capital) is to be cherished and restored and not converted into other forms of capital. Hence, the inclusive wealth framework brings in the best of the Strong or Broad definition by

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<sup>107</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

<sup>108</sup> Loosely, the shadow price is the change in the objective value of the optimal solution of an optimization problem obtained by relaxing the constraint by one unit. In a business application, a shadow price is the maximum price that management is willing to pay for an extra unit of a given limited resource.[1] For example, what is the price of keeping a production line operational for an additional hour if the production line is already operated at its maximum 40 hour limit? That price is the shadow price.

<sup>109</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

placing more restrictive conditions on the ability to substitute particular forms of capital. Pearson, Harris and Walker<sup>110</sup> have been working on incorporating the most useful aspects of both the Weak and Strong definitions into the Inclusive Wealth framework to ensure that Inclusive Wealth has something like the following properties:

- The measure would allow for the quantification of the total capital stock, thus allowing analysis of the overall trend.
- The measure would allow the substitutability of each form of capital within the measure to be governed by an assigned relative weighting.
- The limitations effecting substitutability of each form of capital would be clearly understood and accounted for. In particular, any critical thresholds such as ecological limits or the inability to be further substituted would be taken into account, together with the level of difficulty in reversing the substitution of different types of capital (irreversibility). This last point is very important. As Ehrlich *et al*<sup>111</sup> have explained

“It is important to realize that even if an economy satisfies the sustainability criterion (i.e., relative to population, inclusive investment is not negative) today, or has satisfied the criterion in the recent past, it might not continue to do so in the future. Whether it is able to do so depends on the scale of the economy (measured by, say, gross domestic product [GDP]), among other things. If the scale becomes too large relative to the natural capital base of the economy, the economy will be unable to maintain its inclusive wealth. Specifically, as an economy’s scale increases, natural capital (e.g., ecosystems) becomes more scarce relative to the size of the economy. Consequently, the amount of other types of capital needed to substitute for natural capital—that is, the shadow price of natural capital—may rise. The extent to which the shadow price rises depends on a number of factors, including the rate of technological progress. There can even come a point where no amount of feasible investment in manufactured capital or human capital can offset further declines in natural capital.”<sup>112</sup>

The ecosystem services listed below provided by natural capital, for free currently, are not cost effectively replaceable or substitutable by technological innovation. These ecosystem services complement and are depended on by life on our planet:

- production of atmospheric gases.
- supporting evolutionary processes, and biodiversity;
- purification of soil, water and air.
- storage and cycling of fresh water and nutrients.

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<sup>110</sup> Pearson, L., Harris, M. and Walker, B. (2003) *Measuring and Modeling Sustainable Development in Australia using Inclusive Wealth*, Commonwealth Science and Industry Research Organisation.

<sup>111</sup> Ehrlich, P. R., Goulder, L.H. (2007). *Is Current Consumption Compatible with Sustainability? A General Framework and Some Indications for the United States*. *Conservation Biology* 21(5):1145–54.

<sup>112</sup> Ibid

- regulation of the chemistry of the atmosphere and oceans.
- maintenance of habitats for wildlife.
- disposing of organic wastes.
- sequestration and treatment of waste.
- pest and disease control by insects, birds and other organisms.
- production of the variety of species for food, fibres, pharmaceuticals and materials.
- conversion of solar energy into natural materials.
- prevention of soil erosion and sediment loss.
- alleviating floods and managing runoff.
- protection against UV radiation.
- regulation of the local and global climate.
- development of topsoil and maintenance of soil fertility.
- production of grasslands, fertilizers and food.

Arrow *et al*<sup>113</sup> have applied the inclusive wealth approach to a number of countries to assess whether or not we are consuming too much or whether in fact “current generations are making the investments that are necessary to assure higher real living standards in the future, despite stresses on the natural resource base.”<sup>114</sup> They stated that

“Although the evidence is far from conclusive... We...find evidence that several nations of the globe are failing to meet a sustainability criterion: their investments in human and manufactured capital are not sufficient to offset the depletion of natural capital...”.

### 1.2.2 Clarifying Sustainable Development and the Role of Ethics and Values

It is also important to clarify that the call for sustainable development is both scientifically and ethically based. In addition to understanding scientifically the state of the planet and the extent of extreme poverty and global inequality there are also ethical decisions to be made by society on what it is they wish to sustain and maintain indefinitely and what they wish to change. Sustainable development involves these two components

- sustaining (maintaining) the things that we value and
- improving the condition of people, society and the environment to ensure that what we value is sustained for us and for future generations. This is the ethical principle of intergenerational equity.

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<sup>113</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18(3), pp 147-172

<sup>114</sup> Ibid.

So we can gain great clarity in our actions if we begin any discussion of sustainable development with the question: ‘What do we value and wish to sustain?’ Having worked this out, it is valuable to then ask ‘What needs to be done to ensure that those things, which we value, are indeed sustained?’ If we value the ecosystems, upon which life and our lives depend, then sustainable development needs to ensure the survival or maintenance of ecosystems services and biodiversity. The greenhouse gas reduction targets that nations choose is partly an ethical decision. For every degree that global temperatures may increase due to human induced global warming scientists warn us that more species will become extinct and more vulnerable people are highly likely to die. Table 1.2 illustrates this.

How much do we value the right for all species to survive? How much do we value a human life? CSIRO’s research shows that with a small temperature rise 81 per cent of the Great Barrier Reef will be bleached. How much do we value the sustaining of the Great Barrier Reef and all the jobs and businesses that depend on it? Rising temperatures from global warming is also predicted to lead to more days per annum over 35 degrees in Australia. The elderly, in particular, are vulnerable to such hot days. In Europe, in 2003, extreme heat was a factor in 35,000 deaths. How much do we value our fellow human beings lives? If, through such debates and discussions of ethics and values, we realise that sustaining the things that we value is really important to us then, logically, it is vital that we achieve such greenhouse gas reduction targets and achieve sustainability, otherwise the things that we have said we want to sustain will not be sustained. They will be degraded or made extinct. But in addressing an issue like greenhouse gas emission reduction targets we also need to be sensitive to other social and economic aspects that we wish to sustain. In seeking to achieve ecologically sustainable cuts to greenhouse gas emissions, it is important to do this in a way that ensures that people do not lose their jobs permanently. We do not want towns and communities that, for instance, were dependant on coal mining to collapse and fragment. Thus to ensure that people are treated with respect we also will need to invest in structural readjustment packages and retraining and job creation schemes to ensure people are valued and treated with the dignity that they deserve during a transition to a sustainable society.

**Table 1.2: Summary of climate change impacts on Australia across selected areas.**  
(Source: CSIRO Marine & Atmospheric Research (2006))

Temp rise	Tourism	Water and Primary Industries	Infrastructure and Insurance
>4°C	<ul style="list-style-type: none"> <li>- Most Australian vertebrates lose 90 to 100% of their core habitat</li> </ul>	<ul style="list-style-type: none"> <li>- Extreme rainfall in Victoria increases by 25%</li> </ul>	<ul style="list-style-type: none"> <li>- Peak electricity demand in Adelaide, Brisbane and Melbourne increases by 9 to 25%</li> <li>- 180 days a year above 35°C in SA and NT</li> <li>- '100-year' storm tides along Victoria's east coast 30% more frequent</li> </ul>
>3°C	<ul style="list-style-type: none"> <li>- Distribution of Great Barrier Reef species shrinks by 95%</li> <li>- 65% of Reef species lost in Cairns region</li> <li>- Snow-covered alpine area shrinks by 20 to 85%</li> <li>- '60 day' snow cover declines by 40 to 95%</li> </ul>	<ul style="list-style-type: none"> <li>- 55% loss of Eucalyptus core habitat</li> <li>- Timber yields in southern Australia rise by 25 to 50%, but fall by same margin in North Qld and the Top End</li> <li>- Australian net primary production falls by 6%</li> <li>- Flow in the Murray-Darling falls by 16 to 48%</li> </ul>	<ul style="list-style-type: none"> <li>- Dengue fever transmission zone reaches Brisbane and possibly Sydney</li> <li>- Temperature-related deaths of people over 65 rise by 144 to 200%</li> <li>- Oceania experiences a net loss of GDP</li> </ul>
>2°C	<ul style="list-style-type: none"> <li>- 97% of the Great Barrier Reef bleached</li> <li>- 80% of Kakadu freshwater wetlands lost</li> </ul>	<ul style="list-style-type: none"> <li>- Pasture growth slows by 31%</li> <li>- Macquarie River Basin (NSW) flows fall by 5 to 35%</li> <li>- Livestock carrying capacity in native pasture systems falls by 40%</li> </ul>	<ul style="list-style-type: none"> <li>- Temperature-related deaths of people over 65 rises by 89 to 123%</li> <li>- Road maintenance costs in Australia rise by 17%, despite a decline in South Australia</li> <li>- '100-year' storm tides along Victoria's east coast 15% more frequent</li> <li>- Tropical cyclone rainfall increases 20 to 30%, as wind speed increases 5 to 10%</li> <li>- Forest fire danger rises 10% across Australia</li> </ul>
>1°C	<ul style="list-style-type: none"> <li>- 81% of the Great Barrier Reef bleached</li> <li>- Vertebrates in the World Heritage Wet Tropics lose 90% of their core habitat.</li> </ul>	<ul style="list-style-type: none"> <li>- Melbourne's water supply falls 7 to 35%</li> <li>- Murray-Darling flows fall 12 to 25%</li> <li>- Queensland fruit fly spreads south</li> <li>- 40% loss of Eucalyptus core habitat</li> </ul>	<ul style="list-style-type: none"> <li>- Height of '100-year' storm surge at Cairns rises 22%, doubling the flooded area</li> <li>- Storm surge rises 25% along Victoria's east coast</li> <li>- Double the people exposed to flooding in Australia and New Zealand</li> </ul>
<1°C	<ul style="list-style-type: none"> <li>- Snow-covered alpine areas shrink by 10 to 40%</li> <li>- Vertebrates in the World Heritage Wet Tropics lose half their habitat</li> </ul>	<ul style="list-style-type: none"> <li>- 14% of Victoria's marine invertebrates lose habitat</li> <li>- Droughts in NSW 70% more frequent and more widespread</li> <li>- Wheat production increases with temperature rises up to 3 to 4°C, if precipitation also increases; but export value declines.</li> <li>- Melbourne's water supply falls 3 to 11%</li> </ul>	<ul style="list-style-type: none"> <li>- 18% more days above 35°C in SA</li> <li>- Extreme rainfall 10 to 20% more intense in NSW</li> <li>- Electricity infrastructure suffers 3% decrease in transmission efficiency</li> <li>- Demand for natural gas heating in Melbourne falls</li> <li>- Peak electricity demand in Melbourne and Sydney falls by up to 1%, and rises in Adelaide and Brisbane by 2 to 5%</li> </ul>

### 1.2.3 Sustainable Development Requires No Major Trade Offs

If we value environmental, social and economic conditions and goals, we need to approach sustainability (ecological, social and economic) goals as goals to be achieved, with no major trade-offs. One of the critically important implications to the sustainability decision-making process, where society wants to pursue a range of goals simultaneously, is that it must be based on the principle of 'no-major-trade-offs'. Logically, if society is committed to sustaining something, it cannot trade-off

the continued existence of that thing or attribute in order to meet other goals. Similarly, in a sustainable development approach, it is desirable for actions taken in the pursuit of one goal to also contribute to the achievement of other goals: ‘win–win–win’ outcomes. As former Australian Liberal Leader of the Senate Robert Hill states

‘We need to develop decision-making processes which take into account, not only the financial costs and benefits of our actions, but also the social and environmental consequences. Those processes will need to shift the focus away from short-term economic gain towards long-term economic, social and environmental impacts – the triple bottom line.’<sup>115</sup> Striking the right balance between the economic, social and environmental values of our actions is the essence of sustainable development.<sup>116</sup>

In the past, following a rather simplistic application of optimization theory, it has been assumed that the pursuit of multiple goals means that no one goal can be maximized; there must be major trade-offs. But, in complex systems such as economies, societies and ecosystems, we are still so far from a theoretical perfect optimum that there may be significant potential to find solutions that can deliver multiple goals through ‘no major- trade-offs’ and ‘win–win outcomes’. To deliver such outcomes does require a major commitment to foster innovation and to increase greatly the capability of long term thinking and the handling of complex issues. Take for instance the award-winning, AU\$3 billion project to tackle salinity in south-western Western Australia. The company, Woodside Petroleum, is the partner for this biomass/activated charcoal/eucalyptus oil project, which will involve the planting of millions of Mallee eucalyptus trees to lower the water table and thus mitigate the effects of salinity in Western Australia.<sup>117</sup> The activated charcoal from plantations will take the pressure off native forests that are presently being used for activated charcoal all over the world, as it is in high demand as a reductant in mineral refining. Finally, it will also act as a carbon sink whilst creating new jobs. This thesis will show, through such case studies, that genuine win–win–win opportunities exist.

To capture both the sustaining and changing aspects of Sustainable Development it can be defined as follows: *progress that genuinely sustains and improves economic, social and environmental well-being with no major trade offs, locally and globally, now and in the future.* This definition captures the ideas in the well being and sustainability literature, the local and global dimensions of the sustainable development challenge and the need to achieve no major trade offs between economic, social and environmental goals and outcomes. But still such a definition is quite abstract for many

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<sup>115</sup> An address to The International Society of Ecological Economists by the former Federal Minister for the Environment and Heritage Senator the Hon Robert Hill Australian National University Canberra July 6, 2000

<sup>116</sup> Achieving the Triple-Bottom Line: An address by the Federal Minister for the Environment and Heritage Senator the Hon Robert Hill to the John Stuart Mill Society Adelaide June 13, 2000 ([www.deh.gov.au/minister/env/2000/sp13jun00.html](http://www.deh.gov.au/minister/env/2000/sp13jun00.html))

<sup>117</sup> Barton, A (1999) *The Oil Mallee Project: A Multifaceted Industrial Ecology Case Study*. Journal of Industrial Ecology. Spring/Summer 1999, Vol. 3, No. 2-3, Pages 161-176 Posted Online March 13, 2006. Available at <http://www.mitpressjournals.org/doi/pdf/10.1162/108819899569467> Accessed 8.01.08

people. What does it mean in practise for a society to seek to achieve sustainable development? What does it mean for a society to aspire to becoming a sustainable society?

#### 1.2.4 A Charter for Sustainable Development: The Earth Charter

One of the most significant attempts to work out both what people value and then what does it mean to aspire to creating a sustainable society has been the process to develop the Earth Charter which is printed in full in Appendix 1.2. The Earth Charter is a significant document in that it synthesizes both what we value as humanity and also outlines a list of things to do to ensure that what we value is sustained. It was the World Commission on Environment and Development (WCED) chaired by Gro Harlem Brundtland that issued the proposal leading to the early efforts to create an Earth Charter. In *Our Common Future*, the WCED called for creation of "a universal declaration" in the form of "a new charter" that would "consolidate and extend relevant legal principles" creating "new norms . . . needed to maintain livelihoods and life on our shared planet" and "to guide state behaviour in the transition to sustainable development."<sup>118</sup>

The United Nations Conference on Environment and Development (UNCED), the Earth Summit held in Rio de Janeiro in 1992, took up the challenge of drafting the Earth Charter. A number of governments submitted recommendations. Many non-governmental organizations, including groups representing the major religious faiths, became actively involved. However, the time was not right. An NGO Earth Charter was drafted at Rio, but efforts to create a UN Earth Charter were abandoned. Agreement was reached on the Rio Declaration, which is a valuable document, but it does not contain the ethical vision required for an Earth Charter.

A new Earth Charter Initiative was launched in 1994 with the final draft launched in 2000.<sup>119</sup> The Earth Charter Initiative is part of the worldwide global ethics movement which seeks to identify common goals and shared values that transcend cultural, religious, and national boundaries. Its development has been influenced by the growing literature on global ethics. During the last three decades of the twentieth century, the practice of cross-cultural and inter-religious dialogue has spread widely, and there is a growing awareness that peoples from diverse traditions share belief in many fundamental values. The "Declaration toward a Global Ethic" issued by the *Parliament of the World's Religions* in 1993 is a very good example. In addition, the increasing consciousness of global interdependence and the identification of common problems has intensified the search for and articulation of shared ethical principles. The Earth Charter consultation has promoted the worldwide dialogue on global ethics, and the ethical vision in the Earth Charter is a contribution to the search for a global ethic. The Earth Charter outlines clearly what socially and environmentally we need to do to achieve sustainable development.

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<sup>118</sup> World Commission on Environment and Development (WCED). (1987) *Our Common Future*. Oxford University Press,

<sup>119</sup> See *Earth Charter A Brief History* at [http://www.earthcharterusa.org/ec\\_history.htm](http://www.earthcharterusa.org/ec_history.htm) Accessed 8.01.08

### 1.2.6 Reaction to the Earth Charter

The Earth Charter has been publicly endorsed, recognized, or supported by people and organizations across a wide range of the political spectrum, from conservative to liberal, as well as from all major religious traditions. It has received support from business corporations, grassroots activists, universities, governments, professional bodies and global non-governmental organizations. Overall, reaction to the document can be characterized as overwhelmingly positive.

However, the Charter has also received significant opposition from some groups and governments. In the United States and a few other countries, members of the Religious Right have objected to the document on grounds that it is secular, espouses socialism, and contains no reference to the doctrines of Judeo-Christianity. Some argue that the Earth Charter is part of a conspiracy to supplant traditional religions with a modern form of paganism and cite an informal comment by Mikhail Gorbachev, a member of the governing body in charge of the Earth Charter process, that the document is "a kind of Ten Commandments", and point to the fact that at the 2002 World Summit on Sustainable Development in Johannesburg, South Africa, a copy of the document was placed symbolically in an "Ark of Hope".<sup>120</sup> Some members of the American Religious Right infer from these incidents that the Charter is a proposed replacement for the Ten Commandments, and part of a conspiracy to establish a New World Government that replaces individual "national sovereignty" and get pagan teachings into schools by stealth.<sup>121</sup> Yet the Charter itself makes no statements to support these claims of intent to supplant any of the world's religions or to create a world government. The Charter is simply a statement of common ethical values. It recognises humanity's shared responsibility to the Earth and to each other.

Right wing think tanks have sought to try to stir the more orthodox and traditional churches into action against the Earth Charter. For instance, the Centre for Independent Studies produced a critique of the idea of there being an intrinsic right of all living things to exist in the early '90s. It was very critical of this approach, saying it was 'dangerously New Age'. The Centre for Independent Studies in the 1990s was trying to panic the churches to make sure they do not support principles which underpin the Earth Charter and the call for sustainable development.<sup>122</sup>

Overall these dissenters are relatively few in number. Overall, few disagree with the goals and principles of the Earth Charter but it is important to note that the Earth Charter does not address the scale and speed issues of how fast these goals and principles need to be achieved. Businesses and

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<sup>120</sup> See Ark of Hope at <http://www.arkofhope.org/> Accessed 29 June 2008

<sup>121</sup> Jasper, W. (2003) *The global school board: by rejoining UNESCO, the U.S. /government is aiding the UN's grab for power and boosting the Earth Charter crusade to paganize our children*. New American. Available at [http://findarticles.com/p/articles/mi\\_m0JZS/is\\_10\\_19/ai\\_n25067806/pg\\_1?tag=artBody:col1](http://findarticles.com/p/articles/mi_m0JZS/is_10_19/ai_n25067806/pg_1?tag=artBody:col1)

<sup>122</sup> See The Earth Charter in Australia Available at [http://www.earthcharter.org.au/\\_data/page/11026/EC\\_conf1999.pdf](http://www.earthcharter.org.au/_data/page/11026/EC_conf1999.pdf) Accessed 29 June 2008.

governments recognise the need to developing targets to achieve certain goals by certain dates to achieve sustainable development.

### 1.2.7 Defining Social, Economic and Environmental Sustainability

In this sub section, what follows is a list of, to date, the toughest targets recommended thus far by scientists of what is required to achieve ecological and social sustainability. These targets are often hotly debated. But in listing the toughest targets and discussing efforts in the world to achieve these tough targets the thesis cannot be accused of underestimating the scale and speed of the task. I have attempted to do this below with the following lists that I have developed of social, environmental and economic goals befitting a society aspiring to become simultaneously socially, environmentally and economically sustainable. It is very important to emphasize that achieving a sustainable society is not simply achieving targets to ensure ecological sustainability. Ecological sustainability cannot be done at the expense of social sustainability. As societies strive to achieve ecological sustainability it must not be done in a way that punishes or hurts segments of the community. This can cause deep alienation and lead to a backlash. Rather an economic growth that is socially and environmentally sustainable needs to arise out of the aspirations of citizens, communities, organizations, corporations and institutions working together. This social, human dimension is emerging as the key to whether societies achieve ecological sustainability or not. In reality these two dimensions are intimately related but for clarity I will consider the environmental dimension of sustainability first followed by the social and economic dimensions of sustainability. A sustainable society is *socially sustainable*, if at the very least it:

- Eradicates poverty and homelessness as an ethical, social, and environmental imperative. The nations of the world have committed to the UN Millennium Development Goals which seeks to halve world poverty by 2015. (Chapter 6, Subsection 6.1.1)
- Stabilises global population to assist both poverty reduction and the achievement of environmental sustainability. (Chapter 6, Subsection 6.1.3)
- Ensure universal access to education (Chapter 6, Subsection 6.1.4)
- Ensure universal access to health care (Chapter 6, Subsection 6.1.5)
- Invests in ecologically forms of sustainable development that both reduce poverty and achieve environmental sustainability. (Chapter 6, Subsection 6.1.6)
- Guarantees the right to potable water and safe sanitation. (Chapter 6, Subsection 6.1.6)
- Eliminates corruption in all public and private institutions (Chapter 6, Subsection 6.1.10)
- Promotes the equitable distribution of wealth within nations and among nations. (Chapter 6, Subsection 6.2.1)

- Is built on the principles of social justice and equal opportunity where equal opportunity ensures equal access to high levels of education, information, employment and health care. (Chapter 6.2.3)
- Seeks to achieve as close to full employment as possible. (Chapter 6, Subsection 6.2.4)
- Ensures basic labour standards and rights. (Chapter 6, Subsection 6.2.5)
- Ensures gender equality and equal opportunity for woman (Chapter 6, Subsection 6.2.7)
- Gives expression to human potential through creativity and innovation. (Chapter 6, Subsection 6.2.8)
- Encourages tolerance and cultural diversity (Chapter 6, Subsection 6.2.10)
- Is strengthened by democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision-making, and access to justice. (Chapter 6, Subsection 6.3)
- Promote a Culture of Tolerance, Non-violence, and Peace Chapter 6, Subsection 6.3.2)

Many of these social sustainability goals are discussed in detail in Chapter 6 of this thesis. Such a strong social sustainability foundation would greatly assist societies to achieve ecological sustainability. But in practise what does the process of achieving ecological sustainability look like? To achieve, for instance, the ecological sustainability goals of the Earth Charter such as ensuring the right of all living things to live (ensure no more species extinction) what needs to be done? The following is a list of key stretch goals which would need to be achieved to achieve *ecological sustainability*. Some of these goals may seem excessive but ecological sustainability is based on the precautionary principle.<sup>123</sup> The precautionary principle states where there are likely threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. Whilst ambitious, the following targets surely are necessary if humanity is to ensure it avoids irreversible adverse effects and lives within the ecological limits of the planet forever:

- A Factor 4-10 dematerialisation (for developed countries), and then maintenance of a capped quantity of materials and energy for all purposes.<sup>124</sup> The Netherlands, Sweden, and Austria governments have all committed to achieving Factor 4. (Chapter 5, Subsections 5.3.4-5.3.5)
- Achieve a natural stabilisation of global population through ending extreme poverty and reducing infant mortality rates in the 3<sup>rd</sup> world. (Chapter 6)

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<sup>123</sup> UN (1992) *Rio Declaration on Environment and Development*. UN Available At [www.unep.org/Documents/multilingual/Default.asp?DocumentID=78&ArticleID=1163](http://www.unep.org/Documents/multilingual/Default.asp?DocumentID=78&ArticleID=1163) Accessed 8.01.08

<sup>124</sup> Weaver, P., Jansen, L., Van Grootveld, G., Van Spiegel, E., and Vergragt, P. (2000) *Sustainable Technology Development*, Sheffield, UK: Greenleaf Publishing. ([www.greenleaf-publishing.com/catalogue/std.htm](http://www.greenleaf-publishing.com/catalogue/std.htm))

- Decouple economic growth from greenhouse gas emissions on a scale and speed fast enough to avoid dangerous climate change. Numerous organisations and businesses are now adopting goals of achieving climate neutrality as quickly as possible. UNEP has created a global climate neutral network which includes four nations which have committed to becoming climate neutral: New Zealand, Norway, Costa Rica and Iceland.<sup>125</sup> (Chapter 7)
- Nations to reduce oil dependence as soon as possible.<sup>126</sup> Sweden and Iceland have committed to transform their economies to become free of needing any oil imports. Sweden has committed to be independent of oil imports by 2020. (Chapter 7, Subsection 7.3.5)
- Renewable resources be used efficiently and their use not be permitted to exceed their long-term rates of natural regeneration. Harvesting rates in industries such as forestry and fisheries must not exceed ecologically maximum sustainable yield. (Chapter 3, Subsection 3.1 and Chapter 8, Subsections 8.1.6 and 8.1.8-8.1.10)
- Major restoration of habitat for threatened species. Protecting the world's biodiversity hotspots<sup>127</sup> as soon as possible. Most OECD countries have biodiversity hotspot programs. These existing programs need to be expanded. (Chapter 8, Subsection 8.1.8 – 8.1.10)
- Ensure ecologically sustainable management the remaining forests of the world. China, New Zealand, the Philippines, Sri Lanka, Thailand, and Vietnam all have total or partial bans on deforestation.<sup>128</sup> (Chapter 8, Subsection 8.1.8-8.1.10)
- Ensure rangeland protection and restoration. (Chapter 8, Subsection 8.1.10)
- Restore soil fertility and improve global soil conservation practices as an ethical, economic, food security and climate change imperative. (Chapter 8, Subsection 8.1.8-8.1.10)
- Restore oceanic fisheries through establishing of a worldwide network of marine reserves, which would cover roughly 30 percent of the ocean. (Chapter 8, Subsections 8.1.6)
- Wilderness corridors need to be restored to allow species to migrate north or south during climate change over the coming centuries. (Chapter 8, Subsection 8.1.8-8.1.10)
- Reduce air pollution levels below that recommended by the World Health Organisation (Chapter 8, Subsection 8.2)
- Reduce freshwater extraction below rates that ensure renewable use of water for future generations. (Chapter 8, Subsection 8.3)

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<sup>125</sup> See UNEP Climate Neutral Network at [http://www.climateneutral.unep.org/cnn\\_frontpage.aspx?m=49](http://www.climateneutral.unep.org/cnn_frontpage.aspx?m=49)

<sup>126</sup> Lovins, A., Datta., EK et al. (2004) *Winning the Oil endgame: Innovation for Profits, Jobs, and Security*, Rocky Mountain Institute, Colorado/Earthscan, London. Freely downloadable from <[www.oilendgame.org](http://www.oilendgame.org)>.

<sup>127</sup> Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent. (2000) *Biodiversity hotspots for conservation priorities*. Nature 403:853-858.

<sup>128</sup> Durst, P. et al., (2001) *Forests Out of Bounds: Impacts and Effectiveness of Logging Bans in Natural Forests in Asia-Pacific*. FAO, Asia-Pacific Forestry Commission, Bangkok.

- Shifting linear material flows to a closed-loop economy (encourage recycling) to get as close as thermodynamically and economically possible to zero waste. Japan has committed to becoming a closed loop recycling society. Numerous governments have committed to zero waste targets. The Australian Capital Territory government in Australia has committed to zero waste by 2010. (Chapter 8, Subsection 8.4)
- Facilitate and encourage good product stewardship which involves responsible product design, use, re-use, recycling and disposal. The EU has embraced product stewardship for many products. (Chapter 8, Subsection 8.4)
- Adopt national sustainable consumption programs in line with recommendations from the 2002 UNEP Sustainable Consumption and Production report.<sup>129</sup> Recommendations from this report have been adopted by a number of EU countries. (Chapter 8, Subsection 8.4)

Chapters 7 and 8 consider these goals and targets in more detail and how they correlate with economic growth and prosperity. This is because a sustainable society's economic goals are also equally important. It is vital that a society achieves the social and environmental goals without damaging the economy but rather strengthening it. Hence to achieve economic goals governments should seek to develop and implement a robust fiscal framework and effective economic policy to help ensure the achievement over time of

- Decoupling economic growth from environmental pressures absolutely without significantly harming economic growth rates or the competitiveness of business.<sup>130</sup> (Chapter 5 and Chapter 4 respectively)
- Achieving “green” growth through encouraging investment in eco-efficiency initiatives and still more substantive transformations to sustainability whilst reducing negative rebound effects. (Chapter 5, Subsection 5.3.7)
- Ensuring non-declining inclusive wealth and well being for future generations but ideally aim to ensure greater choice and opportunity for future generations to achieve higher well being.<sup>131</sup> (Chapter 5, Subsections 5.5 and 5.6)
- Creating meaningful employment. (Chapter 6, Subsection 6.2.4.1)
- Providing information. Adam Smith's ‘Invisible hand’ works only under certain criteria that include the markets having perfect information. But who has perfect information? One of the

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<sup>129</sup> UNEP (2002) *Sustainable Consumption: Global Status Report 2002*, UNEP, Paris (report written by Professor Chris Ryan, RMIT University, Melbourne, Australia, and the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden)

<sup>130</sup> OECD Secretariat. (2002) *Indicators to Measure the Decoupling of Environmental Pressure from Economic Growth*, OECD. Paris

<sup>131</sup> Arrow, K., Dasgupta, P., Goulder, L., Daily, G., Ehrlich, P., Heal, G., Levin, S., Maler, K.G., Schneider, S., Starrett, D., Walker, B., (2004) *Are We Consuming Too Much?* Journal of Economic Perspectives, Volume 18, 3, pp 147-172

key roles of government is to supply relevant information to help markets more efficiently allocate resources.

- Facilitating and encouraging innovation for sustainability through investing in research, development & demonstration (RD&D).
- Internalising externalities with minimal harm to business's competitiveness through eco-taxes, feebates, levies, market based instruments, ie: tradeable permits and caps and other creative market signals.<sup>132</sup> (Chapter 4, Subsection 4.2)
- Taxing social and environmental 'bads', whilst providing effective non-inflationary incentives to social and environmental 'goods'.<sup>133</sup> (Chapter 6, Subsection 6.2.4.1)
- Reduce and remove perverse subsidies.<sup>134</sup>
- Measure what matters. It is vital that decision makers have feedback on the effectiveness or otherwise of their decisions to help them make better decisions in the future. (Chapter 5, Subsections 5.5 and 5.6)
- Maintain the GDP measure but also phase in additional measurements of national well being and progress. (Chapter 5, Subsections 5.5 and 5.6)

The Earth Charter plus the above list of targets would be seen by most as an ambitious list of things to do by even the most radical NGO. Whilst any one of these goals can be achieved many would doubt that all these goals and targets could be achieved simultaneously by a nation. If any nation achieved all the above goals and targets it would be historic. Yet the above list, is created by combining targets either recommended by respected scientists or already committed to be leading governments.

### **1.3 Exploring the Ecological Modernisation Discourse - Is it Possible to “Have It All”?**

It is still contested whether or not sustainable development with no major trade offs can be achieved. For instance, 1987 Brundtland Commission report *Our Common Future* claimed that it was economically and technologically feasible for the world economy to grow fast enough to reduce poverty without increasing environmental damage. But, in the Brundtland Commission report this was asserted rather than demonstrated.<sup>135</sup> *Our Common Future* was heavily criticised for this. In

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<sup>132</sup> Hargroves, K., Smith, M. (eds) (2005) 'The Natural Advantage of Nations', Earthscan/ James&James Publishing, London: Available At: [www.thenaturaladvantage.info](http://www.thenaturaladvantage.info) Accessed 8.01.08

<sup>133</sup> von Weizsäcker, E. and Jessinghaus, J. (1992) *Ecological Tax Reform: A Policy Proposal for Sustainable Development*, Zed Books, London

<sup>134</sup> Myers, N., Kent, J. (2001) *Perverse Subsidies: How Misused Tax Dollars Harm the Environment and the Economy*. Island Press. New York.

<sup>135</sup> Common, M. Stagl, S. (2005) *Ecological Economics: An Introduction*. Cambridge University Press. Cambridge

1994, Dunchin and Lange<sup>136</sup> did undertake such modelling. They modelled whether or not it was possible to reconcile the required economic growth to dramatically reduce poverty without increasing environmental damage. Their modelling showed that it was not. This thesis argues that Dunchin and Lange's assessments of what was economically and technically possible were too pessimistic. Twenty years on from the publication of *Our Common Future* this key assumption of *Our Common Future* and the field of ecological modernisation is still contested. Similarly *Our Common Future* argued that was not a significant trade off between jobs and the environment. Yet this claim was backed up by very few studies, and as the world recession hit in the early 1990s, the media and the conservative right-wing side of politics challenged this claim that there was not a major trade off between environment and jobs. The vested interests often utilising and funding right wing think tanks ran a significant campaign in the early 1990s arguing that sustainable development would lead to significant loss of jobs, harm business competitiveness and the economy. Their campaign resonated with many in the early 1990s due to the global recession of the time. These weaknesses are listed here to demonstrate to what extent there is still a need now, twenty years after *Our Common Future* was first published to

- a) Begin to stock-take empirical studies from the last twenty years to examine whether or not it is possible to achieve sustainable development with no major trade offs.
- b) Begin to review empirical studies from the last 20 years which help to back up or disprove the central claims of *Our Common Future* regarding the compatibility of economic growth and environmental and social sustainability.

This is the central goal of this thesis. Twenty years on from *Our Common Future* is a good time to begin to review the empirical evidence to test the claim from *Our Common Future* regarding whether or not it is possible, as Brundtland stated to have “a new form of growth, one that is forceful but also environmentally and socially sustainable?” From the mid-1980s onwards, the changing nature of environmental policies and politics in a number of European and non-European countries has provided a better empirical foundation for the development of a more systematic analysis of this question.

This question also goes to the heart of ecological modernisation. As Dryzek stated “Much of its (ecological modernisation's) appeal lies in its promise that “we can have it all: economic growth, environmental conservation, social justice”<sup>137</sup>. This thesis examines in Chapters 5-8 whether we indeed can have it all as Dryzek described it. This thesis contends that new empirical studies assessing developments in institutional, policy, and technical change from the late 1980s onwards allows this central assertion of ecological modernisation to begin to be tested. Thus this thesis, by addressing one of the key contested assertions of *Our Common Future*, also addresses one of the central claims of

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<sup>136</sup> Dunchin, F., Lange, G.M (1994) *The future of the environment: Ecological Economics and Technological Change*. Oxford University Press. New York.

<sup>137</sup> Dryzek, J. (1997) *The Politics of the Earth: Environmental Discourses*. Oxford University Press. Oxford:

ecological modernisation as well. Hence this theses claim to be part of and building on the ecological modernisation tradition.

This thesis is a defence of and a contribution to the discourse of strong ecological modernisation. This thesis in Chapter 3 and Chapter 5 especially seeks to address the main criticisms of ecological modernisation. Critics of ecological modernisation argue either that

- a) Economic growth cannot be decoupled from physical growth and environmental pressures or
- b) If decoupling can be achieved, that it will be insufficient to achieve environmental sustainability on the scale or speed required or
- c) That negative rebound effects will undermine efforts to decouple economic growth from environmental pressures through eco-efficiency and resource productivity improvements.

Chapter 5 of this thesis addresses these criticisms. Critics of ecological modernisation also argue that even if sufficient decoupling can be technically achieved; vested interests and political realities will make it very hard for such changes to occur. Chapter 3 discusses the nature and challenge of vested interests and discusses strategies to address them. Chapters 4 to 9 develop these strategies.

Since this thesis is a defence of strong ecological modernisation theory, before proceeding further it is important to address the following:

- a) what is ecological modernisation and what are its common elements?
- b) the historical context within which ecological modernisation developed
- c) some of the key debates and advances in the four phases so far of ecological modernisation.
- d) What is strong ecological modernisation and how is it different from weak ecological modernisation?

### 1.3.1 What is Ecological Modernisation?

Whilst it is commonly acknowledged<sup>138</sup> that there is no single definition of the theory of ecological modernization, the majority of contributions in this discourse distinguish contemporary processes of environmental reform in new ways from its predecessors during the 1970s. The concept of ecological modernization originated in Germany in the early 1980s, within the context of an overall sense of failure of 1970s environmental policy (to effectively address the scale and urgency of the environmental crisis) and an NGO environmental movement of which a significant proportion was anti- growth, anti-technology, anti-modernisation, anti-business and largely reactive in its campaign strategies to any development project. The NGO environment movement of the time Mol argues “can

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<sup>138</sup> Mol, A. (1999) *Ecological Modernization and the Environmental Transition of Europe: Between National Variations and Common Denominators*. J. Environ. Policy Plann. 1: 167–181 (1999)

be labelled as largely embracing de-modernization or de-industrialization perspectives among their central ideology.”<sup>139</sup>

### 1.3.2 Evidence of Decoupling of Economic Growth from Environmental Pressures – 1970s and 1980s.

In the 1980s academics, working within the environmental and resource studies fields, began to see significant changes emerging in technological eco-innovations and the social practices and institutions that actually dealt with environmental problems. This started to change the discourse. From the debates about these changes the theory of ecological modernisation emerged. For example, some empirical studies showed that in the 1970s, with the OPEC oil crisis, a decoupling of economic growth and oil consumption was identified for the first time. In countries such as Germany, Japan, the Netherlands, the USA, Sweden and Denmark decoupling was found to be beginning across a number of environmental indicators, As Mol writes

“In a number of cases (countries and/or specific industrial sectors and/or specific environmental issues) it was actually claimed that an environmental reform resulted in an absolute decline of emissions and use of natural resources, regardless of growth in financial or material terms. However, although these sometimes controversial empirical studies lie behind the idea of ecological modernisation, they do not form the core. Central stage in ecological modernisation is given to the associated social practices and institutional transformations, which are often believed to be at the foundations of these physical changes. In the debate on the changing character of the social practices and institutions since the 1980s, adherents to the theory of ecological modernisation positioned themselves by claiming that these transformations in institutions and social practices could not be explained away as mere window-dressing or rhetoric, but should indeed be seen as structural transformations in industrial society’s institutional order, as far as these concerned the preservation of its sustenance base.”<sup>140</sup>

### 1.3.3 Common Elements of Ecological Modernisation – a response to new realities.

Ecological modernization therefore grew out of real changes both to social practices and institutional responses to the environmental crisis which existing environmental discourses had trouble explaining. Ecological modernisation (EM) was an attempt to acknowledge the new emerging reality that

- a) The severity of environmental problems and the loss of ecosystem resilience threatens the ability of many parts of the economy to be productive. EM recognises the economic and business costs of not undertaking environmental protection. EM also recognises the positive financial benefits of utilising resources more productively and innovating new “greener” products. EM thus is able to demonstrate that inaction on environmental protection will have

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<sup>139</sup> Ibid.

<sup>140</sup> Ibid.

significant economic costs. EM's innovation is thus developing a new framework that turns the environmental crisis into positive sum games so that greening business and greening the economy can provide better overall social, environmental and financial outcomes long term compared to inaction on environmental protection. EM theory explicitly describes environmental improvements as being economically feasible; indeed, entrepreneurial agents and economic/market dynamics are seen as playing leading roles in bringing about needed ecological changes.

- b) Decoupling between economic growth and environmental pressures is possible across many environmental indicators. Decoupling of economic growth from environmental pressures was starting to occur across a number of environmental indicators as early as the 1970s. This was a significant historical development. As Dr Jim MacNeil, inaugural head of the OECD Environment Directorate from 1977-1984 and Director of the UN Commission of Sustainable Development from 1984-1987 explained<sup>141</sup> that until the 1970s economic growth and environmental pollution had been strongly coupled. Hence Dr MacNeil said that all economists and environmentalists until the 1970s had assumed that significant decoupling was not possible. The potential for decoupling offered a new way to reconcile economic growth with environmental sustainability. The OECD Environment Directorate was the first to explore this opportunity and published a major report on it as early as 1984.<sup>142</sup>
- c) Whilst technology and design choices had contributed to, and in many cases directly caused, environmental and health problems it was understood that technology could be harnessed to help prevent and stop pollution, recycle materials, manufacture renewable energy technologies and make more eco-efficient lighting, appliances, and industrial equipment. One of the most important contributions of ecological modernisation has been the reframing of the role of technology in the social-environment relationship. As Fisher and Freudenburg comment "Before ecological modernisation theory, most of the established theories of environment–society relationships, tended to view technological development and economic growth as being antithetical to environmental preservation<sup>143</sup>...Unlike theorists who see technological

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<sup>141</sup> Private Communication, 5, April, 2006.

<sup>142</sup> OECD (1984) *The Impact of Environmental Measures on the Rate of Economic Growth, Rate of Inflation, Productivity and International Trade*, Background Papers Prepared for the International Conference on Environment and Economics, vol. 1, Paris.

<sup>143</sup> Dunlap, R. E., and K. D. Van Liere. (1978) *The "new environmental paradigm."* J. Environ. Educ. 9(Summer):10–19.

Foster, J. B. (1992). *The absolute general law of environmental degradation under capitalism*. Capitalism Nature Socialism 2(3):77–82.

O'Connor, J. (1991) *On the two contradictions of capitalism*. Capitalism Nature Socialism 2(3 October): 107–109.

O'Connor, J. (1994) *Is sustainable capitalism possible? In Is capitalism sustainable*, ed. J. O'Connor, 152–175. New York: Guilford Press.

Schnaiberg, A. (1980) *The environment: From surplus to scarcity*. New York: Oxford University Press.

Schnaiberg, A., and K. Gould. (1994) *Environment and society: The enduring conflict*. New York: St. Martin's Press.

development as being generally problematic<sup>144</sup>—pointing to a potential need to stop capitalism and/or the process of industrialization to deal with ecological crises -- ecological modernisation argues that environmental problems can best be solved through further advancement of technology and industrialization.”<sup>145</sup> The ability of the private sector to innovate rapidly alternatives to pollutants such as sulphur dioxide and ozone depleting CFCs and the multi-lateral ratification of the Sulphur and Montreal Protocols respectively were seen as models of rapid ecological modernisation in the 1980s and 1990s.

- d) The net harm to jobs growth from environmental protection was minimal and with wise policy settings jobs growth could be enhanced. By 1984, already it was recognised that measures to protect the environment, rather than harming jobs growth could stimulate it. In 1984, the OECD Environment Directorate<sup>146</sup> published the first major study on this topic arguing this.
- e) Whilst economic and government policy and incentives to date were seen as a key driver for unsustainable development they were also recognised as a potential key driver for a transition to sustainable development.<sup>147</sup> It was recognised that to achieve the shift to sustainability fast enough, the capacity of business and the market to innovate rapidly would be crucial. It was recognised that economic and government policies provided many useful tools to help design more effective market based price signals and incentives (eco-taxes, cap and trade emissions trading markets, replacing perverse subsidies with subsidies that enhanced sustainability outcomes) to drive and reward eco-innovations in the market place enabling a transition to sustainable development.<sup>148</sup>
- f) Given the failure in government environmental policy in the 1970s it was recognised that the central agencies of government, and not simply the Environmental Protection Agencies (EPAs), were needed to take a whole of government approach to sustainable development. As *Our Common Future* stated,

“Governments, pressured by their citizens, saw the need to clean up the (environmental) mess....and established agencies (EPAs) to do this...but much of their work has.. been after-the-fact repair of the damage. The mandates of the central economic and sectoral ministries are also often too narrow, too concerned with quantities of production or growth. The present challenge is to

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<sup>144</sup> Ibid.

<sup>145</sup> Spaargaren, G., and A. P. J. Mol. (1992) *Sociology, environment, and modernity: Ecological modernization as a theory of social change*. Society Nat. Resources 5:323–344.

<sup>146</sup> OECD (1984) ‘*The Impact of Environmental Measures on the Rate of Economic Growth, Rate of Inflation, Productivity and International Trade*’, Background Papers Prepared for the International Conference on Environment and Economics, vol. 1, Paris

<sup>147</sup> OECD (1991) *Guidelines for the Application of Economic Instruments in Environmental Policy*. Background Paper No. 1. Environment Committee Meeting at Ministerial Level. Paris.

Pearce, D. (1991) *The role of carbon taxes in adjusting to global warming*. Economic Journal.v.101(407), pp. 938-48.

Repetto, R, R C Dower, R Jenkins, and J Geoghegan. (1992) *Green Fees: How a Tax Shift Can Work for the Environment and the Economy*. Washington, DC: World Resources Institute.

<sup>148</sup> Ibid.

give the central economic and sectoral ministries the responsibility for the quality of those parts of the...environment affected by their decisions, and to give the environmental agencies more power to cope with the effects of unsustainable development.”<sup>149</sup>

- g) The reality that the environmental performance of governments correlates with increasing activism among economic actors, active nongovernmental organizations and a scientifically literate population. The reality that the potential for improved ecological outcomes is dependent on changes in the institutional structure of society.<sup>150</sup> This point is re-enforced by recent studies that establish the linkage between ecological modernization and political modernization.<sup>151</sup>
- h) Given the sense of inadequacy to date of government environmental regulation and policy, it was recognised that new models of regulatory approaches were needed such as independent 3<sup>rd</sup> party certification of products.
- i) Given the scale and speed of change needed to address the global environmental crisis, it was recognised that it was vital that as many stakeholders are involved in the process as possible. The greater the scale of change required in a society the more important it is for all the key stakeholders of that society to be engaged meaningfully in that change process. As Fisher and Freudenberg wrote, “Ecological modernization depicts political actors as building new and different coalitions to make environmental protection politically feasible.”<sup>152</sup>

Thus, Ecological Modernisation in the 1980s and 1990s was a new environmental discourse, a new middle way, recommending a shift in the environmental strategies of the 1970s whilst at the same time seeking to provide a new rigorous and inclusive framework for the many crucial actors – business (including key actors such as entrepreneurs, CEOs, accountants, engineers), government, R&D institutions and also the NGO environmental movement - without abandoning the key message of the need for urgent and radical action to avert environmental catastrophe.

There has been considerable diversity and internal debate among the contributors to the ecological modernization theory. Without giving an extensive analysis and overview of the ecological

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<sup>149</sup> Brundtland Commission (1987) *Our Common Future*. UN Brundtland Commission. Oxford University Press. p10

<sup>150</sup> Mol, A. P. J. (2000) *The environmental movement in an era of ecological modernization*. *GeoForum* 31:45–56.

<sup>151</sup> Janicke, M., (1993) *Uberokologische und politische Modernisierungen*. *Zeitschrift fur Umweltpolitik und Umweltrecht* 2, 159±175.

Leroy, P., and J. van Tatenhove. (2000) *Political modernization theory and environmental politics*. In *Environment and global modernity*, eds. G. Spaargaren, A. P. J. Mol, and F. H. Buttel, 187–208. London: Sage Studies in International Sociology.

Mol, A. P. J. (2000) *Globalization and environment: Between apocalypse-blindness and ecological modernization*. In *Environment and global modernity*, eds. G. Spaargaren, A. P. J. Mol, and F. H. Buttel, 121–150. London: Sage Studies in International Sociology.

Spaargaren, G. (1997) *The ecological modernization of production and consumption: Essays in environmental sociology*. Wageningen, the Netherlands: Wageningen University.

<sup>152</sup> Fisher, D. Freudenburg, W. (2001) *Ecological Modernization and Its Critics: Assessing the Past and Looking Toward the Future*. *Society and Natural Resources*, 14:701–709, 2001

modernization literature up to the present, I believe that it makes sense to distinguish at least four stages in the development and maturation of ecological modernization theory. This overview of the development of ecological modernization theory in four phases is important to show that ideas of ecological modernization have developed in the course of constant debate and with critical evaluations involving those within and without this school of thought. The overview reveals that ecological modernization theory is still developing. This overview concludes by emphasizing that, whilst there is ongoing disagreement with proponents of ecological modernisation and its critics, there is an emerging consensus, on what conditions, best enable ecological modernisation to flourish.

## 1.4 Four Phases of Ecological Modernisation

### 1.4.1 The First Stage of Ecological Modernisation Theory

Mol characterises Ecological Modernisation in its early stage “As a normative claim of a desired environmental reform path, failing to identify widespread empirical references of such processes in the societies of West Europe.”<sup>153</sup> The Brundtland Commission’s *Our Common Future* is a good example of an ecological modernisation publication which, as discussed above at times, made significant assertions of a desired environmental reform path without always being able to provide adequate empirical data, comprehensive modelling or detailed policy description to back it up. As discussed previously, the 1987 Brundtland Commission report *Our Common Future* claimed that it was economically and technologically feasible for the world economy to grow fast enough to reduce poverty without increasing environmental damage. But, in the Brundtland Commission report this was asserted rather than demonstrated.<sup>154</sup> Twenty years on from the publication of *Our Common Future* this key assumption of *Our Common Future* and the field of ecological modernisation is still contested. Other major weaknesses of *Our Common Future* included the fact that it provided no detailed policy prescription and it ignored the role of vested interests blocking efforts to achieve sustainable development. These weaknesses of *Our Common Future* mirror the weaknesses of the ecological modernisation discourse of this first phase.

Another important characteristic of early ecological modernisation was a heavy emphasis on the role of technological innovation in bringing about environmental reform, especially by Huber<sup>155</sup>. Mol describes Huber’s writing in the mid- 1980s as being

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<sup>153</sup> Ibid.

<sup>154</sup> Common, M. Stagl, S. (2005) *Ecological Economics: An Introduction*. Cambridge University Press. Cambridge.

<sup>155</sup> Huber, J. (1982) *Die verlorene Unschuld der Ökologie*. Neue Technologien und Superindustrielle Entwicklung. Frankfurt am Main: Fisher Verlag.

Huber, J. (1985) *Die Regenbogengesellschaft*. Ökologie und Sozialpolitik, Frankfurt am Main: Fisher Verlag.

Huber, J. (1991) *Unternehmen Umwelt*. Weichenstellungen für eine Ökologische Marktwirtschaft. Frankfurt am Main: Fisher Verlag.

“characterized by a heavy emphasis on the role of technological innovations in bringing about environmental reforms, especially in the sphere of industrial production; a rather critical attitude towards the (bureaucratic and inefficient) state, also shared by the early writings of Janicke<sup>156</sup>, a very favourable—if not naive—attitude towards market actors and market dynamics in environmental reforms (later glorified by neo-liberal scholars); a system theory perspective with a relatively underdeveloped notion of human agency and social struggles; and an orientation to the nation state level. Some of the more critical remarks on ecological modernization theory still refer to these initial contributions.”

Critics today of ecological modernisation still criticise the heavy emphasis on technological innovation. Murphy & Bendell<sup>157</sup>, as recently as 1997 summarized ecological modernization (eco-modernism is the term they use for it) as:

“the perspective that treats the environment as another technological problem to be overcome in the pursuit of progress. To the eco-modernist, pollution is an economic opportunity for prevention and clean-up technologies and certainly not an indication of fundamental problems with the current economic system.”

This summary and its implicit criticism identifies some of the shortcomings in the earlier development of ecological modernization theory. More recent writings have addressed those shortcomings more or less adequately.<sup>158</sup>

Despite these writings, however, it is fair to criticise writings of ecological modernisation today for still presenting a narrow conception of the scale, speed and type of technological innovations needed to achieve adequate decoupling of economic growth from environmental sustainability. For instance, respected environmental economist Dr Paul Ekins simply recommended the tool of eco-efficiency as the main technological tool to achieve decoupling of economic growth and environmental sustainability in the main theme papers for the UN Asia Pacific Green Growth program launched in 2006. This thesis argues that, whilst eco-efficiencies and tools like cleaner production are a good start, they are just that, a start. To achieve sustainability requires a much greater shift to truly eco-modernise production and consumption systems to sustainability and ensure that new unforeseen problems do not arise.

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<sup>156</sup> Janicke, M. (1986) *Staatsversagen. Die Ohnmacht der Politik in die Industriegesellschaft*. Munchen: Piper.

<sup>157</sup> Murphy, D.F., Bendell, J., (1997) In: *The Company of Partners. Business, Environmental Groups and Sustainable Development Post-Rio*. The Policy Press, Bristol.

<sup>158</sup> Spaargaren, G. and Mol, A.P.J. (1992) *Sociology, environment and modernity. Ecological modernisation as a theory of social change*. *Society and Natural Resources*, 5: 323–344.

Hajer, M.A. (1995) *The Politics of Environmental Discourse. Ecological Modernisation and the Policy Process*. Oxford: Oxford University Press.

Rinkevicius, L. (1998) *Ecological Modernization and its Perspectives in Lithuania : Attitudes, Expectations, Actions*. Dissertation in Sociology, Kaunas University of Technology, Kaunas.

Technologies have caused significant environmental harm in the past because they often have unexpected side effects or second order consequences that were not originally understood by the designers of the technology. Another key reason why technologies in the past have so often created problems is that their environmental effects have been a secondary consideration. For instance, the reason plastics do not degrade in the environment is because they are designed to be persistent; similarly fertilisers were designed to add nitrogen to soil so it is not an accident that they also add nitrogen to waterways as well as leading to algae blooms. Part of the problem Commoner argued in his book, *The Closing Circle*<sup>159</sup> was that designers make their aims too narrow: historically they have seldom aimed to protect the environment. He argued that technology can be successful in the ecosystem, ‘if its aims are directed toward the system as a whole rather than some apparently accessible part.’

Sewerage technology is an example which illustrates this point. In 1972 Commoner argued that engineers designed their technology to overcome a specific problem: when raw sewerage was dumped into rivers it consumed too much of the rivers oxygen supply as it decomposed. Modern secondary sewerage treatment plants are designed to reduce the oxygen demand of the sewerage. However, the treated sewerage still contains nutrients which help algae to bloom, and when the algae die they also deplete the river of oxygen. Instead of this piecemeal solution,

Commoner argued that engineers should look at the natural cycle and reincorporate the sewerage into that cycle by returning it to the soil rather than putting it into the nearest waterway. Commoner advocated a new type of technology, that is designing with the full knowledge of ecology and the desire to fit in with natural systems. This requires tools, in addition to eco-efficiency, such as Whole System Approaches to Sustainable Design (often called simple Design for Environment or Design for Sustainability), Biomimetic Design, and Green Chemistry Design combined with a detailed knowledge of natural systems to enable a rapid leapfrog to benign by design industrial and built environment systems. On the policy side there is a wide range of initiatives needed such as Sustainable Technology Assessment. These will be discussed in detail in Chapter 7 of this thesis.

Another important criticism of ecological modernisation comes from Jevons Paradox, often known as rebound effects as outlined in 1980 by economists Daniel Khazzoom and Len Brookes.<sup>160</sup> Negative rebound effects from technology and eco-efficiencies are real and will be discussed in detail in this thesis. This thesis will argue that to address rebound effects a broad policy portfolio approach is needed of economic incentives, regulation, sustainable technology assessment and the creation of Sustainability or Future Funds.<sup>161</sup> This thesis will attempt to show that unless such policy measures to

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<sup>159</sup> Commoner, B. (1972) *The Closing Circle: Nature Man & Technology*, Bantam Books, Toronto.

<sup>160</sup> Khazzoom, J.D (1980) ‘*Economic Implications of Mandated Efficiency Standards for Household Appliances*’, *Energy Journal*, Vol. 1 pp21-39

<sup>161</sup> Foran, B. Crane, D (2007) *Powerful Choices: Options for Australia’s Transition to a Low-Carbon Economy*. (in Press)

dramatically reduce rebound effects are implemented much of the environmental gains of eco-innovation and eco-efficiencies will be undone over time. This thesis's discussion of rebound effects is covered mainly in Chapters 1,4,7 and 8 whilst Jevons Paradox is discussed briefly in Chapter 2 as part of a discussion of the history of the great sustainability debates. Thus this thesis, in these chapters, will address a number of the main criticisms of the first phase of ecological modernisation.

#### 1.4.2 The Second Stage of Ecological Modernisation

Building upon several of these limitations, ecological modernization studies in the second period, from the late 1980s to the mid 1990s, placed less emphasis on and had a less deterministic view regarding technological innovations as the key driver behind ecological modernization. In addition, these contributions gave evidence of a more balanced view on state and market dynamics in ecological transformation processes, through the work of Weale<sup>162</sup> and then later the work of Janicke<sup>163</sup>.

Another major criticism of ecological modernization in this second period was that it was too Eurocentric.<sup>164</sup> The emphasis remained on national or comparative studies of industrial production in Organization for Economic Co-operation and Development (OECD) countries.<sup>165</sup> Critics argued that the theories of ecological modernization had been developed primarily in and against the background of a small group of West European countries, most notably Germany, the Netherlands and the UK but at the same time sustainability is not something that can be achieved in just one country. International trade and the fact that pollution such as greenhouse gas emissions is truly global means that all countries need to be engaged in the process of sustainable development. Many of the economies of the world growing the fastest such as China by the mid 1990s were achieving very little decoupling of economic growth and environmental pressure. Research has shown that nations do appear to vary in the degree to which institutions and outcomes of ecological modernization are evident.<sup>166</sup>

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<sup>162</sup> Weale, A. (1992) *The New Politics of Pollution*. Manchester: Manchester University Press.

<sup>163</sup> Janicke, M. (1991) *The Political System's Capacity for Environmental Policy*. Berlin: Freie University

Janicke, M. (1993) *U8 berokologische und politieke modernisierungen*. Zeitschrift fur Umweltpolitik und Umweltrecht, 2: 159–175.

<sup>164</sup> Hannigan, J. (1995) *Environmental sociology: A social constructivist perspective*. London: Routledge.

<sup>165</sup> Weale, A. (1992) *The New Politics of Pollution*. Manchester: Manchester University Press.

Hajer, M.A. (1995) *The Politics of Environmental Discourse. Ecological Modernisation and the Policy Process*. Oxford: Oxford University Press.

<sup>166</sup> Frijns, J., P. T. Phuong, and A. P. J. Mol. (2000) *Ecological modernization theory and industrializing economies: The case of Viet Nam*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 257–291. Essex: Frank Cass.

Gille, Z. (2000) *Legacy of waste or wasted legacy? The end of industrial ecology in post-Socialist Hungary*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. P. J. Mol and D. A. Sonnenfeld, 203–234. Essex: Frank Cass.

Mol, A. P. J. (1999) *Ecological modernization and the environmental transformation of Europe: Between national variations and common denominators*. *J. Environ. Policy Plan.* 1:167–181.

During this phase, more attention is also paid to the institutional and cultural dynamics of ecological modernization, and the role of human agencies in environment-induced social transformations<sup>167</sup>. Thanks largely to the momentum built from *Our Common Future* and the Rio World Summit on Environment and Development new and significant international conventions were agreed upon in 1992, such as the Convention on Biological Diversity and the UN Framework Convention on Climate Change.

But probably the main and most serious criticism of EM in this period was, whilst decoupling was being achieved in a number of European OECD countries across many environmental indicators, the level of decoupling of economic growth and environmental pressures was woefully insufficient. Rebound effects (as discussed briefly above), the spread of western consumerism globally, and the failure to significantly decouple economic growth from greenhouse gas emissions have overwhelmed the gains, that have been made, from technological eco-innovation.

Hence critics focused on the neglect of some ecological modernisation writers of consumption and life-styles and rebound effects. Critics also focused on ecological modernisation's overly optimistic idea of environmental reforms in social practices, institutional developments. Ecological modernisation by the mid 1990s was criticised for not addressing realistically the level of sustainability policy, regulatory and institutional reform needed to achieve the required level of decoupling fast enough to achieve sustainable development. Critics argued that the "policy reforms" recommended by ecological modernisation to date were inadequate to create genuinely green businesses let alone green economies. Much of these criticisms were brought to the fore and addressed next in the third phase of ecological modernisation by scholars outside the ecological modernization tradition such as Christoff<sup>168</sup>, Blowers<sup>169</sup> and Dryzek<sup>170</sup>. We consider these important advances next in a discussion of the third phase and 4<sup>th</sup> phase of ecological modernisation and then we consider further how this thesis will address some of the main criticisms of ecological modernisation and in so doing advance some of the great sustainability debates.

### 1.4.3 Third Stage of Ecological Modernisation

The advances put forward in studies, papers and book publications of the third period, from the mid-1990s to the 2002 World Summit on Sustainable Development in Johannesburg are very significant and need to be understood to understand the context to which this thesis is a contribution. This period of ecological modernisation theory is very important in that EM contributors in this period

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<sup>167</sup> Cohen, M. (1999) *Ecological modernisation, environmental knowledge, and national character: a preliminary analysis of the Netherlands*. Environmental Politics, 9.

<sup>168</sup> Christoff, P. (1996) *Ecological modernisation, ecological modernities*. Environmental Politics, 5: 476– 500.

<sup>169</sup> Blowers, A. (1997) *Environmental policy: ecological modernisation and the risk society?* Urban Studies, 34: 845–871.

<sup>170</sup> Dryzek, J.S. (1997) *The Politics of the Earth : Environmental Discourses*. Oxford: Oxford University Press.

- lay a better conceptual foundation for ecological modernisation and address many of the major criticisms of the field.
- focus on developing and integrating technological and design innovations that achieve large and rapid resource productivity improvements (Factor 4 or better) to make it technically and economically possible for stronger and more rapid decoupling of economic growth and environmental to occur.
- develop new sustainable consumption and production frameworks within the EM philosophy and
- target the key actors through publications and the building of sector, professional and business forums and networks needed to create the social conditions to enable the achievement of EM.

Also this period sees ecological modernisation's central principles and strategies formally adopted by more and more mainstream institutions and organisations. This period also sees many nations develop Agenda 21 blueprints for their nation based on an ecological modernisation approach.

#### 1.4.4 Major Criticisms of EM Addressed: A Stronger Form of EM is Proposed

The first significant advance in this third phase of evolution in ecological modernisation comes from the work of Dr Peter Christoff. In 1996 Christoff<sup>171</sup> addressed the main criticism of what he called the "weak" form of ecological modernisation namely that it is only about marginal change and technical innovation. The "weak" form of ecological modernisation uses the language of sustainability and modernisation but proposed only minor changes to policy, institutions and participatory approaches to address vested interests. Christoff proposed a new "strong" form of ecological modernisation to address the main criticism of ecological modernisation and provide a more realistic way forward to genuinely achieve sustainable development.

Christoff's "strong" ecological modernisation still recognises the importance of technological innovation, but recognises that technological change is not a panacea on its own. Strong ecological modernisation recommends radical change to technology and consumption patterns but also recognises that achieving social justice is just as important.

Strong ecological modernisation recommends a comprehensive policy, regulatory and institutional reform agenda to achieve rapid and significant decoupling of economic growth and environmental pressure. In Australia, a significant example of such comprehensive policy package, was Krockenberger *et al's* *Natural Advantage: Blueprint for a Sustainable Australia*. This 2000 publication was published as the official Australian NGO recommended Agenda 21 strategy for Australia. It was

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<sup>171</sup> Christoff, P. (1996) Ecological modernisation, ecological modernities. *Environmental Politics*, 5: 476– 500.

deliberately based on the strong ecological modernisation framework of Christof<sup>172</sup> who has been a long time policy advisor to the Australian Conservation Foundation.

Strong ecological modernisation also recognises the risks of strong policy settings leading to heavily polluting industries relocating overseas. As York and Rosa<sup>173</sup> point out dematerialisation of industry in one country will achieve little if it simply leads to heavily polluting industries being exported to another country. Strong EM adopts a more reflexive policy approach that works with industry to achieve larger de-materialism targets and commits to extending public participation and deliberation in policy settings. Strong EM addresses the need for more active public policy processes and participation in the development and implementation of sustainability policy and institutional change. By 2003, some aspects of strong ecological modernisation could be seen in Germany.<sup>174</sup>

Other major areas of criticism of ecological modernisation were addressed through clarifying and expanding the ecological modernisation discourse in this third phase. In the third phase, traditional ecological modernisation studies of industrial production are increasingly complemented by paying attention to ecological transformations related to consumption processes.<sup>175</sup>

The Euro-centrist criticism of the second period resulted in various national studies on environmental reforms in non-EU countries (new industrializing countries and the transitional economies in East Central Europe, but also for instance the USA and Canada)<sup>176</sup> with mixed conclusions on the relevance of this theoretical framework for understanding processes of environmental reform. Besides studies referring to the key countries, Germany, the UK and the Netherlands<sup>177</sup>, empirical studies using this theoretical framework have been conducted in, among others, Finland<sup>178</sup>, Canada<sup>179</sup>, Denmark<sup>180</sup>,

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<sup>172</sup> Ibid.

<sup>173</sup> York, R. Rosa, E.A (2003) *Key Challenges to Ecological Modernisation Theory*. Organisation and Environment. 16. (3) September: 273-288

<sup>174</sup> Dryzek, J.S. Downes, D. Hunold, C. Schlosberg, D. Hernes, H.K (2003) *Green States and Social Movements: Environmentalism in the United States, United Kingdom, Germany, and Norway*. Oxford: Oxford University Press, 2003.

<sup>175</sup> Spaargaren, G. (1997) *The Ecological Modernisation of Production and Consumption. Essays in Environmental Sociology*. Dissertation, Wageningen Agricultural University, Wageningen.

<sup>176</sup> Mol, A.P.J. (1995) *The Refinement of Production. Ecological Modernisation Theory and the Chemical Industry*. Utrecht: Jan van Arkel:International Books.

<sup>177</sup> Cohen, M. J. (2000) *Ecological modernization, environment knowledge and national character: A preliminary analysis of the Netherlands*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 77–107. Essex: Frank Cass.

<sup>178</sup> Jokinen, P. and Koskinen, K. (1998) *Unity in environmental discourse? The role of decision-makers, experts and citizens in developing Finnish environmental policy*. Policy and Politics, 26: 55–70.

Jokinen, P. (2000) *Europeanisation and ecological modernisation: Agro-environmental policy and practices in Finland*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 138–170. Essex: Frank Cass.

<sup>179</sup> Harris, S. (1996) *The Search for a Landfill Site in an Age of Risk : The Role of Trust, Risk and the Environment*. Dissertation, McMaster University, Hamilton.

<sup>180</sup> Andersen, M.S. (1994) *Governance by Green Taxes. Making Pollution Prevention Pay*. Manchester: Manchester University Press.

Europe<sup>181</sup>, Lithuania<sup>182</sup>, Hungary<sup>183</sup>, Kenya<sup>184</sup>, South-east Asian countries<sup>185</sup>; Taiwan<sup>186</sup>, China<sup>187</sup>, Japan<sup>188</sup> and the USA.<sup>189</sup>

As discussed above, one of the main criticisms of ecological modernisation is that there has been insufficient decoupling of economic growth and environmental pressures to date. Thus some non-EM environmentalists argue that this shows that economic growth and environmental pressures are coupled and that it is naively and dangerously optimistic to pretend that significant decoupling is possible.<sup>190</sup> In the mid 1990s-2002 EM academics and EM practitioners acknowledged that despite innovations increasing eco-efficiencies in recent decades, the net resource and energy flows were still increasing. They acknowledged that this was due to a range of factors such as increasing globalization of production, global uptake of Western consumption patterns in the East and South, and global

<sup>181</sup> Gouldson, A. and Murphy, J. (1996) *Ecological modernisation and the European Union*. *Geoforum*, 27: 11–21. Neale, A. (1997) *Organising environmental self-regulation: liberal governmentality and the pursuit of ecological modernisation in Europe*. *Environmental Politics*, 6: 1–24.

Roberts, P. (1997) *Sustainable development strategies for regional development in Europe: an ecological modernisation approach*. *Regional Contact*, 11: 92–104.

Jackson, T. and Roberts, P. (1999) *Ecological modernization as a model for regional development: the changing nature and context of the Eastern Scotland Structural Fund Programme*. *Journal of Environmental Policy & Planning*, 1: 61–75.

European Environmental Agency (1998), *Europe's Environment: The Second Assessment*, New York/Amsterdam: Elsevier

<sup>182</sup> Rinkevicius, L. (1998) *Ecological Modernization and its Perspectives in Lithuania : Attitudes, Expectations, Actions*. Dissertation in Sociology, Kaunas University of Technology, Kaunas.

Rinkevicius, L. (2000). *Ecological modernisation as cultural politics: Transformation of civic environmental activism in Lithuania*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 171–202. Essex: Frank Cass.

<sup>183</sup> Gille, Z. (2000) *Legacy of waste or wasted legacy? The rise and fall of industrial ecology in socialist and postsocialist Hungary*. *Environmental Politics*, 9.

Gille, Z. (2000) *Legacy of waste or wasted legacy? The end of industrial ecology in post-Socialist Hungary*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 203–234. Essex: Frank Cass.

<sup>184</sup> Frijns, J., Kirai, Malombe, J. et al. (1997) *Pollution Control of Small Scale Metal Industries in Nairobi*. Wageningen/Nairobi: Department of Environmental Sociology WAU:HABRI.

<sup>185</sup> Frijns, J., P. T. Phuong, and A. P. J. Mol. (2000) *Ecological modernization theory and industrializing economies: The case of Viet Nam*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 257–291. Essex: Frank Cass. Sonnenfeld, D. A. (2000) *Contradictions of ecological modernization: Pulp and paper manufacturing in south-east Asia*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol and D. A. Sonnenfeld, 235–256. Essex: Frank Cass.

<sup>186</sup> Yang, Li-Fang (2005) *Embedded autonomy and ecological modernisation in Taiwan*. *International Journal of Environment and Sustainable Development* 2005 - Vol. 4, No.3 pp. 310 - 330

<sup>187</sup> Lei, Z. (1997) *Challenges and Opportunities : A Study on Environmental Management of Township and Village Enterprises (TVEs) in China*. Department of Social Sciences, Wageningen University, Wageningen.

<sup>188</sup> Brendan, B (2005) *Ecological Modernisation and Japan*. Routledge.

<sup>189</sup> Pellow, D. N., A. Schnaiberg, and A. S. Weinberg. (2000) *Putting the ecological modernization thesis to the test: The promises and performances of urban recycling*. In *Ecological modernisation around the world: Perspectives and critical debates*, eds. A. P. J. Mol, and D. A. Sonnenfeld, 109–137. Essex: Frank Cass.

<sup>190</sup> Catton, W. R., Jr. (1980). *Overshoot: The ecological basis of revolutionary change*. Urbana:University of Illinois Press. Dunlap, R. E., and K. D. Van Liere. (1978) *The "new environmental paradigm."* *J. Environ. Educ.* 9(Summer):10–19.

Foster, J. B. (1992) *The absolute general law of environmental degradation under capitalism*. *Capitalism Nature Socialism* 2(3):77–82.

O'Connor, J. (1991). *On the two contradictions of capitalism*. *Capitalism Nature Socialism* 2(3 October): 107–109.

O'Connor, J. 1994. *Is sustainable capitalism possible? In Is capitalism sustainable*, ed. J. O'Connor, 152–175. New York: Guilford Press

population growth. EM academics, practitioners and government programs<sup>191</sup> sought to address the challenge of the scale and speed required for achieving sustainability.

Using the Ehrlich and Commoner formulae<sup>192</sup> and other methodologies more and more EM experts and sustainability practitioners calculated that at least factor 10-20 improvements<sup>193</sup> from technical eco-innovation and sustainable consumption is now needed to achieve sustainable development. In 1993 a number of leading sustainability thinkers formed the Factor 10 Club<sup>194</sup> to promote understanding of the scale and speed now required for ESD and to provide detailed assessment of how to achieve it.<sup>195</sup> Members of the Factor 10 Club also sought to help catalyse the technical change needed and complimented this with renewed efforts to encourage and create better incentives for sustainable consumption. Members of the Factor 10 Club from the mid 1990s to 2002 published a number of important new books<sup>196</sup> outlining ways to achieve at least Factor 4, namely a 75 per cent improvement in resource productivity.<sup>197</sup> This assessment of the scale needed to sustainable development has since been backed up by leading government studies in the ecological modernisation tradition, i.e. the Netherlands Government in their Inter-ministerial Sustainable Technology Development Programme (Sustainable Technology Development Programme). The programme is one of the first to both work out the scale and speed of change required to achieve nationwide ecological and social sustainable development over the next 50 years.

In setting a time-horizon of 50 years – two generations into the future – it was found that ten to twenty-fold eco-efficiency improvements will be needed to achieve meaningful reductions in environmental stress. It was also found that the benefits of incremental technological development could not provide such improvements.

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<sup>191</sup> Weaver, P., Jansen, L., van Grootveld, G., van Spiegel, E. and Vergragt, P. (2000) *Sustainable Technology Development*, Greenleaf Publishing, Sheffield, UK.

<sup>192</sup> Commoner, B. (1971) 'The Environmental Cost of Economic Growth' in Shurr, S. (1971) *Energy, Economic Growth and the Environment*, John Hopkins University Press, Baltimore/London, pp 30-65. [It should be noted clearly though that the 'T' for technology in The Commoner- Ehrlich equation uses the word technology in the broadest sense of the word. The variable T in the Commoner-Ehrlich equation refers to two forms of reductions to environmental impact namely those due to economic structure (changing the composition of output towards less damaging products, changing the production-consumption system.) and technical change (substituting less damaging factor inputs for more damaging ones such as using renewable energy, and increasing the resource productivity)]

<sup>193</sup> Schmidt-Bleek, F. (1998) *Das MIPS-Konzept – Faktor 10*, Droemer Muenchen.

<sup>194</sup> See Factor 10 Club Declarations 1994 and 1995 and Statement to Leaders in Government and Business, 1997 Factor 10 Institute, F-83660 Carnoules, France

<sup>195</sup> Paleocrassas, Y. (1999) *Factor 10 And Fiscal Reform*, Report Of The Factor 10 Club, Factor 10 Institute, La Rabassière, F-83 660 Carnoules

<sup>196</sup> Weaver, P. Schmidt-Bleek eds (2000) *Factor 10 – Manifesto For A Sustainable Planet*, Greenleaf, London, 2000

<sup>197</sup> Weizsaecker, E. U et al (1995) *Faktor 4* Droemer, Muenchen,

Paul Hawken, E.Lovins. H. Lovins (1999) *Natural Capitalism: Creating the Next Industrial Revolution* Earthscan. Available At: [www.natcap.org](http://www.natcap.org) Accessed 8.01.08

Leo Jansen, Chairman, Dutch Inter-ministerial Sustainable Technology Development  
Program, 2000<sup>198</sup>

The governments of Austria, the Netherlands, Norway have publicly committed to pursuing Factor 4, or 75 percent efficiencies. The same approach has been endorsed by the European Union as the new paradigm for sustainable development. Austria, Sweden, and OECD environment ministers have urged the adoption of Factor Ten goals, as have the World Business Council for Sustainable Development and the United Nations Environment Program (UNEP). The concept of Factor 10 (a target of reducing environmental pressures by a factor of 10) is not only common parlance for most environmental ministers in the world, but such leading corporations as Dow Europe and Mitsubishi Electric see it as a powerful strategy to gain a competitive advantage. Universities like ANU organised forums and symposiums on Factor 10<sup>199</sup> to raise awareness amongst the public, students and decision makers of these issues.

But Factor 10 style eco-innovation will not be enough on its own to achieve sustainable development. History has shown that globally the spread of western consumption patterns are swamping gains made from eco-efficiencies and eco-design. Also studies show that it will be physically impossible for all countries globally to adopt current western consumption patterns. For instance the UNEP (2002) *Sustainable Consumption – A Global Status* report stated that,<sup>200</sup>

If China were to match the US for levels of car ownership and oil consumption per person it would mean producing approximately 850 million more cars and more than doubling the world output of oil. Those additional cars would produce more CO<sub>2</sub> per annum than the whole of the rest of the world's transportation systems. If China were match US consumption per head of paper, it would need more paper than the world currently produces. If China were to consume seafood at the per capita rate of Japan, it would need 100 million tonnes, more than today's total catch. If China's beef consumption was to match the USA's per capita consumption and if that beef was produced mainly in feedlot, this would take grain equivalent to the entire US harvest.

It is vital that the world embraces sustainable consumption patterns to reduce environmental impact rapidly. Professor Ryan charts the history of the discussion of sustainable consumption and production in UNEP's 2002 *Sustainable Consumption – A Global Status* report<sup>201</sup> written for and launched at the 2002 World Summit for Sustainable Development. This report, clearly positioned in the EM tradition,

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<sup>198</sup> Weaver, P., Jansen, L., van Grootveld, G., van Spiegel, E. and Vergragt, P. (2000) *Sustainable Technology Development*, Greenleaf Publishing, Sheffield, UK, Foreword, p 7.

<sup>199</sup> Smith, M et al (2001) *Factor 10: A Future Worth Having*. ANU. Available At: <http://www.anu.edu.au/factorofTEN/assets/factor10background.pdf> Accessed 2 January 2008

<sup>200</sup> UNEP (2002) *Sustainable Consumption – A Global Status Report 2002*, UNEP, Paris.

<sup>201</sup> UNEP (2002) *Sustainable Consumption: Global Status Report 2002*, UNEP, Paris (report written by Professor Chris Ryan, RMIT University, Melbourne, Australia, and the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden)

outlined a comprehensive framework for governments and other key actors to assist societies make the shift to sustainable consumption.

Ecological modernisation outlines a desired path towards sustainability. But the success of this path depends on the actions of numerous actors throughout society. Ecological modernisation cannot be achieved without the active engagement of these actors. In this third phase of ecological modernisation we see a range of academics and practitioners begin to publish new books which provide significant new resources to enable these actors to more easily act as effective change agents. These books provided significantly new resources for the key actors of ecological modernisation such as business leaders<sup>202</sup> and managers<sup>203</sup>, accountants<sup>204</sup>, engineers<sup>205</sup>, economists<sup>206</sup>, government policymakers<sup>207</sup> and regulators<sup>208</sup>, actors operating in national systems of innovation<sup>209</sup>, urban and transport planners<sup>210</sup>, and NGOs<sup>211</sup>.

These books helped to provide the foundation for many mainstream organisations not simply endorse sustainability but actively work on either implementing sustainable solutions, lobbying governments and business for change or creating education and training materials in sustainable development. These books helped to inspire people to form many cross sectoral networks to work on sustainable development. Also this period sees ecological modernisation's central principles and strategies formally adopted by more and more mainstream institutions, organisations and professional bodies in especially Europe and Asia. For instance, the OECD's 2001-2011 Environmental Strategy, agreed to

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<sup>202</sup> Holliday, C., Schmidheiny, S. and Watts, P. (2002) *Walking the Talk, The Business Case for Sustainable Development*, World Business Council for Sustainable Development, Greenleaf Publishing, Sheffield, UK

<sup>203</sup> Hawken, P., Lovins, A. and Lovins, L.H. (1999) '*Natural Capitalism: Creating the Next Industrial Revolution*', Earthscan, London. Freely downloadable from: [www.natcap.org](http://www.natcap.org)

<sup>204</sup> Schaltegger, S. and Burritt, R. (2000) *Contemporary Environmental Accounting: Issues, Concepts and Practice*, Greenleaf Publishing, Sheffield, UK

Burritt, R., Hahn, T. and Schaltegger, S. (2002) '*Towards a Comprehensive Framework for Environmental Management Accounting: Links Between Business Actors and EMA Tools*', *Australian Accounting Review*, July, vol 12, no 2, pp39–50

<sup>205</sup> Beder, S. (1998) *The New Engineer: Management and Professional Responsibility in a Changing World*, Macmillan, Melbourne, 1998.

<sup>206</sup> Roodman, D. (1999) *The Natural Wealth of Nations: Harnessing the Market and the Environment*, *Worldwatch Environment Alert Series*, WW Norton, New York/Earthscan, London.

<sup>207</sup> Connor, R. and Dovers, S. (2004) *Institutional Change for Sustainable Development*, Edward Elgar,

Cheltenham. Dovers, S. (1997) '*Sustainability: Demands on Policy*', *Journal of Public Policy* vol 16, pp303–318

Dovers, S. (2001) *Institutions and Sustainability*, ACF Tela Paper 7, Australian Conservation Foundation, Melbourne

Dovers, S. (2002) '*Sustainability: Reviewing Australia's Progress*', *International Journal of Environmental Studies*, vol 59, pp559–571

Dovers, S. and Wild River, S. (eds) (2003) *Managing Australia's Environment*, Federation Press, Sydney

<sup>208</sup> Braithwaite, J. and Drahos, P. (2000) *Global Business Regulation*, Cambridge University Press, Cambridge.

<sup>209</sup> Weaver, P., Jansen, L., van Grootveld, G., van Spiegel, E. and Vergragt, P. (2000) *Sustainable Technology Development*, Greenleaf Publishing, Sheffield, UK.

<sup>210</sup> Newman, P. and Kenworthy, J. (1999) *Sustainability and Cities*, Island Press, Washington, DC

<sup>211</sup> ACF (Australian Conservation Foundation) (2000) *Natural Advantage: Blueprint for a Sustainable Australia*, ACF, Melbourne.

by all OECD environmental ministers, adopts formally much of the “weak” ecological modernisation paradigm in its stated goals and design. Decoupling economic growth from environmental pressures is adopted as one of the five main goals of the OECD’s 2001-2011 Environmental Strategy. For instance new business industry groups adopt the “weak” form of ecological modernisation agenda such as the *World Business Council for Sustainable Development*. This period also sees many nations develop Agenda 21 blueprints for their nation based on an ecological modernisation approach. The OECD, for instance, published “*Sustainable Development Strategies: A Resource Book*” in 2002 to assist all OECD nations develop Agenda 21 Blueprints and national sustainability strategies along ecological modernisation lines. Overall the trend is clear that more and more countries around the world are adopting many aspects of an ecological approach. As the 2007, World Ecological Modernisation report stated

“In the 1970s, seven countries including the Netherlands entered the period of ecological modernization. In the 1980s, 11 countries including Italy entered the period of ecological modernization. In the 1990s, 40 countries including South Korea entered the period of ecological modernization..”<sup>212</sup>

These signs of significant progress made during the 3<sup>rd</sup> phase of ecological modernisation did not result in the hoped for outcomes of the Johannesburg 2002 World Summit for Sustainable Development. The governments of especially the USA and Australia continued to play an undermining role for international multi-lateral sustainable development agreements. As we will discuss in Chapter 3 much of the energy generated by the 2002 World Summit for Sustainable Development was subsequently lost through resources being focused on the war on terror and the war in Iraq instead of sustainable development. Nevertheless some important results were achieved from the 2002 World Summit for Sustainable Development such as the formation of a regional government network for sustainable development modelled on ICLEI and the agreement for a UN Decade of Education in Sustainable Development from 2005-2015. Advances like these will help create the conditions to make it easier for ecological modernisation to flourish.

#### 1.4.5 Fourth Stage of Ecological Modernisation

Between 2002 and 2008, there has been a significant shift in the debates and discourse on aspects of ecological modernisation such as climate change and water policies globally. There is in 2008 now far stronger political, business and community will for action to decouple economic growth from greenhouse gas emissions in particular. A significant shift has occurred in 2006-7 driven by the latest IPCC 4<sup>th</sup> Assessment, the UK Stern Review, Al Gore’s *An Inconvenient Truth* and the change of government in late 2007 in Australia. As Dr Pachauri, the chair of the IPCC, argues this shift in

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<sup>212</sup> See the *World Ecological Modernisation Report 2007* at <http://en.chinagate.com.cn/english/reports/50007.htm> Accessed 8.01.08

commitment on climate change is finally ensuring that nations move from paying lip service to sustainable development and now start understand its importance,

“The concept of sustainable development was really enunciated and popularized through the report of the Brundtland Commission, and it is appropriate that we are focusing today on a report that was released 20 years ago. However, the importance of sustainability in development policies and practice has not been realized until recently. As is often the case it is only the occurrence of the threat of a crisis that spurs human society to unusual actions and changes in pathways. In the case of sustainable development, I think the wake up call has really come from the sudden growth in awareness and understanding on the scientific realities of climate change.”<sup>213</sup>

The shift in the climate change discourse in Australia for instance has been historic. In fact, it could be argued that 2006 - with the launch of Al Gore’s film *An Inconvenient Truth*<sup>214</sup> and the *Stern Review*<sup>215</sup> - was an historic tipping point; when the majority of Australians finally understood the seriousness of human induced climate change. This shift in the climate change debates is discussed in detail in Chapter 8 of this thesis.

However it is pertinent to note that this is not the first time historically there has been an upsurge in interest, awareness and good intentions regarding environmental and social sustainability. As Chapter 2 shows as far back as 1908 in the USA there was an upsurge of interest in environmental sustainability led by President Theodore Roosevelt. Similarly, there was a significant wave of interest and concern in the late 1980s and early 1990s. This thesis argues that it is important to understand why in the past such upsurges did not result in a rapid shift to sustainability to better understand the lessons for today.

In this 4<sup>th</sup> phase of ecological modernisation (EM), EM writers have drawn attention to one of the key reasons why, in the past, significant shifts in environmental debates and community interest did not lead to strong ecological modernisation – namely the reality of vested interests and blocking coalitions. In 2004 Janicke<sup>216</sup> made a key insight, namely that, to date, ecological modernisation had not distinguished clearly enough between ecological restructuring and ecological modernisation, the latter requiring considerably more political, social and industrial change, risk and cost. It is important to distinguish between intrinsically unsustainable industries that would need to be restructured with

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<sup>213</sup> Pachauri, R.K (2007) 2007 K R Narayanan Oration *Coping with Climate Change: Is Development in India and the World Sustainable?* Available At <http://rspas.anu.edu.au/papers/narayanan/2007oration.pdf> Accessed 8.01.08

<sup>214</sup> Smith, M. and Hargroves, K. (2007) ‘*The Gore Factor: Reviewing the impact of An Inconvenient Truth*’, CSIRO ECOS, Australia. Available at [www.publish.csiro.au/?act=view\\_file&file\\_id=EC134p16.pdf](http://www.publish.csiro.au/?act=view_file&file_id=EC134p16.pdf). Accessed 14 April 2007.

<sup>215</sup> Stern, N. (2006) *The Stern Review: The Economics of Climate Change*, Cambridge University Press, Cambridge. Available at

[www.hm-treasury.gov.uk/independent\\_reviews/stern\\_review\\_economics\\_climate\\_change/sternreview\\_index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm). Accessed 14 April 2007

<sup>216</sup> Janicke, M (2004) *Industrial Transformation between Ecological Modernisation and Structural Change*. In K. Jacob. M. Binder eds. *Governance for Industrial Transformation*. Proceedings of the 2003 Berlin Conference on the Human Dimensions of Global Environmental Change. Berlin: Environmental Policy Research Centre.

those industries which can be modernised ecologically relatively easily. This distinction is important to make as it helps explain why an “environmental problem” for which there is a readily available, marketable and cost effective technical solution is relatively easy to solve (Ozone, Acid Rain etc) compared to where either industries need to be restructured (fishing, forestry, coal and forestry, unsustainable agriculture) or where there are not yet commercially viable or cost effective solutions (geo-sequestration for the coal industry).

There have always been some industries that need to be restructured and not simply modernised to achieve sustainable development. These industries have traditionally opposed and fought any sign of ecological modernisation initiatives in many countries. These vested interests in the USA, Europe, and Australia have utilised an increasingly sophisticated network of industry funded right wing think tanks and media contracts to run effective campaigns against any ecological modernisation. This is discussed in detail in Chapter 3.

This thesis discusses in Chapter 3 the fact that purposeful ecological modernization policy and institutional reform has rarely occurred without a fight from those vested interests who either will be, or perceive that they will be, negatively affected. These vested interests have historically formed politically conservative blocking coalitions to sustainable development. As Chapter 3 shows this anti-sustainability conservative blocking coalition have demonstrated themselves to be effective and powerful at preventing change towards sustainable development. The anti-sustainability conservative movement have utilized the media effectively to spread doubt, for instance, about the science of climate change and spread fear amongst the general population that sustainable development will harm business competitiveness, jobs and economic growth. One of the main reasons that the upsurge in interest and commitment in sustainability in the late 1980s and early 1990s failed to realize its early promise was due to the success of a concerted campaign against sustainable development based on the argument that it would harm jobs, business competitiveness and economic growth. These vested interests working with right wing think tanks and the media have been extraordinarily effective at convincing the general public that anyone who is pro sustainable development is anti growth, anti-jobs and anti-business competitiveness. (Chapter 3) This is the other key reason why this thesis focuses on these three key sustainability debates (Chapters 4-8).

This thesis argues in Chapter 3 and 9 that, to help create the conditions under which ecological modernization is more likely to flourish, there is a need for new institutions, new campaign strategies and new anti-blocking coalition style “think tanks” that are networked with progressive industry groups, innovation/R&D and educational institutions. Such new strong anti-blocking coalitions are needed to provide confidence to other progressive business, government and civil society organizations to publicly commit and implement strong ecological modernization actions and measures.

This thesis concludes that since we live in a world where business, government and civil society all have power new institutions like National Councils for Sustainable Development and new sustainability focused boundary organizations and think tanks are needed to bring together representatives and leaders across all the key sectors and stakeholders of any nation to build consensus for action on environmental and social sustainability which is inclusive. Such strategies are vital to countering efforts from vested interests to undermine and even block efforts to achieve a transition to a sustainable society.

This thesis is not simply theoretical. As part of the practice of the thesis, the author has co-founded a new “anti-blocking coalition” sustainability think tank, The Natural Edge Project (TNEP) ([www.naturaledgeproject.net](http://www.naturaledgeproject.net)) with Karlson ‘Charlie’ Hargroves. This think tank is not unique. All around the world other sustainability orientated think tanks have formed such as the Forum for the Future (UK), the International Institute of Environment and Development (UK), The Wuppertal Institute (Germany), The International Institute of Sustainable Development (Canada), The Earth Institute (USA), The Worldwatch Institute (USA), The Rocky Mountain Institute (USA).

This thesis thus seeks to not simply be of interest to the academic community, but also those looking for new frameworks with which to build consensus for action on sustainable development across the silo’d institutions of society whether from within (through cross institutional structures like National Councils for Sustainable Development) or from outside traditional institutions (through these relatively new environmental and social sustainability orientated think tanks).



