

## Sustainability Analysis of New Zealand

Commissioned background paper for the Parliamentary Commissioner for the Environment's Review of New Zealand Progress to Sustainable Development 2006

Lin Roberts, The Natural Step New Zealand

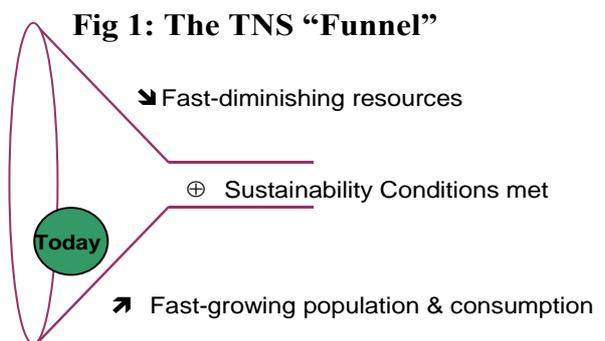
This article provides an overview of sustainability in New Zealand, covering where we are now, what a sustainable New Zealand would look like, and the steps we need to take to get there. It then discusses how this overview could be the basis for a future process to develop a national consensus and enthusiastic backing for a common vision of a sustainable future. It uses the science-based systems framework developed by The Natural Step<sup>1</sup> to:

- A:** define the conditions for a sustainable society;
- B:** assess New Zealand's current national sustainability by assessing it against the system conditions;
- C:** develop a vision of what NZ society could look like at some time in the future when it was functioning in accordance with the sustainability conditions; and
- D:** by backcasting from the desired future condition to our present situation, set out some of the key steps we need to start taking now, as a society, and some criteria to use to assess proposed actions.

Within the time frame and resources available for this project, the overview is necessarily reasonably broad brush, but it yields important signposts to the key areas of vulnerability and opportunity for New Zealand as nation.

### A: DEFINING SUSTAINABILITY

We live in a fast-changing world, in which the pace of change is accelerating. Alterations over the last two decades in our day-to-day lives, and in business decisions, exemplify the scale of these changes. Although the pressures that have forced these changes may appear random or unforeseeable, many stem from the 'squeeze' of a world with a rising population – which is consuming more and more per capita – and a diminishing resource base. The Natural Step uses the metaphor of the 'funnel' to describe how decreasing environmental and social headroom, the 'licence-to-operate' granted by society, will impinge upon the freedom of operation of a business and the options available for a society (Fig 1).



<sup>1</sup> The Natural Step is an international sustainability organisation, founded in Sweden in 1988 and now operating in 12 countries. It is a non-profit research, advisory and think tank organisation that helps businesses, governments and communities integrate sustainability into core strategy and operations. For more detail, see [www.naturalstep.org](http://www.naturalstep.org); [www.naturalstep.org.nz](http://www.naturalstep.org.nz).

As one approaches the ‘walls’ of this metaphorical funnel, impacts on business and society manifest in diverse ways, including resource scarcity and costs (critically including the resource of absorption of waste); more stringent regulations; reputation with markets and the public; health and safety concerns; difficulty in securing capital; and so forth. For New Zealand there will be particular challenges in getting our goods to market, tourists to our shores and maintaining primary production, in a world where fossil fuel use becomes constrained through scarcity, price and/or international agreements regarding climate change. Sustainable development pressures have been with us for many years and will, inevitably and increasingly, define the future business and public agenda.

The Natural Step Framework is based on a systems view of the sustainable natural cycles of this planet (see Appendix 1 for more detail, and related references). Human society is capable of damaging nature and altering life-supporting ecological structures and functions in only three major ways. Based on this understanding, The Natural Step defined three basic system conditions for maintaining the essential ecological processes on which we depend. In addition The Natural Step recognizes that social and economic dynamics fundamentally drive the actions that lead to ecosystem changes. Therefore, the fourth system condition focuses on socioeconomic dynamics and affirms that meeting human needs worldwide is an integral and essential part of sustainability.

Together these four System Conditions (see Box 1) define the minimum conditions we need to meet to achieve a sustainable society. In effect, they define the opening of the funnel – if we can meet the System Conditions, then we know the walls of the funnel will stop systematically closing in.

**Box 1: The Four System Conditions for Sustainability of The Natural Step Framework**

In the sustainable society, nature is not subject to systematically increasing ...

1. ... concentrations of substances extracted from the Earth's crust
2. ... concentrations of substances produced by society
3. ... degradation by physical means

and people are not subject to conditions that systematically

4. ... undermine their capacity to meet their needs.

In this study, the System Conditions are used collectively to define the necessary conditions of sustainability, to explore current sustainability issues, and also to provide the basis for developing a vision of a fully sustainable society. Once we know where we are today and where we need to get to tomorrow, we are then in a position to ‘backcast’ from this vision, identifying the incremental steps necessary to reach that sustainable future.

By starting from the ‘end-goal’ perspective, backcasting can help make sustainable development tractable. It can also help New Zealand make short-term investment decisions which, whilst not delivering the end-goal themselves (full sustainability being so far from where society is today), nevertheless constitute steps leading incrementally towards further future actions that eventually lead to the desired goal of full sustainability.

If tackled proactively, sustainable development will not only enable us to avoid the ‘walls of the funnel’, but also to identify the new opportunities available in a more sustainable future world. If we continue to react to issues as we go on blundering into those ‘walls’, we will merely perpetuate the historic pattern of responding reactively, at substantial cost and disruption to business and society, as issues hit us one after the other. Proactive and strategic decisions are, in the end, more intelligent and cost-effective than merely reacting to sustainability issues as they inevitably arise. A

true commitment to sustainable development is therefore about a great deal more than altruism, as it helps deal strategically with the unavoidable sustainable development pressures that will define the future.

## **B: HOW SUSTAINABLE IS NEW ZEALAND TODAY?**

This is assessed by examining the extent to which we currently infringe each of the System Conditions.

**System Condition One:** *In the sustainable society, nature is not subject to systematically increasing concentrations of substances extracted from the Earth's crust.*

This system condition is concerned with materials that were previously safely sequestered in the earth's crust but are now accumulating in living systems as a result of our mining activity. It does not mean "no mining" *per se*, but it does mean

- Systematically reducing dependence on fossil fuels;
- Substituting certain minerals that are scarce in nature (e.g. cadmium, silver, lead, radioactive materials) with others that are more abundant (e.g. Fe, Al, Si, Ti, Mg etc);
- Using all mined materials efficiently.

### **a) Fossil Fuels**

New Zealanders, like people everywhere, have become dependent on fossil fuels in almost all aspects of our lives. As a cheap, energy-dense and easily-transported form of energy, oil in particular has made possible much of the economic growth and increased consumption of resources of the last forty years. Many aspects of our lifestyle – our ready access to a wide range of consumer goods, processed foods and pharmaceuticals from all parts of the globe, our ability to travel freely nationally and internationally, and our ability to earn a living exporting heavy goods over long distances and enticing tourists from all over the world to visit - are directly dependent on cheap abundant supplies of oil. So too are such basic life-support services as our energy-intensive sewage and clean-water pumping and treatment systems, modern intensive agricultural methods, running of basic IT and security systems, etc. The release of CO<sub>2</sub> and related climate change gases, which results from burning fossil fuels around the globe, is also having a measurable impact on atmospheric CO<sub>2</sub> concentrations (discussed further under System Condition 2 below) and hence on the climate, and potentially therefore on our ability to live in low-lying coastal and other flood-prone areas and to maintain our primary production.

So how dependent is the New Zealand community and economy on fossil fuels for maintaining our material standard of living and our quality of life?

In 2004, imported oil accounted for 20% of New Zealand's imports bill, around the same level as during the oil shocks of the 1970s. New Zealand imports 4.6 million tonnes of fossil fuels/year but it also mines or drills for a further 10.9 million tonnes, of which 2.8 million tonnes are exported.<sup>2</sup> So approximately 12.6 million tonnes of fossil fuel and its combustion products are released into the New Zealand environment each year.

By international standards, we are lucky in that a high percentage of our electricity supply comes from renewables (64% in 2004), but 69% of our total energy is from fossil fuel (calendar year 2004, MED 2005). Investment in renewable sources of energy is increasing, but not as fast as demand or as envisaged in the Energy Efficiency Strategy. Energy security concerns led to the commissioning

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<sup>2</sup> Lennox, J, 2006. Resource Flow Model Study. Draft report for MFE.

of a new diesel fired plant at Whirinaki in 2004 and other proposals for coal or oil fired plants are on the drawing board.<sup>3</sup>

New Zealand has a low ranking in OECD with respect to the energy efficiency of our production – in 2003 New Zealand was 22nd out of 30 OECD countries in terms of the total primary energy used to achieve a given unit of GDP and 41% higher than average for the 15 countries in the EU in 2003 (0.24 cf 0.17)<sup>4</sup>.

The most energy intensive (energy use per \$GDP) sectors are petrochemicals/oil (including methanol and urea production), fishing, transport & storage, and base metal processing (aluminium and steel).<sup>5</sup> Agriculture also is becoming more energy intensive and more fossil fuel dependent, using energy both directly, e.g. for irrigation pumps, and indirectly for fossil fuel dependent inputs such as fertiliser. The burgeoning dairy industry now exports products worth \$6 billion per year, 20% by value of merchandise exports, and contributes 7% of GDP (MAF, 2005, p. 20). Its peak electricity demand on farms is considered to be in excess of 260 MW. Counting resistance and power factor losses, dairy farming accounts for 9% of New Zealand's electricity demand at peak times<sup>6</sup>, while the rapid escalation in use of urea and other fertilisers represents heavy fossil fuel use upstream. Much of the new land for dairying comes from the clearing of plantation forests, thus turning a presumed carbon sink into a generator of methane emissions<sup>7</sup>.

**Transport:** New Zealand is heavily dependent on fossil fuels for transport. We rely on it to transport people and goods within New Zealand, to carry our exports to market, and to bring our tourists and imports to our shores. There is very minimal use of renewable fuels for transport in New Zealand.<sup>8</sup>

Our road vehicle fleet consisted of 3,668,577 million vehicles as at 30 June 2004<sup>9</sup>, giving us one of the highest levels of road vehicle ownership per capita in the world<sup>10</sup>. In part, this is explained by geography – a long thin country makes road transport convenient – but is also the result of a number of decisions over last 20 years which have resulted in a major shift away from the significantly more fuel-efficient transport systems (rail to road, and buses and cycles to private cars). We have 94,000 km of roads but only 4,000 km of rail<sup>11</sup>, down from a peak of 5,700 km in

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<sup>3</sup> *PM backs thermal plant*, Karen Arnold, The Press, 4 March 2006. "Prime Minister Helen Clark yesterday signalled her support for the development of a coal-fired power station in Southland, saying the Government realised thermal energy was going to be an essential part of the answer to the country's energy needs....Comalco New Zealand managing director Tom Campbell said 'a coal-fired power station utilising Southland lignite would be the best option once affordable carbon dioxide-catching technology was available.'" Also Mighty River Power is seeking to convert the mothballed Marsden B to a coal-fired power station, operational late 2008/early 2009.

<http://www.mightyriverpower.co.nz/Generation/Projects/MarsdenB/QuestionsAnswers/Default.aspx>

<sup>4</sup> OECD Factbook 2005: Total primary energy supply per unit of GDP, tonnes of oil equivalent (toe) per thousand 1995 US dollar of GDP (calculated using Purchasing Power parity)

<http://caliban.sourceoecd.org/vl=10418647/cl=13/nw=1/rpsv/fact2005/07-02-01-g01.htm>

<sup>5</sup> 2003 figures <http://www.stats.govt.nz/NR/rdonlyres/701056BB-B81E-4E73-ADF2-5CFDA84E45E5/0/EnergyEconomyandEmissionsReport.pdf> accessed 31 Aug 06

<sup>6</sup> Souness 2005

<sup>7</sup> Need reference. (Helio?)

<sup>8</sup> Current alternatives include biodiesel and bioethanol, usually blended with fossil fuels, and electric vehicles. There is an ongoing trial with biodiesel in Waste Management trucks in Auckland, a trial with Stagecoach buses in Auckland was carried out last year, and a 12 month trial involving running 4 city buses on 5-20% biodiesel began in Christchurch in September 2006 (David Stenhouse, ECAN, pers. comm.).

<sup>9</sup> - about 2.5 million passenger cars and vans, 0.5 million goods vans, trucks and utilities, and 0.5 million other vehicles (such as trailers, motorcycles, tractors). <http://www.transport.govt.nz/qa6/>. As 23% of the population of New Zealand are under 14 years old, that is almost a car per person for everyone old enough to drive.

[http://www.sasi.group.shef.ac.uk/worldmapper/posters/worldmapper\\_map31\\_ver5.pdf](http://www.sasi.group.shef.ac.uk/worldmapper/posters/worldmapper_map31_ver5.pdf)

<sup>10</sup> and, with 613 cars for every 1000 people in the country, is second only to Luxemborg in cars per capita

<sup>11</sup> <http://www.helio-international.org/reports/oecd2.cfm>

1952<sup>12</sup>. Furthermore, and since the rail service was privatized in 1993, most of the remaining inter-city passenger services have been closed down, with the Auckland-Wellington service scheduled to end in September. Urban passenger trains are significant only in Wellington, though patronage is increasing in Auckland<sup>13</sup> where the network was bought back from Tranz Rail into public ownership in 2002.<sup>14</sup> As fuel prices rise, bus patronage is also increasing in many centres<sup>15</sup> but not as fast as car use and congestion.

Since import restrictions were eased and import tariffs were reduced in the 1980s, large numbers of used cars, predominantly from Japan, have appeared on the market – in 1990 nearly five times as many arrived as just two years before – and in 1998, New Zealand became one of the few countries in the world to remove import tariffs on motor vehicles.<sup>16</sup> There are now 230,000 new car registrations every year, seven times more than in 1960. About 70% of these are used imports<sup>17</sup>.

The low cost of buying a car made individual motorised mobility accessible to the majority of New Zealanders and (until very recently) the relatively low price of fuel led to a culture of ‘the bigger the better’. In the 1960s a typical car would have a 1.5 litre engine. By 1990 the average engine size was 2.4 litres. In 2005 it hit 3 litres. Our biggest selling brand new cars in 2004 were 4-litre Ford Falcons and Holden Commodores, starting at 3.6 litres, followed by the 1.8 litre Toyota Corolla.<sup>18</sup> The number of 4WDs on the road increased steadily – the number of 4WDs imported to NZ more than tripled from about 10,000 in 2001 to more than 36,000 in 2004<sup>19</sup>. Tax advantages also result in many companies providing company cars for staff – in 2004, 94,000 business cars were registered, the majority 2 litre or more. However, as fuel prices rise, purchases of very large cars and 4WD vehicles are starting to decline - for each of the five months to July 2006, imports of vehicles, parts and accessories showed a decline with the largest decrease in July being in new, petrol driven cars over 3000cc.<sup>20</sup>

Travel habits have also changed over the last forty years as convenience and personal safety issues have become more prominent. In 1960s New Zealand, most children walked or cycled to school.

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<sup>12</sup> [http://en.wikipedia.org/wiki/Rail\\_transport\\_in\\_New\\_Zealand](http://en.wikipedia.org/wiki/Rail_transport_in_New_Zealand), accessed 28 August 2006.

<sup>13</sup> The number of train passengers in the Auckland region has been climbing since October 2005 to just over 5m. This compares to 3.8m for the equivalent period last year, a 32.5% increase. Of those journeys, 1.91m were made on western line services (compared with 1.35m last year) and 3.12m on the southern and eastern lines (compared with 2.45m last year). ARC figures quoted in *New Zealand Transport & Logistics Business Week*, 20 July 2006

<sup>14</sup> [http://en.wikipedia.org/wiki/Rail\\_transport\\_in\\_New\\_Zealand](http://en.wikipedia.org/wiki/Rail_transport_in_New_Zealand), accessed 28 August 2006

<sup>15</sup> Daily bus patronage into Auckland city was up by 2.2% from 21,776 last year to 22,251 this year with growth primarily from the new \$290m Northern Busway on the Northern Motorway (ARC figures quoted in *New Zealand Transport & Logistics Business Week*, 20 July 2006). In the Waikato, soaring petrol prices this year are being credited with another increase in Hamilton bus patronage. Environment Waikato figures show the number of bus tickets sold last month was up 14 per cent on the same month last year. Tickets sold for the 2005-06 year were up 6.43 per cent on the same period the year before. Between July 1 last year and April 30 this year, 1.54 million bus tickets were sold. (*Waikato Times*, 27 May 2006). In the Canterbury region 15.82 million passenger trips were made on public transport during the 2005-06 year, which was 2.33% more than carried in 2004/05 and equals approximately 53,800 trips being made each weekday. Patronage in the Greater Christchurch area in 2005/06 was 15.61 million passenger trips, the highest figure since 1985 when 15.4 million passenger trips were made (pers.comm. David Stenhouse, Passenger Services, ECAN.)

<sup>16</sup> [http://en.wikipedia.org/wiki/Grey\\_import\\_vehicles](http://en.wikipedia.org/wiki/Grey_import_vehicles)

<sup>17</sup> <http://www.mfe.govt.nz/publications/ser/gentle-footprints-may06/4.pdf>

<sup>18</sup> <http://www.mfe.govt.nz/publications/ser/gentle-footprints-may06/4.pdf>. It is only recently that attempts have been made to track the average fuel efficiency of the New Zealand car fleet. A regulation change has meant that as of Feb 2005 importers need to supply fuel efficiency and emissions data for most imported cars. <http://www.landtransport.govt.nz/publications/infosheets/infosheet-2-15.html> and Ministry of Transport staff are currently developing methods to estimate average fleet efficiency..

<sup>19</sup> Ageing 4WDs Add To NZ's Pollution 2 February 2005 *New Zealand Energy & Environment Business Week*, quoting Motor Industry Association CEO Perry Kerr.

<sup>20</sup> Statistics NZ Press Release 24 August 2006. <http://www.stats.govt.nz/products-and-services/media-releases/overseas-merchandise-trade/overseas-merchandise-trade-jul06-mr.htm> (accessed 31 August 2006). However it is still unusual for car advertisement or motoring journalists to address fuel efficiency.

Now, being driven by car is the most common way of getting to both primary and intermediate schools. The number of trips has almost doubled from about 19 million trips in 1989/90 to about 37 million trips in 1997/98. 92% of all trips are by car. One third of all car rides cover less than two kilometres, and two thirds are shorter than five kilometres. As a result, householders use 80% of New Zealand's petrol, and emit over 20% of New Zealand's CO<sub>2</sub> - both are increasing at far higher rates than total spending by households - and transport is one of the biggest growth areas of New Zealand's greenhouse gas emissions.

Sprawling urban areas and the trend towards 'lifestyle blocks' on the edge of most cities has increased the length of the average commute to work or school, and this, together with increased congestion, particularly in Auckland, has increased the average hours per week spent travelling.

Fossil fuel use for internal freight has also increased markedly. The deregulation of road transport in 1989 lifted the prohibition on road freight transport over distances greater than 150km that had favoured the more energy efficient rail, and allowed trucks up to 44 tonnes onto the roads. By 2003, 85% of the freight payload was carried by trucks weighing more than 10 tonnes and travelling more than 20,000 kilometres per year (or more)<sup>21</sup>, rising to 87% in 2005<sup>22</sup>.

The fossil fuel component of our imports is also rising, both directly and indirectly. Our petroleum and petroleum products imports have, since May 2006, been the main contributor to our rising import bill for merchandise goods<sup>23</sup>, but most of the other products we import also have a significant direct or indirect fossil fuel component. Many of our imported goods are derived from fossil fuels (e.g. plastics, synthetic rubber, many fertilisers and textiles) and many (e.g. automobiles, machinery and electronics) involve energy intensive production steps offshore (e.g. metal smelting and refining). In total we annually import 16 million tonnes of goods<sup>24</sup> and all will have been transported by fossil fuels.

All our imports travel a significant distance to reach us from their point of manufacture, but they may also have travelled many thousands of kilometres before that. As cheap oil became available over the last forty years, longer and longer supply chains have become the norm. There are both energy and ethical costs associated with globalisation as producers at each stage in the supply chain seek out the economically most efficient place to produce; at present oil prices, the financial cost of transport in between these stages remains minor. Even for goods manufactured in New Zealand, it is not uncommon for the raw materials to have travelled tens of thousands of kilometres in many stages before arrival. For example, a synthetic fabric for a backpack made in Christchurch may have started its life as oil in the Middle East, then travelled to USA to be turned into fibre, then to South East Asia for dyeing and proofing (using chemicals that themselves have travelled many kilometres) and Australia for weaving into a fabric, before arriving in New Zealand to be made into a pack, before export again to a market in Europe or North America.

We are also heavily dependent on fossil fuels to transport the 25 million tonnes of goods we export each year<sup>25</sup>. Maintaining our competitive position in distant markets is likely to becoming harder as

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<sup>21</sup> Profile of the Heavy Vehicle Fleet, Update 2004. <http://www.ltsa.govt.nz/publications/docs/hv-fleet-2004.pdf#search=%2285%25%20road%20truck%2010%20tonnes%20NZ%22> (accessed 21 September 2006)

<sup>22</sup> The Press, 3 July 2006. A report by Transport Engineering Research New Zealand says this reliance on road freight is likely to continue, with the 100 million tones carried by trucks in 2005 doubling to about 200 million tones a year. Rail freight would increase from about 16 million tones a year to 34 million tones.

<sup>23</sup> which in 2006 reached a record high for a July month of \$3,758 million (Statistics New Zealand)

<sup>24</sup> Statistics NZ Overseas Cargo Statistics, quoted in Lennox, J, 2006. Resource Flow Model Study. Draft report for MFE.

<sup>25</sup> Ibid.

the proportion of the cost going to transport increases and as consumers become more discriminating in seeking to minimise the carbon footprint they are responsible for.<sup>26</sup>

**Tourism:** Tourism directly and indirectly contributes about 10% of New Zealand GDP. Visitor numbers are steadily growing and forecasted to grow from the current 2 million per year to 3 million by 2009.

The average international tourist arrives via an 11,000 km (one way) fossil fuelled flight, then travels on average 1500km during a stay of 21 days. Domestic tourists travel about 614 km on a 3 day holiday.<sup>27</sup> In terms of our Kyoto commitments, we are only counted responsible for the CO<sub>2</sub> emissions associated with travel within New Zealand (which amounts to around 6 % of national carbon dioxide emissions), but when considering our economy's dependence on fossil fuels (and the global climate's vulnerability to CO<sub>2</sub> emissions), all this fuel consumption must be taken into account. Tourism is likely to be impacted by the significant fuel price increases predicted over the next ten years and by the removal of the current exemption of aviation fuel from carbon taxes and other penalties related to global warming.<sup>28</sup>

**Housing:** New Zealand homes tend not to be very energy efficient, but New Zealand still has the lowest residential energy use *per capita* in the OECD, despite having larger-than-average houses (by floor area). This is probably largely due to New Zealand's temperate climate, resulting in relatively low amounts of energy used for space heating, and the tendency not to heat (or air condition) the entire house. In some cases, this may be an income-related trade-off in terms of comfort or welfare (with New Zealand having relatively modest income *per capita* compared with its OECD counterparts).<sup>29</sup>

## b) Minerals

How dependent is our society and economy on **mined materials**, especially the rarer minerals?

New Zealand's mining industry is relatively small so almost all of the mining to extract the metals we use happens offshore. The extraction of fossil fuels for our consumption also puts other elements into circulation – fossil fuel extraction brings into the biosphere not only large volumes of carbon previously out of circulation, but also significant quantities of a wide range of heavy metals, many of them toxic, which were previously safely sequestered in the earth's crust<sup>30</sup>.

New Zealand contains a variety of minerals reflecting its diverse geology and dynamic tectonic history. While New Zealand is best known for its gold production (9.8 tonnes in 2002), there is also

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<sup>26</sup> Many European consumers are already beginning to try and reduce their "food miles" – the distance their food has travelled to reach them. In their September 2006 Report "Greening Supermarkets", the UK National Consumer Council rated the main supermarket chains on five indicators: food transport, waste, nature (fish), nature (trees) and sustainable farming. In assessing Waitrose they comment that although it has a good variety of in-season vegetables, "it also sells the highest proportion of air-freighted fruit, including apricots, strawberries and blueberries from New Zealand." "By our calculations, the CO<sub>2</sub> contribution from air-freighting just one small 225g punnet of New Zealand strawberries is equivalent to the CO<sub>2</sub> emissions from eleven school runs in the car.

<http://www.ncc.org.uk/responsibleconsumption/greening-supermarkets.pdf>

<sup>27</sup> [http://www.landcareresearch.co.nz/research/sustain\\_business/tourism/energy\\_consumption.asp](http://www.landcareresearch.co.nz/research/sustain_business/tourism/energy_consumption.asp)

<sup>28</sup> In July 2006, European Members of Parliament "gave overwhelming backing to a demand for new measures designed to curb the negative environmental impact caused by the spectacular growth in air travel. The proposals, drafted by the Green MEP, Caroline Lucas, would end the anomaly under which aviation fuel is exempt from taxes and duties, effectively subsidising air travel." [http://www.nzherald.co.nz/section/story.cfm?c\\_id=3&ObjectID=10389829](http://www.nzherald.co.nz/section/story.cfm?c_id=3&ObjectID=10389829)

<sup>29</sup> <http://www.climatechange.govt.nz/resources/reports/policy-review-05/policy-review-05-3.pdf>

<sup>30</sup> For a number of elements, e.g. V, Li, Ga, Be, Hg, Si, B, Ge, S, Se and of course C, more of the element enters the biosphere through fossil fuel extraction than through mining. Surprisingly this is also true for aluminium. Azar, C., Holmberg, J. & K. Lingren. 1996. Socio-ecological indicators for sustainability. *Ecological Economics* 18:89-112.

production of silver (28.7 tonnes in 2002), and mining of ironsand (1.7 million tonnes in 2002), coal (4.5 million tonnes in 2002), aggregate, limestone, clay, dolomite, pumice, salt, serpentine, zeolite and bentonite. In addition, there are resources or potential for deposits of titanium (ilmenite beachsands), platinum, sulphur, phosphate, silica and mercury.<sup>31 32 33</sup>

Of these, the elements of concern with respect to the system conditions for sustainability are those which are systematically accumulating in living systems. Globally, man-made flows into the biosphere exceed natural flows by 22 times for silver, 3.7 times for sulphur, 3.5 times for phosphorus, and 6.4 times for carbon (coal, gas and oil).<sup>34</sup> Mining activities also bring to the surface many elements beside the elements mined – coal, oil and gold mining all bring to the surface and into the biosphere significant quantities of a wide range of heavy metals, including nickel, copper, lead and cadmium, which were previously safely sequestered in the earth's crust. Mining can also cause significant physical disruption of ecosystems (addressed below under System Condition 3). It can generate significant quantities of acid waste rock and the extraction process often involves use of other toxins such as cyanide.

Geothermal waters also bring a number of rare elements to the surface. Geothermal fluids from geothermal power stations are a major source of arsenic, boron, mercury and other geothermal chemicals found in the Waikato River, which have to be removed before the water can be safely drunk.<sup>35</sup>

Most of the heavy metals in the NZ economy and environment are imported in the form of manufactured goods (e.g. vehicles, electronic goods and machinery), or as raw materials for electronic and other goods manufactured here. Cadmium arrives in many electronic goods but also as a contaminant of phosphate fertiliser, ending up in soils and water. Phosphate is a mined material that is deliberately scattered across the environment – excess phosphorus runs off into waterways causing eutrophication, but phosphate can also contain arsenic, cadmium, chromium, fluorine, strontium, thorium, uranium and zinc, which then accumulate in the soil.<sup>36</sup> Copper, chromium and arsenic are used in pesticides – copper chromium arsenic (CCA) is used as timber preservative, copper is used in fungicide sprays principally in horticulture, and arsenic is a significant problem at an estimated 10,000 former sheep dip sites as well as in geothermal water, and even in sawdust and wood shavings from treated timber.<sup>37</sup> It is also turning up in soil samples from new vineyard areas where CCA treated poles have been used.<sup>38</sup> Heavy metals enter sewage systems from industry (especially electroplaters), but also from domestic sources such as zinc in sun creams, and then enter the environment – discharges from the Bromley sewage station in Christchurch contain

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<sup>31</sup> <http://www.stats.govt.nz/quick-facts/industries/minerals.htm>

<sup>32</sup> National commodity Summary

[www.crownminerals.govt.nz/minerals/facts/downloads/2002\\_mining\\_production\\_stats.xls](http://www.crownminerals.govt.nz/minerals/facts/downloads/2002_mining_production_stats.xls)

<sup>33</sup> However the total contribution of the mining industry (defined as including oil and gas production and extraction, mineral production, coal mining, exploration and services to mining to the NZ economy is quite small. In 2003, the mining industry directly contributed \$1,323m (1 percent) towards New Zealand's total GDP and accounted for approximately 1 percent (6.2PJ) of New Zealand's total energy demand.

<http://www.stats.govt.nz/NR/rdonlyres/701056BB-B81E-4E73-ADF2-5CFDA84E45E5/0/EnergyEconomyandEmissionsReport.pdf>

<sup>34</sup> Azar, Holmberg & Lindgren 1995

<sup>35</sup> [www.environmentwaikato.govt.nz/enviroinfo/water/healthyivers/waikato/facts6e.htm](http://www.environmentwaikato.govt.nz/enviroinfo/water/healthyivers/waikato/facts6e.htm) ;

<sup>36</sup> Canterbury high country that has never been fertilised has a background level of 0.5ppm of cadmium; Canterbury low country which has had around 50 years of fertiliser applications averages around 2ppm cadmium, while Waikato soils (which have high phosphorus retention and fixation rates so farmers apply at higher levels to ensure some available for plants) have cadmium levels up to 8ppm. Jeremy Cuff, ECAN, pers. com. Sept 2006.

<sup>37</sup> Brett Robinson, HortResearch, <http://archive.antenna.nl/pipermail/source-weekly/2003/000028.html>

<sup>38</sup> "Vineyard posts pose aquifer risk", Dan Hutchison and Debbie Jamieson, The Press, 1 Dec 2005. Poison, including arsenic, is leaching from vineyard posts into soils and aquifers in wine regions.... The studies.... show vineyards above aquifers posed a small risk to water quality. The first study, by HortResearch, shows a quarter of soil samples taken within a few centimetres of posts exceeded Australian guidelines by up to four times.

chromium, copper, lead, nickel and zinc at levels significantly exceeding the water quality standards.<sup>39 40</sup>

How effective are our systems for recapturing metals, and returning them to the economic cycle, reducing need for further mining? There are reasonably developed recovery systems in place for the metals and other materials used in packaging, but the actual and target recovery rates (under the Packaging Accord) are very low (65% for aluminium, 55% for glass, 23% for plastic, 43% for steel). For all these materials, the raw materials (aluminium, silica, carbon, iron) are abundant elements, so the main advantage of recycling is the avoided pollution and the energy savings from reducing the need for more virgin materials – in the case of aluminium this saving is significant.

For all the heavy metals, recycling systems are patchy, and it is difficult to get any data on recovery rates. More than 500,000 lead acid batteries are recycled each year and there are a few very small scale recycling schemes for other batteries<sup>41</sup> but no nation-wide system for recovery of batteries or electronic wastes, so it is likely that copper, nickel, cadmium, mercury, lead and other metals are entering the environment at landfills and other places where consumer goods are discarded. Each year we also abandon 25,000 cars, either on the sides of roads or out in nature.<sup>42</sup>

**System Condition Two:** *In the sustainable society, nature is not subject to systematically increasing concentrations of substances produced by society.*

This condition covers both a) manmade compounds that we are putting out at greater rates than nature can break down (including many persistent bioaccumulative substances such as DDT, PCBs, and PCPs), as well as b) natural compounds that are accumulating in natural systems as a result of human activity (e.g. CO<sub>2</sub> and nitrogen), generally as a result of a change in chemical form which overwhelms natural purification processes. Responding to this condition means systematically replacing certain persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature, and using all substances produced by society efficiently.

**a) Manmade compounds:**

Like other countries, New Zealand embraced the new ‘wonder chemicals’, such as DDT, when they first became available. The organochlorine insecticide DDT was used extensively to control grass grub and porina during 1940-70, resulting in the build up of residues (mainly DDE) in the soil. These residues remain with us today. These residues still constrain land use options in some areas, though this year Fonterra, in the context of a drive to increase milk production, has increased their DDT weighted average limit from 0.2ppm to 0.7ppm, confident that the larger volumes of milk through the plants will dilute contaminants below the limits set by export markets. This decision opens up a lot of formerly unusable South Island land for dairying.<sup>43</sup>

A range of other persistent organic pollutants (POPs) were used in NZ from the mid-1940s to the 1960s, mainly in agriculture, horticulture and timber treatment. Smaller amounts were also used in public parks and by home gardeners. The use of POPs to assist food production was progressively restricted by regulation, so that by the mid-1970s their use had largely ceased. A programme to withdraw PCBs from service in New Zealand and to effect their disposal via high-temperature incineration in Europe was initiated in the mid-1980s – the small quantities exempt must be

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<sup>39</sup> Christchurch City Council statistics 1999.

<sup>40</sup> Get data on heavy metals in soils from ECAN man at Timaru

<sup>41</sup> <http://www.mfe.govt.nz/issues/waste/special/batteries/>

<sup>42</sup> Gentle Footprints, MFE 2006.

<sup>43</sup> Dairy Monitoring Report July 2006 <http://www.maf.govt.nz/mafnet/rural-nz/statistics-and-forecasts/farm-monitoring/2006/dairy/dairy-monitoring-report.pdf> and “Fonterra eases DDT threshold”, David King, The Press, 8 May 2006.

completely withdrawn from use and destroyed no later than 2016. All of the POPs covered by the Stockholm Convention were formally deregistered by the Pesticides Board in 1989. The use of chlordane, dieldrin and pentachlorophenol by the timber treatment and manufacturing industry also ceased about this time.<sup>44</sup> The legacy of this era is low level contamination of wide areas, and concentrated hotspots in timber treatment yards, sheep dip sites, dump sites and pesticide storage areas, such as Mapua. Residues in horticultural land close to urban areas, and in old landfill sites, can be remobilised by subsequent changes in land use, particularly for urban/industrial development.

Various government reviews have examined concentrations of key POPs and dioxins in soils, rivers, air, food, human breast milk and human serum.<sup>45</sup> They generally conclude that concentrations are low compared to other countries and to international guidelines, with concentrations of dioxins, PCBs and DDE increasing with age - people over 65 have significantly higher loads than people under 24. Human milk is a high fat material from an organism near the top of the food chain, and consequently studies of human milk provide a good indication of the prevalence of persistent fat soluble chemicals in the environment. A 1998 study examined human breast milk for dioxins, PCBs and a number of organochlorine insecticides. The study found dioxins, PCBs and the organochlorine insecticides Beta-HCH, HCB, DDT and its metabolites, dieldrin, and heptachlor epoxide in the breast milk samples of all 53 women in the study, but that the levels of dioxins, PCBs and all but one of the organochlorines studied decreased significantly between 1988 and 1998,<sup>46</sup> thanks presumably to the bans in place covering these POPs.

However although we have addressed the worst of POPs, many other persistent substances are still in use, and studies elsewhere suggest they are likely to be accumulating in human tissue.<sup>47</sup> To date no study (that I have been able to locate) has been conducted to examine the full range of contaminants found in New Zealand mothers' milk or any other body fluids.

Most regional councils have been proactive in collecting and disposing of banned and unwanted agrichemicals, including POPs. Significant collection and disposal of agrichemical POPs occurred between 1997 and 1999, when seven councils worked together to collect and ship 120 tonnes of intractable agrichemicals (including POPs) for disposal overseas. Since then, some regions have maintained ongoing collections, while others have run less frequent programmes. A more coordinated approach got underway in 2003 and, under the present collection programme involving 13 regional councils (out of 16), over 290 tonnes of unwanted agrichemicals will have been collected between 2003 and June 2006, of which 228 tonnes were intractable agrichemicals, including POPs. A further 175 tonnes of unwanted intractable agrichemicals are estimated to remain on rural properties among New Zealand's 16 regions. Nine regions are now considered "effectively clear" of intractable agrichemical stockpiles, and collection efforts will focus on clearing the remaining regions.<sup>48</sup>

A wide range of pesticides are still used in primary production and also for pest management on protected lands, but thanks largely to pressure from overseas markets, many sectors are

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<sup>44</sup> <http://www.mfe.govt.nz/publications/hazardous/stockholm-convention-pops-jun06/html/page5.html>

<sup>45</sup> <http://www.mfe.govt.nz/publications/hazardous/stockholm-convention-pops-jun06/html/page9.html>

<sup>46</sup> Investigation of organochlorine contaminants in the milk of New Zealand women, April 2001.

[http://www.moh.govt.nz/moh.nsf/238fd5fb4fd051844c256669006aed57/2143f4f9c3dffc35cc256a5a007cbf36/\\$FILE/OrganochlorinesinMilkofNewZealandWomen.pdf](http://www.moh.govt.nz/moh.nsf/238fd5fb4fd051844c256669006aed57/2143f4f9c3dffc35cc256a5a007cbf36/$FILE/OrganochlorinesinMilkofNewZealandWomen.pdf)

<sup>47</sup> For example, a study of the umbilical chord blood of ten newborn US babies in 2005 found an average of 200 chemical contaminants in their blood stream, the most common being mercury [SC1], fire retardants, pesticides and the Teflon chemical PFOA [all SC2]. Of the 287 chemicals found, 180 cause cancers in humans or animals, 217 are toxic to the brain and nervous system, and 208 cause birth defects or abnormal development in animal tests.

<http://www.ewg.org/reports/bodyburden2/execsumm.php>

<sup>48</sup> <http://www.mfe.govt.nz/publications/hazardous/stockholm-convention-pops-jun06/html/page5.html>

progressively switching out of persistent broad-spectrum chemicals into more target specific “soft” chemicals<sup>49</sup> (though it must be remembered that target specific chemicals can still be hazardous).<sup>50</sup> Customer pressure has been strongest on the horticultural sector, and as a result this sector has made the most progress in phasing out use of persistent chemicals and switching to integrated pest management programmes and to organics, particularly for crops destined for the export market. However pesticide residues are still regularly found in New Zealand foods sampled in the Total Diet Survey.<sup>51</sup>

The chemicals side of the Hazardous Substances and New Organisms Act 1996 came in to effect in 2001, replacing a variety of previous pieces of legislation. A last minute scramble resulted in several hundred thousand substances being notified just prior to the Act coming into force, thus allowing continued use of the substances until they were reassessed. The sheer volume of substances meant it was not possible to individually assess and set conditions for all these compounds in a manageable time frame, so in July 2006, 218,000 substances were transferred across into the new regime under a number of group standards. One of the criteria used to group substances and then set relevant controls was whether a substance had environmental persistence, bioaccumulative and toxic properties (PBT).

Environmental persistence, bioaccumulative properties and toxicity are among the many factors considered when assessing new substances under the HSNO Act but there is no specific focus in the legislation or accompanying regulations on reducing the number of persistent chemicals in use in NZ, nor is there any national level data on the range and volumes of persistent chemicals used, even within a single category such as pesticides.

As mentioned above, there are a number of initiatives in the primary production sector to reduce use of persistent chemicals, particularly in horticulture (e.g. pipfruit and kiwifruit). There have also been a number of regional and local hazardous waste management strategies and some cleaner production programmes which address use of persistent substances, but as yet there is no national approach. The Environmental Risk Management Authority, which administers the HSNO legislation, developed a Hazardous Substances Risk Reduction Strategy in 2004 which could provide this, but as yet they have made limited progress in establishing a baseline, or taking a more proactive approach to encouraging applicants and users to think about how they can avoid use of hazardous substances, especially persistent ones, eliminate problematic components from compounds or develop greener alternatives.

In 2003 we exported 5678 tonnes of hazardous waste for safe disposal. In the same year we imported 14,895 tonnes of hazardous waste for treatment. These wastes came from Pacific Islands that do not have the facilities to either recover or appropriately treat hazardous wastes.<sup>52</sup>

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<sup>49</sup> In 2003 we imported US\$72 million pesticides. Herbicide sales (by volume) have increased 1994-2003, while insecticides and fungicide sales have decreased. <http://www.ermanz.govt.nz/news-events/archives/presentations/JimWalker05.pdf> For possum control, DoC favours 1080 which breaks down readily used in preference to more persistent rodenticides.

<sup>50</sup> Some of the more targeted chemicals (such as synthetic pyrethroids) are in fact highly toxic albeit to a narrow spectrum of organisms. In the UK we have lots of experience of nanogram levels leaching into rivers and wiping out whole food chains by taking out the insects. So the nature of SC2 substance is highly germane to what constitutes a perceived safe level or ‘best practice’ for handling/use/washing/disposal. Pers.comm. Mark Everard, UK Environment Agency. Sept.06.

<sup>51</sup> *2003/2004 New Zealand Total Diet Survey Summary: Agricultural Compound Residues, Selected Contaminants and Nutrients* “Of the 990 food samples screened for 221 agricultural compound residues, 498 (50%) were found to contain detectable residues. This is lower than the percentage (59%) found in the 1997/1998 NZTDS. Residues of 82 different agricultural compounds were found in the 2003/04 survey. Residues were detected in only 997 (0.5%) of the approximately 199,100 individual analytical agricultural compound residue results, compared with 1.4% in 1997/98.”

<sup>52</sup> MFE, Gentle Footprints, 2005 <http://www.mfe.govt.nz/publications/ser/gentle-footprints-may06/6-waste.pdf>

b) **natural compounds** increasing in concentrations in the New Zealand environment as a result of human activity (e.g. N, CO<sub>2</sub>):

Human activity in New Zealand is contributing to systematic increases in the concentration of carbon dioxide, methane and nitrous oxides in the atmosphere, and to increased concentrations of nitrogen and phosphorus in soils, ground water and waterways.

New Zealand's greenhouse gas emissions (excluding the land use, land-use change and forestry sector) increased from 61.5 million tonnes carbon dioxide equivalent in 1990 to 74.6 million tonnes carbon dioxide equivalent in 2004. 49.4% of these emissions were from the agricultural sector, predominantly methane emissions from ruminant farm animals, and nitrous oxide emissions from animal excreta and nitrogenous fertiliser use. The energy sector (principally transport) was responsible for 42.4% in 2004, industrial processes 5.6%, waste 2.5%, and solvents and other products < 0.1%.<sup>53</sup>

Globally, reactive nitrogen has begun accumulating in the environment because humans are producing reactive nitrogen (by synthetically fixing nitrogen using the Haber-Bosch process, by burning fossil fuel that contains nitrogen and through increased cultivation of nitrogen fixing plants) at rates far greater than the natural conversion rates of reactive nitrogen back to non-reactive atmospheric nitrogen.<sup>54</sup>

New Zealand is contributing to this accumulation through our significantly increased use of nitrogenous fertilisers. More than 770,000 tonnes of nitrogen fertiliser was applied in NZ in the year ending June 2002 – more than ten times that used in 1983<sup>55</sup>. Urea [principally manufactured in Taranaki using natural gas] consumption increased 160% between 1996 and 2002. The result has been faster grass growth & hence increased stocking capacity, but also emissions to air (see above) and leaching through the soil, leading to contamination of ground water (particularly in Canterbury and Waikato), streams and rivers, and lakes.<sup>56</sup> Tools and nutrient budgeting programmes are available to help achieve more targeted, less wasteful, fertiliser application but they are not widely used - for example only 19% of dairy farmers have systems in place to manage their nutrients.<sup>57</sup>

**System Condition Three:** *In the sustainable society, nature is not subject to systematically increasing degradation by physical means.*

Meeting this System Condition means drawing resources only from well-managed eco-systems, systematically pursuing the most productive and efficient use both of those resources and land, and exercising caution in all kinds of modification of nature e.g. over-harvesting and introductions.

When the impacts of introduced species are added to land-use effects and the over-harvest of indigenous species, the result is a woeful record of loss and continuing threat to New Zealand's remaining biodiversity. Since humans arrived in New Zealand 700-800 years ago, extinction has been the fate of 32% of our terrestrial birds, 18% of our seabirds, around half of our frogs, and at least one fish, one bat, three reptiles, probably numerous invertebrates and at least 11 plant

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<sup>53</sup> Projected balance of emissions units during the first commitment period of the Kyoto Protocol. MFE 2006.

<http://www.climatechange.govt.nz/resources/reports/projected-balance-emissions-jun06/html/page5.html#chart3>

<sup>54</sup> Galloway & Cowling 2002, Galloway et al 2002, quoted in PCE Report "Growing for Good"

<sup>55</sup> Statistics NZ 2003, quoted in PCE Report "Growing for Good"

<sup>56</sup> See Chapter 5, PCE Report "Growing for Good" 2004, for a summary of the data.

<sup>57</sup> "Dairy farms cleaner", Tim Cronshaw, The Press, 2 June 2006.

species<sup>58</sup>. Today, over 2,000 species face significant threat, with 533 of those in one of the four categories from Nationally Critical to Serious Decline.<sup>59</sup>

While New Zealand's biodiversity trends seem poor by global standards, this is partly because, as the last major land-mass colonized by humans, it has been impacted starkly recently. The pre-human benchmark is still easy to read in our sub-fossil record and in some parts of the landscape, such as on offshore islands. New Zealanders still understand the nature of an undegraded nature, whereas in many countries the degradation is of such long standing that the benchmarks, and hence human understanding, are compromised. Perhaps this is why we have such a deserved reputation for conservation innovation. While many of our indigenous species are gone forever, protection and restoration of those remaining are still achievable goals.

How has nature been systematically degraded in New Zealand? By about 1600, as a result of fires lit by settlers, around a third of the native forests had been replaced by indigenous grassland. From around 1850 until the late 1900s, there was a second wave of land clearance, again much of it through burning, with a further third of our forest becoming pasture or exotic plantation forest. While the clearance of land has largely been arrested in recent years, the "improvement" of pasture through fertilization and over-sowing has continued to degrade its remaining indigenous elements. In areas of the South Island, the process of tenure review is facilitating this through freeholding productive parts of crown-leased land. This results in scarce lowland biodiversity remnants being lost while less threatened montane areas remain protected.<sup>60</sup>

The loss of wetlands is much more dramatic than that of forests, some 90 % of their original area having been drained or irretrievably modified.<sup>61</sup> Wetlands are uniquely vulnerable at global as well as national and local scales due to their productive soils and a flat topography well-suited to conversion to agricultural, industrial and/or residential purposes. Unlike the forests, however, the degradation of wetlands and consequent loss of their biodiversity continues today.

Other aspects of water management continue to systematically degrade nature, even though, in some cases, the impacts are difficult to measure and articulate. Water abstraction for irrigation is increasing steadily. The area of irrigated land in New Zealand has increased at a rate of about 55% each decade since 1965<sup>62</sup> and it is predicted that this will continue<sup>63</sup>. The additional water allows higher farm productivity but only by also increasing other inputs (electricity for irrigation, fertilisers etc – see SC1 and 2 above). Consequent potential impacts include more nitrates and faecal bacteria run-off into rivers and aquifers; aquifer depletion; reduced river flow for indigenous plants and animals, fishing and recreation; removal of trees and hedges to prevent obstruction of centre-pivot irrigators; and unknown impacts on the, as yet little understood, biodiversity of ground waters.

Removal of vegetation cover (e.g. by forest and scrub clearance and inappropriate tilling) and stock access to stream edges can result in loss of soil and reduction in water quality. Protection of the

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<sup>58</sup> Department of Conservation and Ministry for the Environment. 2000. The New Zealand Biodiversity Strategy.

<sup>59</sup> Hitchmough, R.A. (compiler) 2002. NZ Threat Classification System lists. Department of Conservation. Wellington.

<sup>60</sup> Walker, S.M. et. al. 2006. Assessment of risk of biodiversity loss in New Zealand, and its application to Land Tenure Review. Conference paper, Joint Conference of the NZ Ecological Society and the Ecological Society of Australia, 27 August -1 September 2006.

<sup>61</sup> Ministry for the Environment. 1997. *NZ State of the Environment Report*.

<sup>62</sup> Lincoln Environmental 2000 and Statistics NZ 2003, quoted in PCE Report Growing for Good 2004.

<sup>63</sup> In 2004 MAF estimated that 360,227 hectares were irrigated in 2004, and predicted that up to 425,600 more hectares could be irrigated in future. *Water Programme of Action: Waters of National Importance for Irrigation*. MAF Technical Paper: 04/10, August 2004. [http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/water-programme-of-action/water-of-national-importance-for-irrigation/water-of-national-importance03.htm#\\_Toc90087110](http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/water-programme-of-action/water-of-national-importance-for-irrigation/water-of-national-importance03.htm#_Toc90087110)

edges of rivers and stream by riparian planting and fencing stock out is improving, but we still lose an estimated 390 million tonnes of soil into our marine environment each year.<sup>64</sup>

In contrast, while there is still a boom-bust style over-harvest for some species, and practices like bottom trawling still degrade large areas, management of New Zealand's marine fisheries has taken a positive turn. Our quota management system is widely regarded as one of the best approaches to sustainability globally.

Globally, mining is commonly seen as a threat to nature. In one sense, New Zealand is no different, with coal mining threatening endemic snail species on the West Coast. However, the scale of impact is probably significantly less than that experienced in many parts of the world. Nevertheless, the physical destruction of habitat, disruption of water tables, obstruction of migration and dispersal routes for animals and plant propagules and other physical degradation of natural processes and organisms remains problematic.

About 730,000 hectares (3%) of New Zealand's total land area is taken up by urban areas, with a further 160,000 hectares taken up by transportation networks. Although the area taken up by transportation has not changed significantly over the past 25 years, the rate of urban expansion has been of the order of 4%-5% per year. Where housing and commercial development have expanded, there has been a commensurate decrease in the stock of agricultural land<sup>65</sup>, with many cities paving over their prime soils. Urban areas are 72-98% impervious in business districts (meaning contaminants are quickly picked up and taken by stormwaters into estuaries and little is retained to feed plants), and around 50% impervious in established suburban areas.<sup>66</sup> In many areas house footprints continue to increase, as larger and larger houses occupy more and more of the section, leaving little space for nature. All of this 'concreting over' and 'ploughing up' not only degrades natural habitat but also affects natural flows of water, aquifer recharge, air and water self-purification and a host of natural life-support processes and the organisms that mediate and indicate them.

**System Condition Four:** *In the sustainable society, people are not subject to conditions that systematically undermine their capacity to meet their needs.*

While this system condition goes beyond the direct focus of the current PCE project on environmental sustainability, the ability of people to meet their needs is a key aspect and requirement of a sustainable society, and we are unlikely to be able to achieve environmental sustainability in our society if people are unable to meet the basic needs. Furthermore, since we all depend upon the same global pool of resources and life-support services, it is through equitable and sufficient access to biophysical resources that needs are met locally and globally. Satisfaction of human needs thus become an essential element of a society using resources on a sustainable basis.

Humans have basic needs without which life is either impossible or unfulfilled. From the basics of food and water, through to support from family and community, there are various articulations of these needs. For example, Abram Maslow's well-know 'pyramid of needs' poses a hierarchy of needs from basic life support through to 'self-actualisation'. According to Chilean economist Max-Neef, all humans have the same basic needs - subsistence, protection, affection, understanding, participation, idleness, creation, identity, freedom. Max-Neef postulates that "basic needs are finite, few and classifiable" (in contrast to wants which may be diverse and infinite) and that they are the

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<sup>64</sup> <http://www.mfe.govt.nz/publications/ser/gentle-footprints-may06/8-oceans.pdf>

<sup>65</sup> <http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/land-management/land-use-change/land0001.htm>

<sup>66</sup> [www.landcareresearch.co.nz/research/rurallanduse/spinfo/2006/SPINFO2006\\_rural\\_urban\\_mapping.pdf](http://www.landcareresearch.co.nz/research/rurallanduse/spinfo/2006/SPINFO2006_rural_urban_mapping.pdf)

same in all cultures and all historical periods. These needs are always present, but what changes, both over time and through cultures, is the ways or means by which the needs are satisfied. Any fundamental human need that is not adequately satisfied reveals a human poverty. A key feature of this analysis is that these needs are non-substitutable, with a 'satisfier' for one need failing to address another. For example, money can not compensate for thirst or affection, though our consumer society acts as if it could.<sup>67</sup>

So is New Zealand a country where all the basic needs of all the people are met or have we, like many developed countries, become focused on meeting material wants, and in so doing made it harder to meet some basic needs? Does NZ international policy (trade, immigration etc) and practice act to prevent or help the ability of people in other countries to meet their needs?

A true analysis of New Zealand society against this system condition would be looking at the extent to which people are subject to conditions that systematically undermine their capacity to meet their needs, for example by abuses of political, economic or environmental power. Such a study is beyond the resources available for this project. However as a first step and within the limits of this brief review, Appendix 2 contains a preliminary assessment of how well each of these nine basic needs are currently being met in New Zealand.

In summary, while the majority of New Zealand appear to have little difficulty meeting most of their basic needs, even the financially richest may be struggling to meet some needs because of time poverty<sup>68</sup>, and the financially poorest in our community are struggling to meet many needs. Over the last twenty years our increased focus on individual rights and material wellbeing has increased income inequality and a significant part of the population now has trouble meeting basic subsistence needs. Twenty six percent of children in 2004 were living in families in the "severe" and "significant" hardship categories, up from 18% in 2000. In the same period the proportion of Maori families living in severe hardship rose from 11% to 20% and the proportion of Pacific Island families rose from 16% to 30%.<sup>69</sup>

Time poverty has many impacts. Longer working hours among the full time employed, and a need to hold down several jobs to make ends meet among the most poorly paid, means many families and individuals are time poor, and the time for healthy relaxing social interaction is diminished to the extent that it is leading to poverty in the needs for affection, participation, leisure and creation. Higher acceptance of the messages of advertisers (happiness comes from consumption of material goods) is leading more and more of the population into debt, creating a vicious cycle of needing to spend more hours working (or taking up theft) to pay for the purchases.

New Zealand is a country potentially very rich in all senses. We have a benign climate, fertile land to address our subsistence needs, a wonderful environment for experiencing rejuvenation of the

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<sup>67</sup> Max-Neef, M. 1991. *Human Scale Development* 1991, the Apex Press, New York and London, and Paul Ekins & Max-Neef, M. 1992. *Real-Life Economics: Understanding Wealth Creation*, 1992, Routledge, London. Another set of criteria for basic needs which focuses more on physical needs is the United Nations "Ten determinants for improving well-being and reducing poverty": Being able to...be adequately nourished, be free from avoidable disease, live in an environmentally clean and safe shelter, have adequate and clean drinking water, have clean air, have energy to keep warm and to cook, use traditional medicine, continue using natural elements found in ecosystems for traditional cultural and spiritual practices, cope with extreme natural events including floods, tropical storms and landslides, make sustainable management decisions that respect natural resources and enable the achievement of sustainable income stream. (from "*Exploring the links – human wellbeing, poverty and ecosystem services*" UNEP 2004)

<sup>68</sup> For example, those earning \$100,000 or more are least likely to be satisfied (62%) with their work life balance. <http://www.socialreport.msd.govt.nz/paid-work/satisfaction-work-life-balance.html>

<sup>69</sup> "New Zealand Living Standards 2004" <http://www.msd.govt.nz/work-areas/social-research/living-standards/living-standards-2004.html>

spirit, and high (though diminishing significantly in some areas) levels of social capital. What we may be failing to do is focus on what is really important, the deeper connections that bring us happiness in our lives, and instead spending too much time and money chasing the environmentally, socially and financially damaging mirage of happiness through consumption.

A subsequent study could examine more deeply the mechanisms that undermine the capacity of New Zealanders to meet all their basic needs.

### **C: WHAT MIGHT A SUSTAINABLE NEW ZEALAND SOCIETY LOOK LIKE?**

The system conditions set the minimum conditions for a sustainable society – the minimum required to stop the systematic decline of living systems for nature and people. In describing a desired vision for the future, the normal human reaction is to go beyond this bare minimum, especially for system condition 4, and to aim beyond simply meeting basic needs to a future of restoration and abundance. The vision below of a socially attractive community – flourishing, lively, innovative and happy, where the basic needs of all are met within the ecological constraints of the first three system conditions,<sup>70</sup> is followed by a description of the requirements simply to meet the system conditions.

In a sustainable future, we will have a community of very high social capital where every child is loved and everyone is able to meet their basic needs. All appreciate the value of time – time to work and time for recreation and reflection, time for friends and family and time for oneself. We value individual activity and achievement equally with contributions to collective wellbeing and achievements made in partnership with others. In our communities there will be a high level of participation in a wide range of social, cultural and sporting activities, very high levels of literacy, high levels of engagement in local democracy, high levels of employment, and no family violence or child poverty. The gap between the richest 5% and poorest 5% has shrunk to the point that the rich no longer feel the need to defend their homes with alarms and security fences because the poorest 5% also feel they have a rich full life. All the population balance needs and wants of today with needs of tomorrow and future generations, maintaining high savings levels and low debt levels. The population is fit and healthy, known for its sporting prowess and high levels of involvement in all forms of sport, dance and other forms of physical activity, with low levels of obesity.

The social focus has shifted from “having” to “being” and “knowing”. Life long learning is much valued and people recognize their dependence on functioning nature and appreciate and understand their effects on it and seek to nurture and restore it.

The Genuine Progress Indicator<sup>71</sup> has become the key indicator watched by politicians and the market. Laws and processes are in place that ensure that all externalities are included in the price of transactions, and companies are regularly assessed on their effectiveness, efficiency, ethics and contributions to the community, and their progress towards meeting the system conditions.

We will be world-renowned for our sustainable agricultural, forestry and fishing practices. We will have developed resilient pasture systems, methods of enhancing soil structure and fertility without use of large quantities of imported or fossil fuel based fertilisers, pest control without use of

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<sup>70</sup> Many of the social goals are well expressed in the Desired Outcomes for Social Wellbeing listed in the 2006 Social Development Report – see Appendix 2.

<sup>71</sup> [If the GDP Is Up, Why Is America Down?](#) by Clifford Cobb, Ted Halstead, and Jonathan Rowe. *Atlantic Monthly*, October 1995, pp. 59-78. See also the website of Redefining Progress <http://www.rprogress.org/index.shtml>

persistent chemicals, and be skilled at keeping our fish harvest within sustainable yields. We are highly innovative, adding significant value to our biological raw materials. We focus on quality primary products rather than quantity, and all New Zealanders have ready access to farmers markets where they can buy fresh produce of the region.

Our tourism destinations will be managed to attract longer stay visitors, rather than marketed for volume. This was the essence of the 2010 tourism strategy and it will be fully adopted by all regions. The 100% Pure NZ marketing campaign will be modified to acknowledge this is our goal rather than where we are now – and focus on our aim to be the first sustainable nation in the world.

We will be leaders in sustainable technologies and quick at picking up the most sustainable technologies developed by others - energy efficiency and renewable energy, energy efficient transportation systems (especially the ones that take our exports to the world), biomimicry, resource recovery and recycling. Building on our natural advantages, we will have developed particular expertise in growing and gaining energy from biomass, in wind and geothermal energy, and in ocean power, including wave, current and tidal energy.

Again making a benefit out of a necessity, we will have developed highly effective and efficient closed loop remanufacturing and resource recovery systems, reducing our need for imports of metals to supply New Zealand manufacturers, and have virtually eliminated our dependence on mined materials that are likely to accumulate in nature. Producer responsibility legislation will cover all locally produced and imported goods and we will make minimal use of landfills.

We will be 100% energy self-sufficient using a range of renewable energies (wind, wave, hydro, micro hydro, solar, biofuels, geothermal) via both centralised and distributed energy systems. New Zealand homes are soundly built, well insulated, and affordable, providing healthy comfortable homes with minimal use of energy, and urban planning is done with sustainability as key criteria. All New Zealand cities have very efficient, affordable and well-used public transport systems, and promote walking and cycling, with efficient land (especially train) and sea freight systems.

### **Expressing this in the context of simply meeting the four System Conditions:**

#### **New Zealand will seek to eliminate our contribution to...**

1. ... systematic increases in concentrations of substances from the Earth's crust.

We will eliminate our dependence on fossil fuels for energy (including all transport uses) and chemical feedstock (including urea and plastic manufacture), and retain our nuclear free policy to ensure no accumulation of radioactive material. We will manage our use of mined materials to maximise our use of already mined materials through highly efficient metal recovery systems and minimise our dependence on virgin mined materials likely to accumulate in nature so lithospheric matter doesn't get remobilised into the biosphere, including a low dependence upon linear use of mined phosphorus fertilisers and development of new technologies based on the abundant elements.

2. ... systematic increases in concentrations of substances produced by society. ...

We will systematically assess all the chemicals approved for use in New Zealand and replace persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature. We will eliminate our contribution to increasing concentrations of natural substances such as CO<sub>2</sub>, nitrogen and phosphorus in the environment by moving out of fossil fuels (see above) and significantly improving fertility management so fertilisers do not leach out into groundwater and waterways. We will foster efficient use and cycling of all substances produced by society through a range of measures including legislation (e.g. Producer Responsibility Act), education and economic instruments (disposal and pollution charges, refundable deposits etc).

3. ... systematic physical degradation of nature.

We will draw resources only from well-managed eco-systems, systematically pursuing the most productive and efficient use both of those resources and land, and exercising caution in all kinds of modification of nature e.g. overharvesting and introductions

4 ... conditions that systematically undermine people's capacity to meet their needs.

We will ensure that our behaviour does not restrict the opportunities for other people, now or in the future, to lead a fulfilling life.

## **D: WHAT STEPS SHOULD WE START TAKING NOW TO REACH OUR VISION OF A SUSTAINABLE SOCIETY?**

From the vision of New Zealand society within a sustainable future, we are in a position to explore incremental steps that lead there from today. This process is called backcasting. The ultimate goal is distant from where we are today, and can only be achieved through cross-sectoral understanding, cooperation and community-wide buy-in. To achieve this commitment, this next stage in the process – identifying the key challenges and the multitude of actions to take us to our vision of a sustainable society – needs to be carried out by a group representing the different aspects of New Zealand society, once they have reached agreement on the analysis under A, B and C above. What follows therefore is just an example of how this might work.

### **Key Sustainability Challenges for New Zealand**

**Challenge 1: Reliable energy supply not dependent on fossil fuels or nuclear power (SC1, SC4).** This is the key challenge for all of humanity but one that New Zealand is better placed than many countries to meet. Achieving it will require total commitment from all branches of government, and a wide process of public education and engagement.

**Challenge 2: Sustainable agriculture, forestry and fisheries (SC1-4).** Food and fibre are basic requirements for any human society and New Zealand has tremendous natural assets in its soils, waters and temperate climate to excel in primary production, but we must become much better at doing it sustainably. To maintain export markets for primary production in a carbon conscious world, we need to hang onto/recover our traditional competitive advantage of skills in extensive agriculture so we can show that despite the transport miles to market, our primary produce still uses less energy overall and addresses all other aspects of sustainability as well. Instead of pursuing volume sales we need to focus on products with high value added. We need to learn how to manage production without heavy dependence on mined materials (fossil fuels or fertilizers) and use of persistent chemicals, without causing accumulation of compounds in natural systems, or disrupting water cycles and the ecosystems that depend on water flows, and in ways that retain and build our soils and fish stocks, and build flourishing rural communities.

**Challenge 3: Diverse ways of generating income without violating any of the system conditions (SC1-4).** While primary production is likely to continue to provide the mainstay of our economy, it only employs a small percentage of the population and does not provide all the goods and services our society needs. We therefore need to develop a range of other ways of generating revenue sustainably. For example, the tourism sector needs to focus on sustainable management of their destinations and maximizing revenue from minimum carbon emissions (attracting travelers from closer to home and keeping them for longer) and we need to start identifying and fostering goods and services that meet real human needs and can reach their markets without significant use of fossil fuel, e.g. IP and internet services.

**Challenge 4: Close the Loop (SC1-4).** Using a variety of mechanisms, including market signals (see below), we must develop cyclic systems which recapture materials and feed them back into the economy. A very small start has been made on packaging materials through a voluntary agreement with players in that sector, but a much higher priority is mined materials that are accumulating in living systems e.g. metals such as cadmium, nickel, copper, lead, zinc, mercury, chromium, molybdenum, and silver; semi-metals such as antimony, and non-metals such as carbon, nitrogen and phosphorus.<sup>72</sup> Fostering remanufacture<sup>73</sup>, design for disassembly and reuse, and more effective use of nutrients - through disposal charges, take-back clauses, producer responsibility legislation and other provisions encouraging cyclic use of resources - would serve multiple objectives, including reducing costs of products with high materials input,<sup>74</sup> reducing balance of payment deficits, reducing the environmental and social costs of mining and eutrophication, while probably also increasing employment.

**Challenge 5: Effective use of market signals for sustainability,** including discouragement of activities that violate the system conditions (including by removing subsidies for them) and encouragement of activities that move towards meeting the system conditions (SC 1-4). Under the current pricing systems, acting in a way that enhances the long term survival of our society often requires companies and individuals to act against their own short-term economic self-interest. Fossil fuel pricing for example covers only a minute fraction of the economic impacts of climate change, so commuters, transporters of goods, and other energy users can make decisions without bearing the full cost of those decisions. Farmers bear no cost for contaminating land with cadmium or waterways with nitrogen or for using the shared resource of water, and those who dispose of rare mined materials do not bear the economic, social or environmental cost of mining new minerals to replace them. Reducing biodiversity by land clearance or drainage or poor pest management is not penalized, but enhancing natural capital is often not rewarded, and giving employment to people is taxed. We need to progressively and actively switch pricing signals to encourage sustainable activities and discourage activities which are jeopardizing all of society.

**Challenge 6: Science, research and education systems that support learning and innovation toward a sustainable society (SC1-4).** A truly sustainable society will be a very different society from New Zealand in 2006. Making the transition is going to require new knowledge and skills in many areas, and will need the support an active participation of a well-informed population. It is

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<sup>72</sup> C. Azar, J. Holmberg & K. Lingren, Socio-ecological indicators for sustainability, *Ecological Economics* 18: 89-12, 1996.

<sup>73</sup> "Remanufacturing is a highly sophisticated form of recycling that takes end-of-life components and turns them into like-new products for a fraction of the cost," said Levenick. "Our remanufacturing business is one of the fastest growing parts of our company because this technology helps our customers remain competitive and promotes a sustainable environment by reducing waste and the need for raw materials to make new parts." *Caterpillar to Help Develop Remanufacturing Industry in China*, Green Biz.Com Sep 15, 2006.

[http://www.greenbiz.com/news/news\\_third.cfm?NewsID=34022](http://www.greenbiz.com/news/news_third.cfm?NewsID=34022).

The US remanufacturing industry generates approximately \$65 billion in sales, with the automotive segment (e.g. remanufacture of diesel engines) representing \$37 billion of that total. The cost for a remanufactured part is generally 30-50 percent of what a new part would cost, because labour, energy and raw materials are conserved.

*Remanufacturing: The Original Recycling*. Business Week Online December 30, 2005.

[http://www.businessweek.com/autos/content/dec2005/bw20051230\\_058327.htm?chan=search](http://www.businessweek.com/autos/content/dec2005/bw20051230_058327.htm?chan=search)

<sup>74</sup> "Remanufacturing places as much focus on wringing productivity out of physical materials as out of labor. As a general rule, 70% of the cost to build something new is in the materials and 30% of it in the labor. Remanufacturing asks: Why not work on the larger component? People have been rebuilding things as long as there have been tools, but a small cadre of forward-thinking companies have spotted opportunity anew in the process. Big companies that do it include General Electric (**GE**) and Xerox (**XX**), and smaller outfits such as carpet maker Interface (**IFSIA**) and oil and gas services company Hanover Compressor (**HC**) do it, too. Lately none has been embracing remanufacturing as aggressively as Caterpillar. All these companies are reclaiming products after they've been used one or more life cycles. They then start the manufacturing process over again with materials that are essentially free -- with all the energy costs already baked right in. The business model becomes only more compelling as metals and minerals hover near record prices, and as oil -- the lifeblood of industry -- flirts with \$70 a barrel." *Everything Old is New Again*. Business Week Online September 25, 2006, [http://www.businessweek.com/magazine/content/06\\_39/b4002074.htm?chan=search](http://www.businessweek.com/magazine/content/06_39/b4002074.htm?chan=search)

imperative that sustainability becomes an integral part of all education programmes, and that science funding is targeted to meet the research and innovation needs of a society that is living within the system conditions.

Examples of possible actions to achieve the vision of a sustainable New Zealand society are provided in Appendix 4.

## **TAKING THIS FORWARD – SUSTAINABLE DEVELOPMENT IN NEW ZEALAND**

The overview provided in A, B, and C above can now be used as a starting point for a broader consensus process aimed at developing a common vision for a Sustainable New Zealand, and agreement on the key actions required to get us there.

The Natural Step framework has been used in this way in UK and Sweden, with a basic overview document such as this used as a starting point for developing consensus among a core group of stakeholders. Once this group have contributed to and are happy with the basic presentation of facts under “B”, they move onto “C” and “D”, and once this group have reached the point of feeling ownership, it is taken out to a broader group of stakeholders.

This process has been used in the UK on issues as diverse as PVC manufacture and use, GMOs, Sustainable Urban Drainage Systems, Bulk Printing, and biosolids, and in Sweden issues tackled have included sustainable agriculture, sustainable municipalities and sustainable transport. Some of these processes have been reasonably quick (six months or less) while the more comprehensive subjects have taken longer. For instance the Swedish agriculture process took nearly two years but resulted in a strong common desire across the agriculture sector to be “the greenest agriculture in the world”, and a very effective action plan has flowed from that. The Canadian municipality of Whistler provides a small scale model. Business and policy makers from all sectors applied the above described framework to arrive at a generic description of an attractive sustainable Whistler, as well as ways to go there including indicators. Whistler has received numerous awards for this work including first place in UNEP’s recent Livcom’s “Planning for the Future” Award. This Award was for its long-term comprehensive sustainability plan, *Whistler 2020 – Moving Toward a Sustainable Future*, which is a leading example of the application of The Natural Step Framework in a community planning context.

The specific steps suggested to achieve a consensus on a sustainable vision and action plan in New Zealand are:

- 1) Resource taking the A, B and C sections of this paper to next level of detail and fund peer review of it by a group of 6-8 leading researchers and activists.
- 2) Establish a core panel of 15-20 key individuals across the main spheres of New Zealand life, and through a series of workshops and reiterative reviews gain a common understanding of A and a consensus on the analysis in B. Once this has been achieved, ask the group to develop a vision for New Zealand society (C), then to identify and prioritise actions under D, including a mix of “low hanging fruit” that are likely to deliver easy, early wins, and important strategic but longer term steps.
- 3) Once this core group has reached the point of feeling ownership and commitment to the document and the proposed actions, take the report out to wider groups of stakeholders.
- 4) Hold a series of conferences for public and private sector nationwide, publish articles, host web discussion forms etc to seek further input and to generate buy-in to the vision and the create a consensus for the way forward.

## **CONCLUSION**

Global society is at a cross-roads. Many indications are that we have less than ten years to radically address greenhouse gas emissions or risk potentially catastrophic climate change, and to develop systems that are not heavily dependent on the diminishing oil resource. Many species and ecosystems are also heavily endangered by human activity. To respond effectively in time to prevent these changes becoming irreversible, New Zealanders need to act in a much more integrated and active way to adopt more sustainable practices. The most effective way to do this in a democracy is to build a national consensus around the need to act, and then use rigorously tested sustainability principles to develop a shared vision of the society we want to create, and backcast from that to decide on agreed actions. The Natural Step consensus process offers a tested way to achieve this.

### **Acknowledgements:**

I would like to thank Jane Mountier and Lindsay Eaves for helping me track down some of the data, and Mark Everard, Environment Agency UK, Karl Henrik Robèrt, TNS International, and Steve Henry and John Craig, TNS New Zealand, for providing comments on early drafts.

## Appendix 1

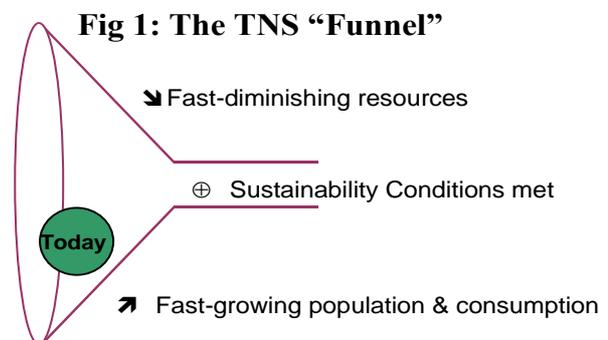
### Overview of The Natural Step framework

The challenge of sustainable development affects us all. Most of us can agree that it is an important concept, but what does it actually mean and how do you go about getting to grips with it in the messy world in which we live? This short overview defines what sustainability and sustainable development mean – they are quite distinct – and the scientific principles that help us understand them. It then introduces the principles and tools of TNS that are known as *The Natural Step Framework*. TNS and its tools are founded upon the application of this science in educating about sustainability, and the practical application of sustainable development.

#### About Sustainability and Sustainable Development

Growing world population and consumption, increasing demands upon and depletion of natural resources, accelerating levels of global pollution and resource depletion, and concerns about the impacts of businesses on society both at home and overseas, are not new problems.

Neither are they avoidable. They will increasingly constrain the “freedom to operate” of organisations and society at large. The Natural Step Framework uses the metaphor of “the funnel” to describe the inevitable tightening of these constraints, and the pressures to become more sustainable (Fig 1). Sustainable development addresses these challenges proactively, based upon a sound understanding of what sustainability means and implies for us.



A sustainable system can continue indefinitely. A sustainable society does not impair or overload the life-support systems that provide for its needs. A sustainable product, process or organisation respects nature’s non-negotiable limits and the rights of those with whom it interacts, however remotely. It is that basic and, at the same time, that remote from what we do today!

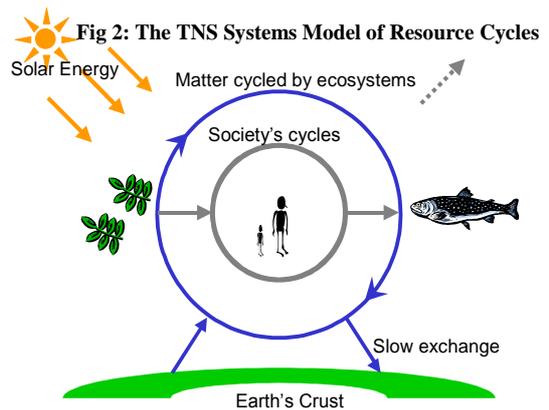
All too often, problems are addressed reactively, using technical means to cure symptoms after problems have arisen. True sustainable development goes a long way beyond merely complying with basic environmental and social obligations, and differs from traditional “end-of-pipe” solutions to pollution and social problems. It addresses issues “upstream”, in the early decision-making process, such that the pursuit of business does not systematically create the kinds of social and environmental problems that will, sooner or later, harm business performance and reputation.

How do we move from concept to practice, and begin applying it in the world that we live in? If we chase them back far enough, it is easy to see that businesses ultimately depend upon natural and human resources including for example, energy, timber, clean air and water, as well as the ingenuity and labour of people that converts these natural resources into economic goods. We all share the same world, and therefore our activities inevitably affect that same world and all those with whom we share it.

Since sustainability challenges are unavoidable, sustainable development is also possibly the greatest business opportunity of the age. It is firstly essential to acknowledge that the inherently sustainable Earth ecosystem, upon which we are fully dependent, operates in definite ways – ways that it is possible to define using science – which ultimately determine what is and what is not sustainable. The Natural Step’s approach to sustainable development is based upon a systematisation of these scientific principles.

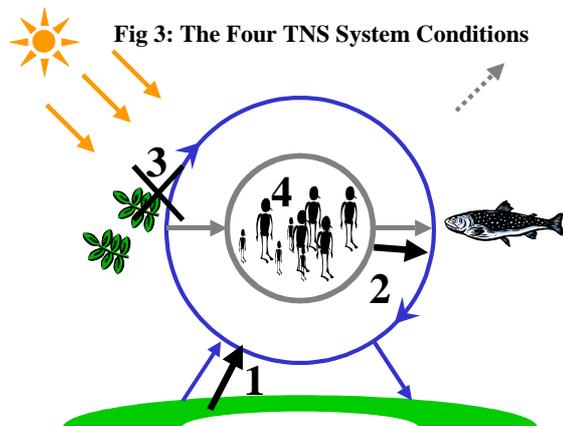
## The Natural Step Framework

The Natural Step (TNS) Framework presents a set of principles and strategic tools based on the scientific principles governing the Earth's ecosystem, the inherently sustainable system that supplies all our needs. At the heart of the Framework is a science-based systems model of this sustainable Earth system (Fig 2). This model incorporates what we know about the way nature operates - the cycling of matter in eco-systems, driven by the sun's energy, via green cells with slow exchanges of matter with the Earth's crust. And within that system are society's cycles that circulate the resources and information of social systems.



The Framework defines what sustainability means and helps organisations get to grips with sustainable development in their decision-making processes. It can also be used to explore the sustainability implications of today's products and processes, and the measures that must be undertaken to make them more sustainable. The Natural Step Framework comprises four elements:

**A. Sustainability awareness** comprises an understanding of sustainability, or in other words the conditions that must be met 'in the funnel' when social systems operate within the constraints of natural systems. The Framework includes four necessary System Conditions for sustainability stemming from the science-based systems model. These four TNS System Conditions are illustrated in Fig 3 in relation to the systems model showing that the System Conditions may also be thought of as four mechanisms by which people prevent natural and social systems from operating sustainably. The System Conditions are listed below:



*In the sustainable society, nature is not subject to systematically increasing...*

4. ...concentrations of substances extracted from the Earth's crust
5. ...concentrations of substances produced by society
6. ...degradation by physical means

*and in that society, people are not subject to conditions that systematically*

4. ... undermine their capacity to meet their needs.

**B. Current Sustainability Assessment:** On the basis of these four necessary System Conditions for sustainability, an objective Sustainability Assessment of the present degree of sustainability can be made.

**C. Visioning:** Having used the System Conditions to determine the present state of unsustainability, the system conditions can then be used as a tool to create a vision of how an organisation/society might operate in a fully sustainable future. It can be useful to consider the System Conditions in terms of sustainability objectives as listed below. If we base our scenario planning on the System Conditions, we encompass not merely the possibilities we might conceive today, but the scientific realities of the future into which society will unavoidably be squeezed.

## The System Conditions as Sustainability Objectives

*“Our ultimate sustainability objectives are to eliminate our contribution to:*

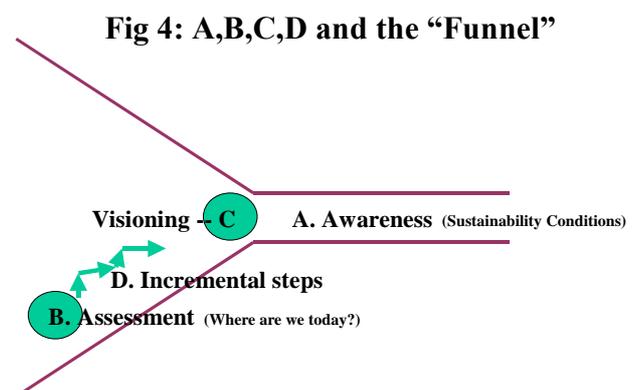
- 1. ... systematic increases in concentrations of substances from the Earth’s crust.*
- 2. ... systematic increases in concentrations of substances produced by society.*
- 3. ...systematic physical degradation of nature.*
- 4. ... conditions that systematically undermine people’s ability to meet their needs.”*

**D. Backcasting** is a process by which to determine the incremental steps that we have to take to reach our vision from where we are today. This differs radically from today’s more common technique of forecasting, which is an extrapolation from today’s knowledge, situation and trends to predict the future. Whilst yielding short-term gains, forecasting overlooks the inevitable changes and discontinuities with current trends that will arise through sustainability pressures. Incremental steps derived from backcasting acknowledge current constraints to full sustainability (for example limits to capital investment or the readiness of the market). However, they also reflect the progressive steps that can be made today, from which further future steps can be taken to lead along a clear path towards the vision of full sustainability.

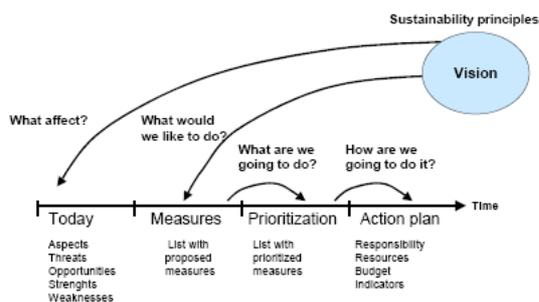
The following guidance can be useful in using the System Conditions.

- 1. This means substituting certain minerals that are scarce in nature with others that are more abundant, and using all mined materials efficiently, and systematically reducing dependence on fossil fuels.*
- 2. This means systematically substituting certain persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature, and using all substances produced by society efficiently.*
- 3. This means drawing resources from only well managed eco-systems, systematically pursuing the most productive and efficient use both of those resources and land, and exercising caution in all kinds of modification of nature e.g. overharvesting and introductions.*
- 4. This means checking whether our behaviour has consequences for people, now or in the future, that restrict their opportunities to lead a fulfilling life, by asking ourselves whether we would like to be subjected to the conditions we create.*

The A,B,C,D steps for applying the TNS Framework are illustrated in the context of “the funnel” in Fig 4. Together, they help define in unambiguous terms what sustainability means, and provides a readily understandable framework to get to grips with the practicalities of sustainable development. This tool helps organisations to integrate sustainable development into all their strategic planning, communication of complex ideas, the sharing of these concepts with partners and other social sectors, and making strategic judgements about the steps they need to take now towards a more sustainable future.



## Applying TNS Framework



It helps us address the fact that we cannot realistically hope to achieve sustainability immediately in a world that is far from sustainable, but enables us to “navigate” increasingly towards sustainability through incremental decisions. Importantly, the strategic approach to sustainable development enabled by backcasting – at odds from today’s more common eco-efficiency emphasis which merely makes unsustainable practice more “lean” – helps organisations avoid decisions that may represent “blind alleys” that do not lead a strategic path towards a clearly-articulated end-goal of sustainability.

See [www.naturalstep.org.nz](http://www.naturalstep.org.nz) for more information about The Natural Step organisation and about The Natural Step Framework and its application. In particular see <http://www.naturalstep.org.nz/r-1-articles.asp> for a wide range of scientific papers and reports about the Framework and <http://www.naturalstep.org.nz/resources-and-links.asp> for books and case studies about the Framework.

## Appendix 2: Preliminary Analysis of how well Basic Human Needs (as defined by Max-Neef) are met in New Zealand.

**Subsistence** – are all New Zealanders adequately nourished and free of avoidable diseases? Do they all have access to environmentally clean and safe shelter, adequate and clean drinking water, clean air, and energy to keep warm and cook? Is work available which allows them to earn enough to meet their subsistence needs?

Since the mid-1980s, life expectancy has increased – New Zealand's life expectancy at birth is around the middle range for the OECD countries at 81 years for females and 76 years for males in 1998-2000, compared with 79 and 73 years respectively in 1990-92. Life expectancy for Maori has improved over this same period but it is still 8.5 years less than non-Maori New Zealanders, with the gap partly reflecting different rates of diabetes<sup>75</sup> and smoking, as well as socio-economic differentials.

Cigarette smoking has decreased over this period, although in 2004 Maori still had the highest rates of smoking of all ethnic groups. Obesity on the other hand has doubled for men and almost doubled for women, reflecting changes in diet and physical activity.

The market income per person, income inequality, population with low incomes, and housing affordability indicators all deteriorated between the late-1980s and early-1990s. However, despite improvements since then, income inequality, population with low incomes, and housing affordability are still worse than they were in the mid-1980s.

In the year to March 2005, market income per person was \$28,998 in constant 1995/1996 dollars compared with \$22,735 in 1988. After growing slowly between 1988 and 1990, market income per person fell sharply between 1990 and 1992. Since then it has been increasing steadily, reflecting labour productivity gains, increasing labour force participation and declining unemployment. Household crowding has also improved steadily between 1986 and 2001.

<sup>75</sup> Mortality and demographic Data 1999, [New Zealand Health and Information Service \(2003\)](http://www.nzhi.govt.nz), p12

Income inequality has increased steadily since the economic reforms of the 1980s. The richest 20% now have 2.8 times more disposable income than the poorest 20%, compared to 2.4 times in 1988. Since 1988, incomes of those in the bottom 20 percent of all incomes have increased only a little, once adjustments for inflation are made, whereas those in the top 20 percent of incomes have climbed by more than a third.<sup>76</sup>

The proportion of the population with low incomes was substantially higher in 2004 than in 1988 and the proportion experiencing severe hardship also increased<sup>77</sup>. Twenty six percent of children in 2004 were living in families in the “severe” and “significant” hardship categories, up from 18% in 2000. In the same period the proportion of Maori families living in severe hardship rose from 11% to 20% and the proportion of Pacific Island families rose from 16% to 30%.<sup>78</sup> In practical terms this meant that in 2004 these families were less able to purchase basic items such as house heating in winter, or to fill prescriptions, and were more likely to go without items such as fresh fruit and vegetables and internet access than they were in 2000. During this same period the economy as a whole grew by 17%. This increase in the number of children in severe and significant hardship was almost entirely driven by falling living standards for beneficiaries with dependent children. Just as importantly, this group’s standard of living not only fell in absolute terms, it also fell in relative terms. While the standard of living for those in the lowest categories fell, everyone else’s improved or stayed constant, widening the gap between the poorest and the rest even further.<sup>79</sup>

Housing affordability was worse in 2004 than in 1988, although improving. Twenty two percent of households spent more than 30% of their income on housing in 2004, up from 11% in 1988, but down from the peak of 25% in 1997.<sup>80</sup> Those who could afford to buy a home are increasingly borrowing against the equity in their homes to finance their consumer spending, and banks are competing to provide the cheapest loans. The result is that on average households in New Zealand do not actually save *anything* out of current income but instead dis-save to the tune of around 12 per cent of income per annum – one of the lowest savings rates of any OECD country. Given many of the purchases are imported, this spending is also widening the country’s current accounts deficit.<sup>81</sup>

In 2005, 3.7% of the labour force (or 79,000 people) were unemployed and actively seeking work. This is considerably down from the peak of 10.4% in 1992 and also down from the rate of 4.1% in 1986 when records began. 22% of the surveyed unemployed had been unemployed for a continuous period of six months or more, substantially lower than the peak of 53 percent in 1992. Maori & Pacific peoples unemployment in 2005 was higher than the average at 8.6% and 6.1% respectively. Our unemployment rate was the lowest in the OECD in 2005 (equal with South Korea)<sup>82</sup> yet our current accounts deficit as a percentage of GDP was also the highest.

**Protection** – are we safe from physical or emotional harm, and free from the threat or fear of harm or danger? If we are physically or mentally ill or disabled, will we be taken care of?

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<sup>76</sup> The equivalised disposable income of a household at the 80th percentile was 2.8 times that of a household at the 20th percentile in 2004, compared with 2.4 times in 1988. An alternative measure is the Gini coefficient, which gives a score of 100 for perfect inequality and a score of 0 for perfect equality. Around the year 2000, New Zealand’s score of 33.9 indicated higher inequality than the OECD median (30.1) and a ranking of 18th out of 25 countries. Northern European countries had the least income inequality, with Denmark having the lowest Gini coefficient of 22.5, and the United States among the highest (35.7). <http://www.socialreport.msd.govt.nz/economic-standard-living/income-inequality.html>

<sup>77</sup> 2006 Social Development Report <http://www.socialreport.msd.govt.nz/economic-standard-living/population-low-incomes.html> and <http://www.socialreport.msd.govt.nz/economic-standard-living/population-low-living-standards.html>

<sup>78</sup> “New Zealand Living Standards 2004” <http://www.msd.govt.nz/work-areas/social-research/living-standards/living-standards-2004.html>

<sup>79</sup> Child Poverty Action Group <http://www.cpag.org.nz/resources/articles/res1154518029.pdf>

<sup>80</sup> <http://www.socialreport.msd.govt.nz/economic-standard-living/housing-affordability.html>

<sup>81</sup> “Imbalances in the New Zealand Economy”, an address by Dr Alan Bollard, Governor of the Reserve Bank of NZ, October 2005. <http://www.rbnz.govt.nz/speeches/2111459.html>

<sup>82</sup> <http://www.socialreport.msd.govt.nz/paid-work/unemployment.html>

In the five years to 2003, 38 children under 15 years of age died as a result of maltreatment. A UNICEF study of child maltreatment deaths in rich nations in the 1990s reported that New Zealand had the third highest child maltreatment death rate (1.2 per 100,000), behind only the United States and Mexico (both 2.2 per 100,000).<sup>83</sup>

The New Zealand National Survey of Crime Victims 2001 showed that 30% of New Zealand adults aged 15 years and over experienced victimisation during 2000, including 9% who were the victim of violent offending.<sup>84</sup> Eleven percent of all people reported they were the victim of an individual property offence, such as theft or willful damage, up from 8 percent in 1995. The proportions of all households which were the victim of a household property offence were 19 percent in 1995 and 17 percent in 2000.<sup>85</sup>

In the same 2001 survey, 29 percent of New Zealanders reported feeling unsafe walking alone in their neighbourhood at night. A fifth (20 percent) reported feeling only "a bit unsafe", while 9 percent felt "very unsafe". Pacific peoples were more likely than other ethnic groups to report feeling unsafe about walking alone in their neighbourhood after dark. Over a third (38 percent) of Pacific peoples said they would "feel unsafe", compared to 29 percent of the European and the other ethnic groups.<sup>86</sup>

The reported criminal offence rate more than doubled between 1971 and 1991, from 586 offences per 10,000 people to 1,284 offences, but by 2001 the rate had dropped to 1,106 reported offences per 10,000 people.<sup>87</sup>

Deaths and injuries from motor vehicle accidents have fallen substantially since 1986, possibly because of better vehicles and safer roads, as well as the impact of legislation, enforcement and education. Fatalities dropped by 47% between 1986 and 2005 and there were 24% fewer injuries.<sup>88</sup>

New Zealand has a comprehensive welfare system. Financial assistance is provided to a wide range of people, including widows, invalids, sick people, unmarried mothers, the unemployed, retired people and those training to improve their work skills, though the exact level of support and the criteria for eligibility are always the subject of debate between political parties.

New Zealanders can also count on a high level of protection if we are taken ill or suffer an accident (though as in most Western countries the expectations of higher and higher levels of intervention do place strains on parts of the system despite consistent increase in expenditure in the sector over the last ten years). Government funding of health services means that all NZ citizens and residents and most longer-stay visitors can receive free inpatient and outpatient public hospital services and subsidies on prescription items and there are a range of support services for people with disabilities in the community. Visits to the doctor and medicines are generally free for children under six years old, and subsidised for older children. Prescribed laboratory tests are free and prescribed drugs generally subsidised. Immunisation is free for children and so are some health checks in the early years of life.<sup>89</sup>

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<sup>83</sup> 2006 Social Development Report – <http://www.socialreport.msd.govt.nz/safety/index.html>

<sup>84</sup> Ibid. A small number of people accounted for the vast majority of violent victimisations. Less than 2 percent of the adult population were victims of violence five or more times, but they experienced 55 percent of the violent victimisations. Violent victimisations made up slightly less than half of the total volume of victimisations disclosed for the 2001 survey.

<sup>85</sup> Ibid.

<sup>86</sup> Ibid.

<sup>87</sup> Ibid.

<sup>88</sup> Ibid.

<sup>89</sup>

**Affection** - Are all our children loved<sup>90</sup> and cared for? Do New Zealanders feel they have adequate time and space to spend with their children, partners, family and friends, enjoying their company in a relaxed fashion, giving and receiving affection, love and friendship?

There is little information on how loved New Zealanders feel, but information on how connected people feel to those around them and how much time they spend with them gives some guide. In 2001, 63% of male secondary school students and 61% of female secondary school students reported that most weeks they were able to spend enough time with Mum and/or Dad. The level was slightly lower (55%) for Maori students than for European (65%).<sup>91</sup> Seventy percent of adults aged 18 years and over had friends or family over for a meal at least once a month in 2004.<sup>92</sup>

For many, the time available for family, extended family and community activities has decreased over the last twenty years. Legislation in 1990 made it possible for shops to open at any time except for 3.5 days of the year (Christmas Day, Good Friday, Easter Sunday and Anzac morning)<sup>93</sup>, providing some of the most liberal shopping hours in the world.<sup>94</sup> Retail workers across New Zealand must now frequently work evenings, at the weekend and on many public holidays, and there are no longer common holidays across the community available for community activities. Even for those not in the retail trade, shopping and spending time earning the money to shop is now consuming more time, though some now rank shopping as their main leisure activity.

Self-assessed loneliness is a proxy indicator of whether people are happy with the amount and quality of social contact they have. In 2004, 18% of New Zealanders reported feeling lonely during the last 12 months: 15% said they felt lonely "sometimes", 2% said they were lonely "most of the time" and fewer than 1% said they "always" felt lonely. Unemployed people and people without a partner were more likely than other New Zealanders to report feeling lonely (31% and 32%, respectively). NZ Europeans reported the lowest rate of loneliness with 15% reporting they were lonely "sometimes", "most of the time" or "always". 22% of Māori and 25% of Pacific peoples reported they were "sometimes", "most of the time" or "always" lonely. Asian peoples and people in other ethnic groups (excluding Asians) reported the highest rates of loneliness (both 36%).<sup>95</sup>

Experiencing loneliness declines as personal income rises. People with personal incomes of \$20,000 or less reported higher rates of loneliness than people with larger incomes: 25 percent said they felt lonely "sometimes", "most of the time" or "always" in the past 12 months. This compares with a loneliness rate of only 5 percent for those with a personal income over \$100,000. People living in Manukau City had the highest reported incidence of loneliness with 21 percent reporting they felt lonely "always", "most of the time" or "sometimes". Those living in the Rodney District had the lowest reported incidence of loneliness (14%).<sup>96</sup>

In 2004, 69 percent of New Zealanders said they believed people can be trusted, with 8 percent reporting "people can almost always be trusted" and 61 percent reporting "people can usually be

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<sup>90</sup> The chief indicator of success used by the Brazilian city Curitiba.

<sup>91</sup> *Youth2000 – New Zealand Youth: A Profile of their Health and Wellbeing* as reported in the 2006 Social Development Report

<sup>92</sup> 2004 *New Zealand Living Standard Survey* as reported in the 2006 Social Development Report.

<sup>93</sup> <http://www.dol.govt.nz/media/easter.asp>.

<sup>94</sup> For example, the UK Government announced in July that Shops in England and Wales will not be allowed to open for longer than the currently legislated 6 hours on Sundays, despite lobbying from retailers

<http://news.bbc.co.uk/1/hi/business/5152800.stm> and in Western Australia, a referendum held on the issue of allowing weekday trading to 9pm and 6 hours of trade on Sundays was defeated. [http://en.wikipedia.org/wiki/Western\\_Australia](http://en.wikipedia.org/wiki/Western_Australia).

In Europe Sunday trading is generally restricted or banned, e.g. see [http://en.wikipedia.org/wiki/Sunday\\_shopping](http://en.wikipedia.org/wiki/Sunday_shopping).

<sup>95</sup> *Quality of Life in New Zealand's largest Cities Survey 2004* as reported in the 2006 Social Development Report

<sup>96</sup> Ibid.

trusted".<sup>97</sup> This is well above the OECD median of 56 percent, but below that of Norway (87%), Denmark and Sweden (both 84%).<sup>98</sup>

Suicide is an indicator of the mental health and social wellbeing of society – feeling deprived of affection can be a factor, but so can feelings of alienation/lack of identity or lack of participation. New Zealand suicide rates are very high by international standards. In 2003 there were 16.9 deaths per 100,000 males (6<sup>th</sup> highest in the OECD), and 6.2 deaths per 100,000 females (4<sup>th</sup> highest in the OECD).<sup>99</sup>

**Participation** – Are all New Zealanders free to participate in family, social and community activities? Are they able to participate in the workforce and in the democratic process? Are people able to express their opinions, accept responsibilities and have their rights protected?

In 2005, 74.6 percent of 15–64 year olds (2.019 million people) were employed for one hour or more per week, the highest rate since 1986 or any time in between. The full-time employment rate is similar to what it was in 1986 (58.7% cf. 60.4%) but the number in part-time employment has increased from 11.9% in 1986 to 15.9%. Although the part-time rate has almost doubled for men since 1986, women (23.8%) continue to have a higher part-time employment rate than men (7.7%).

Voter turnout of the eligible population in the 2005 general election was 77%. Voter turnout at regional and local elections in 2004 was significantly less 44% - the lowest turnout in 15 years. Small and south Island communities tend to register a higher turnout across all election types, and Auckland the lowest.<sup>100</sup>

Being able to communicate and interact easily in the absence of frequent face-to-face contact helps maintain social connectedness. In 2004, 96% of households had access to a telephone, and 65% had access to the internet.<sup>101</sup>

The number of women elected to Parliament has gone up since the mid-1980s, but voter turnout has declined. In 1984, under the first-past-the-post system, 13% of the Members of Parliament were women. This climbed sharply to 29% in the first mixed-member-proportional election held in 1996. Following fluctuations in the subsequent two elections, women now make up 32% of the 121 MPs. The percentage of women on local boards and councils increased from 18% in 1986 to 30% in 1995, and remained at this level in 2004.

It takes time to participate in anything. Many organizations that have survived in the past on the work of volunteers are now struggling to survive as fewer people feel they have time to contribute.

**Understanding** – Does our education system provide young people with an ability to read and write, encourage their critical capacity and curiosity? Does it equip them to understand the world around them, including giving them a sound understanding of our dependence on natural systems and practical skills to live in a sustainable society? Is life-long learning encouraged?

Since the mid-1980s there have been substantial increases in participation in early childhood and tertiary education.<sup>102</sup> The proportion of school leavers with higher qualifications has also increased

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<sup>97</sup> Ibid.

<sup>98</sup> Statistics Canada (2004) and European Commission (2005) as reported in the 2006 Social Development Report

<sup>99</sup> <http://www.socialreport.msd.govt.nz/health/suicide.html>

<sup>100</sup> <http://www.socialreport.msd.govt.nz/civil-political-rights/voter-turnout.html>

<sup>101</sup> <http://www.socialreport.msd.govt.nz/social-connectedness/telephone-internet-access.html>

<sup>102</sup> In July 2005, 94 percent of all Year One students had attended some form of early childhood education service before starting school. In 1986, 4 percent of the population aged 15 years and over was enrolled in public tertiary education institutions, compared to 10 percent in July 2004 and 9 percent in July 2005. In July 2005, 11 percent of the

substantially from 47% in 1986 to 69% in 2004.<sup>103</sup> Most of this increase occurred in the late-1980s, with the level fluctuating between 63% and 69% since 1990. The greater availability of employment and training opportunities for young people without higher qualifications may explain some of the lack of continued growth in this area.<sup>104</sup>

In the year ended June 2005, 76% of the population aged 25–64 years (1.6 million people) had attained an educational qualification at upper secondary level or above, up from 64% in 1991, and 18% (382,000) of adults had a bachelor's degree or higher qualification, compared with 8% in 1991.<sup>105</sup>

All this education has equipped barely half of us with the literacy skills of a “suitable minimum for coping with the demands of everyday life and work in a complex, advanced society.”<sup>106</sup> Results from the first international literacy survey in 1996 show that 54% of New Zealand's population aged 16–65 years had prose literacy skills at Level 3 or above, 50% had document skills at Level 3 or above and 51% had quantitative skills at Level 3 or above. Although all these figures sound very low, they compare fairly well with the OECD median for prose literacy (53.5%) and document literacy (52.9%), but poorly compared with the OECD median for quantitative literacy (57%).<sup>107</sup>

Education for Sustainability is in its infancy in New Zealand. The New Zealand government's “Guidelines for Environmental Education” produced in 1999, began formalising the process of implementing education for sustainability by training teachers in primary and secondary schools. These programmes were optional for teachers and less than 5% participated nationally (Henry, pers comm). These guidelines have been implemented collaboratively with the EnviroSchools programme, a partnership between schools and local government which began in the Waikato in 1993 and has since spread nationally. There are 386 schools in the programme which represents 14% of all schools in NZ (Mardon, pers comm.) Since 2004 there has been a staff of twenty advisors with the Ministry of Education focused on implementing sustainability initiatives, and in May 2006, the Government pledged \$13million for environmental education in schools over the next four years, as part of Labour's post-election agreement with the Green Party<sup>108</sup>. Most universities offer sustainability related courses, but in none has sustainability become an integral part of curriculum or practice.

**Creation** – do New Zealanders have the time, space, skills and support to be inventive, curious, imaginative, and innovative?

New Zealanders have a tradition of innovation, fed largely by our physical space and landscapes and the challenges of our remoteness. With increasing globalisation and ready access to material goods from all over the world, some incentives to inventiveness are diminishing, but the challenges of making our living in the world remain. Over the last ten years there has been increasing public

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population aged 15 years and over (350,853 people) was enrolled in formal tertiary education, 5% in degree and post-graduate courses and 6% in sub-degree courses. Maori are more likely to be enrolled in tertiary education than non-Maori, but Maori and Pacific students are less likely to be enrolled in degree courses than those of other ethnicities.

<sup>103</sup> Note this still means 31% of students left school without achieving NCEA Level 1 or any higher qualification. Maori (53%), those from Decile 1-3 schools (46%) and males (34%) were most likely to leave without qualifications.

<sup>104</sup> <http://www.socialreport.msd.govt.nz/knowledge-skills/school-leavers-higher-qualifications.html>

<sup>104</sup> <http://www.socialreport.msd.govt.nz/knowledge-skills/school-leavers-higher-qualifications.html>

<sup>105</sup> <http://www.socialreport.msd.govt.nz/knowledge-skills/educational-attainment-adult-population.html>

<sup>106</sup> Literacy is defined internationally as prose, document and quantitative skills at Level 3 or above, with Level 3 being a “suitable minimum for coping with the demands of everyday life and work in a complex, advanced society.”

<sup>106</sup> <http://www.socialreport.msd.govt.nz/knowledge-skills/adult-literacy-skills-english.html>

<sup>107</sup> <http://www.socialreport.msd.govt.nz/knowledge-skills/adult-literacy-skills-english.html>

<sup>108</sup> “Government Pledges \$13m For Environmental Education”

[New Zealand Energy & Environment Business Week](#) 17 May 2006

and popular support for those involved in creative activity in the arts, literature, film, design, music and technology. Many schools provide community education classes that allow people to pick up creative skills.

**Leisure** - Do New Zealanders have enough time for relaxation, reflection, tranquillity, spontaneity, recreation and fun, away from work and other commitments? Do they have access to intimate spaces, social gathering places and natural landscapes?

New Zealand has an abundance of beautiful natural environments for recreation. The coast is nowhere far away and over 30% of the land area is in protected parks and reserves, well serviced with tracks, huts and ski-fields. Over the last ten years international quality museums, art galleries and stadia have been opened, and cafés and other places for spending leisure time have increased significantly.

Not surprisingly therefore, four in five New Zealanders surveyed in 2004 (80 percent) were satisfied or very satisfied overall with their leisure time.<sup>109</sup>

But do we have enough time for leisure, or is work, shopping and other activities increasingly impinging on it? A Work-Life Balance Report in 2006 found that only 52% of New Zealanders rate their work-life balance as good to excellent. Forty percent have some or a lot of difficulty getting the balance they want and 46% experience some degree of work-life conflict. Many of those in full time jobs are working longer hours – more than 19% of New Zealanders work more than 50 hours per week, and more than a third (39%) said they needed to work extra (unpaid) hours in their own time to get the job done once or twice a week or more (and both these figures are likely to be underestimates as those working longer hours were likely to be underrepresented in the survey). Two thirds are satisfied with the number of hours they work but 28% would prefer to work fewer hours, even if it means earning less money. The group most satisfied with their work life balance were those working 10-19 hours/week.<sup>110</sup> Employed New Zealanders whose personal incomes are \$20,000 or less (a group that includes many women working part-time) are the most likely to be satisfied overall with their balance of work and life (73%) while those earning \$100,000 or more are least likely to be satisfied (62%).<sup>111</sup>

**Identity** – Do New Zealanders share a strong national identity, have a sense of belonging and value cultural diversity. Is everybody able to pass their cultural traditions on to future generations; and is Māori culture valued and protected?<sup>112</sup> Do they identify with their community, and feel they belong to particular social and ethnic groups? Do they have places they feel they belong to, and are they free to practice their traditional customs and religion?

New Zealanders sense of belonging and sense of place draws on many strands. Our national identity has been shaped by war, sport and other social forces, and we are becoming increasingly rich in cultural diversity, as the cultural identity of the tangata whenua gains more prominence and the variety of immigrants progressively express their own cultures. For many New Zealanders, our landscapes and the “clean, green” environment are an integral part of their identity as New Zealanders.

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<sup>109</sup> According to the *Quality of Life in New Zealand's Largest Cities Survey 2004* reported in the 2006 Social Development Report <http://www.socialreport.msd.govt.nz/leisure-recreation/satisfaction-leisure.html>

<sup>110</sup> Work-Life Balance in New Zealand: A snapshot of employee and employer attitudes and experiences July 2006. <http://www.dol.govt.nz/worklife/snapshot.asp#pref>

<sup>111</sup> <http://www.socialreport.msd.govt.nz/paid-work/satisfaction-work-life-balance.html>

<sup>112</sup> The desired outcomes for cultural identity given in the 2006 Social Development Report.

The 2006 Social Development Report tracked cultural identity via local content programming on New Zealand television (38 % of the prime-time schedule in 2005), people identifying as Māori who can speak in Māori (25% in 2001), and the retention of their first language (other than English and Māori) by identified ethnic groups (this varied widely between ethnic groups, from 17 percent of Cook Islands Māori to 81 percent of Koreans). Maori kohanga reo and Pacific Island language nests have significantly increased language retention and uptake – in July 2001, 10,600 Maori and 4,300 Pacific Island children were enrolled in language nests.<sup>113</sup>

**Freedom** – are New Zealanders free to express themselves including to dissent, to make choices about their lives, and to work and live free of discrimination.

The people of New Zealand are among the freest in the world, and basic rights are enshrined in legislation. In many ways though, these freedoms have never been really put to the test and subtle forms of discrimination are still everywhere – whether it be in a belief that a right to watch rugby outweighs others rights to protest against apartheid, as in the Springbok tour in 1981, in the current debate about the rights of gays to be ordained in the church, or in views about the right of Moslem women to wear the burkha.

### **Appendix 3:**

#### **Desired Outcomes for Social Wellbeing listed in the 2006 Social Development report:**

<http://www.socialreport.msd.govt.nz/introduction/indicators-for-social-report-2006.html#table1n1>

#### **Economic Standard of Living:**

New Zealand is a prosperous society, reflecting the value of both paid and unpaid work. Everybody has access to an adequate income and decent, affordable housing that meets their needs. With an adequate standard of living, people are well-placed to participate fully in society and to exercise choice about how to live their lives.

#### **Health:**

Everybody has the opportunity to enjoy a long and healthy life. Avoidable deaths, disease and injuries are prevented. Everybody has the ability to function, participate and live independently or appropriately supported in society.

#### **Paid Work:**

Everybody has access to meaningful, rewarding and safe employment. An appropriate balance is maintained between paid work and other aspects of life.

#### **Knowledge and Skills:**

Everybody has the knowledge and skills needed to participate fully in society. Lifelong learning and education are valued and supported.

#### **Civil and Political Rights:**

Everybody enjoys civil and political rights. Mechanisms to regulate and arbitrate people's rights in respect of each other are trustworthy.

#### **Cultural Identity:**

New Zealanders share a strong national identity, have a sense of belonging and value cultural diversity. Everybody is able to pass their cultural traditions on to future generations. Māori culture is valued and protected.

#### **Leisure and Recreation:**

Everybody is satisfied with their participation in leisure and recreation activities. They have sufficient time to do what they want to do and can access an adequate range of opportunities for leisure and recreation.

#### **Physical Environment:**

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<sup>113</sup> <http://www.socialreport.msd.govt.nz/cultural-identity/index.html>

The natural and built environment in which people live is clean, healthy and beautiful. Everybody is able to access natural areas and public spaces.

**Safety:**

Everybody enjoys physical safety and feels secure. People are free from victimisation, abuse, violence and avoidable injury.

**Social Connectedness:**

People enjoy constructive relationships with others in their families, whānau, communities, iwi and workplaces. Families support and nurture those in need of care. New Zealand is an inclusive society where people are able to access information and support.”

## **Appendix 4: Examples of Potential Actions to achieve the Vision of a Sustainable New Zealand**

### **System Condition 1**

**Objective 1:**

Eliminate our dependence on **fossil fuels** – for activities within New Zealand, for production of the goods we use, for bringing us imports and tourists, and for taking our exports to market.

**Possible Actions:**

- Make reduction in fossil fuel dependence an overarching government goal and a key performance area for all government departments e.g. set target for 20% reduction in use of fossil fuels (via renewables or efficiency) within 2 years within the sector/area each dept responsible for – first need to establish fuel use within the sector. A wide range of tools, carrots, sticks are available to achieve it, e.g. loans, awards, incentives, advice, information, regulations (e.g. building code requirements for high levels of insulation and solar water panels, company disclosure requirements re fossil fuel dependence), taxes, subsidies, land use planning, funding for research and development in efficiency and renewable technologies, removal of government research funding supporting agricultural intensification, mandatory efficiency labelling on vehicles, appliances, buildings etc, linking quota allocation, funding etc to fuel efficiency (fisheries, irrigation water etc). Outcome: more energy efficient schools, hospitals, homes, farming methods, transportation, factories etc, and greater energy security.
- Regional and local authorities set targets relating to regional and district fuel use e.g. increase use of public transport and cycling by 15% per year, require any new developments have adequate access to public transport, set targets for increasing percentages of local energy production through distributed energy generation (wind, photovoltaics, tidal, biofuels etc), especially important given potential natural disasters in NZ.
- Sponsor up to 50 ‘early adopter’ companies through a sustainable business training programme (addressing SC1-4) within each of the 98 local government regions.
- Investors and exporters and NZTE to start identifying and fostering goods and services that can reach their markets without significant use of fossil fuel. To maintain export markets for primary production in a carbon conscious world, we need to hang onto/recover our traditional competitive advantage of skills in extensive agriculture so we can show that despite the transport miles to market they still use less energy overall, and instead of pursuing volume sales we need to focus on products with high value added.

- Amend Tourism's 100% pure marketing campaign to reflect this is a target (rather than reality) and position NZ as aiming to be first sustainable country in the world.
- Ministry of Tourism, Tourism Industry Association and tourism operators make maximizing revenue from minimum carbon emissions (attracting travelers from closer to home and keeping them for longer) and sustainable management of their destinations their key focus.

### **Objective 2:**

Substitute **minerals that are scarce in nature** with others that are more abundant, and use all mined materials efficiently

### **Possible Actions:**

- Adopt EU standards re elimination of cadmium, nickel, lead etc from electronic and electrical goods sold in NZ and ensure alternatives adopted do not also infringe the system conditions.
- Use economic instruments and/or regulations plus education to significantly increase the capture and cycling of metals from the waste stream, especially those which are scarce in nature, (e.g. national cleaner production programme for electroplaters, backed by possibility of RMA prosecutions; high levies for acceptance of electronic or electrical goods at transfer stations; grants, loans or subsidies for companies wishing to establish remanufacturing plants) and stimulate investment in new technologies not dependent on scarce minerals.
- Set stringent controls on release of mined compounds that are increasing in nature e.g. cadmium and arsenic in fertilisers, from gold mining etc.

## **System Condition 2**

### **Objective 1:**

**Man-made compounds** - systematically substitute persistent and unnatural compounds with ones that are normally abundant or break down more easily in nature, and use all substances produced by society efficiently

### **Possible actions:**

- Assess all the chemicals approved for use in New Zealand to identify those containing persistent substances.
- Apply less stringent conditions and lower ERMA fees to substances that are less persistent (underway)
- Collect unwanted and banned persistent substances and destroy (underway)
- Progressively ban the most persistent substances
- Fund research into green chemistry and more benign alternatives to existing persistent substances e.g. to CCA timber treatment
- Educate users, importers, retailers and manufacturers about the risks posed by persistent substances and the benefits and availability of more benign alternatives, and for all hazardous substances how to use the minimum quantity to achieve the intended purpose.
- Ensure applicants wishing to register substances for importation or manufacture in NZ are fully conversant with the purpose of the HSNO Act and contribute to preventing or managing adverse effects, including by proactively replacing components with hazardous properties.
- Provide access to ERMA database so substance users can see what is in them and the hazards they pose.

- Ensure discharges of persistent compounds incur high penalties.
- Regularly monitor NZ food chain and environment for persistent substances and prosecute infringements

### **Objective 2:**

**Natural compounds** increasing in nature due to human activity –

Eliminate our contribution to increasing concentrations of natural substances such as CO<sub>2</sub>, methane, nitrogen and phosphorus in the environment.

### **Possible actions:**

- Move out of fossil fuels (see above)
- Significantly improving fertility management so fertilisers do not leach out into groundwater and waterways by:
  - significantly increasing research into methods of maintaining and enhancing fertility in ways that do not depend on mined materials, or heavy use of fossil fuel, e.g. through stock and crop rotation, use of nitrogenous plants, use of compost, mulches and worms, more targeted applications,.
  - enhancing technology transfer to farmers re nutrient budgeting, fertiliser application and fertility management
  - enhancing regulatory mechanisms to penalise non-point discharges into waterbodies and require nutrient budgeting.
- Enhance research and adoption of research reducing methane emissions from stock

## **System Condition 3**

### **Objective 1:**

Eliminate our contribution to the progressive **physical degradation** & destruction of nature & natural processes.

### **Possible actions:**

Promote sustainable forms of land use that minimise tillage and erosion (SC3), and fertilizer and energy (including for irrigation) inputs (SC1) and eliminate use of persistent substances (SC2), while providing a good quality of life for their families (SC4).

- redirect research from intensive agriculture to support sustainable and organic agriculture
- develop wide range of user friendly resources to assist farmers to practice sustainable farming (e.g. how to develop resilient pastures, protect biodiversity, minimize tillage, manage fertility, drought-proofing properties, introduce low water demand crops and grasses, water efficiency and conservation and smaller-scale on-farm water storage etc – website, factsheets, workshops etc)
- enforce RMA penalties re infringements and provide carbon credits and other incentives for protecting soils and indigenous ecosystems.
- Develop systems to account for, and reward suppliers of, ecosystem services cf. Costa Rica government initiatives
- Promote active restoration of indigenous systems in those land environments which are either threatened or of particular importance in the retention of soil and water.
- Use education and incentives to promote the protection and restoration of wetlands through sustaining natural inflows and marginal vegetation and minimizing drainage.

### **Objective 2:**

Eliminate our contribution to the progressive degradation & destruction of nature & natural processes by exotic organisms.

**Possible actions:**

- Recognise the economic, ecological and health impacts and potential impacts of invasive alien species in resourcing biosecurity and pest management (SC3, SC4)
- Maintain existing controls on importation of new species.

### **System Condition 4**

**Objective:**

Eliminate our contribution to conditions that undermine people's capacity to meet their basic human needs (for example, unsafe working conditions & not enough pay to live on).

**Possible actions:**

- Enhance actions to address child poverty, child abuse, long term unemployment, parenting skills, rich/poor gap, working hours, materialistic culture, obesity, valuing of cultures and traditions.
- Develop a population strategy based around the concept of all regions of New Zealand living within their ecological footprint.
- Review NZ's trade policy stance to incorporate much greater concern for the wellbeing of workers and their environment in developing countries.

### **System Conditions 1-4**

**Objective 1:**

Efficient resource use and cycling

**Possible Actions:**

- Foster efficient use and cycling of all resources, including energy, water and all substances produced by society, through a range of measures including legislation (e.g. Producer Responsibility Act, disposal bans), education and economic instruments (disposal and pollution charges, refundable deposits etc).
- Speed up the timetable to Zero Waste e.g. encourage both home level and communal composting, impose a significant waste levy at landfills to fund education and waste reduction incentive programmes, build on good examples (e.g. Christchurch's Terranova (Recovered Materials Foundation) and Supershed (recycling of used goods)).

**Objective 2:**

Research and education

**Possible Actions:**

- Innovation funding (research grants, loans etc for public and private R&D) directed to new practices and technologies that move us towards meeting the system conditions.
- Education funding has a large component for a Sustainable future immersed into every curriculum area at all levels.

### **Objective 3:**

Sustainable procurement and practice

#### **Possible Actions:**

- Central, regional and local government and all education and health institutions immediately adopt stringent sustainable procurement policies, based around the System Conditions<sup>114</sup>. (E.g. Canadian & US governments require purchasing to be spent on sustainable products & services – staff can only stay in ecoefficient hotels/motels etc; govt buildings and other purchasing driven by sustainable supply chain agreements.) This instantly puts 40+% of NZ economy into support of sustainable enterprise, better than regulation or subsidy.

### **Objective 4:**

Financial and information signals

#### **Possible Actions:**

- Add GPI to GDP as measures of national health (SC4)
- Establish Government accounting of Ecosystem Services (SC3)
- Undertake an audit of perverse subsidies that allow a failure to account for heavy metals in fertilizers and waste water; that favour international travel over national travel; that favour private over public transport; that discourage private investment in native biodiversity; etc, etc (SC1-4)
- Commit to switch Government tax take by 15% per year from activities that move towards meeting the system conditions (e.g. employment, renewable energy, public transport, private and public investment in biodiversity, cyclic systems that capture and return resources to the economy, community activities that build social capital and allow people to meet their basic needs) to activities that violate the system conditions (e.g. use of fossil fuels, scarce virgin minerals, persistent substances, and unsustainably harvested timber and fish; emission of pollutants; waste generation )
- Change the Commerce Act to require sustainable rather than solely financial outcomes (SC1-4)
- Require RMA applications to address S5 (the Purpose of the Act) by using a guiding set of principles such as 4SCs (SC1-4) so decisions are based on sustainability principles rather than debate “among the leaves” and consequent progressive erosion of what is left.

### **Objective 5:**

Government commitment & structures

#### **Possible Actions:**

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<sup>114</sup> See for example the Procurement policies of Whistler, based on the system conditions, or the University of Canterbury’s draft Materials Plan

- To achieve even some of the actions proposed above requires total government commitment. It may also require reconfiguration of some of the government ministries and departments to allow for greater integration of social, environmental, cultural and economic goals (see for example the Swedish government's Vision for Sustainable Development, spear-headed by a Ministry for Sustainable Development - Appendix 5).

## **Appendix 5: Government Vision for Sustainable Development in Sweden**

From the website of the Ministry for Sustainable Development, Sweden

<http://www.sweden.gov.se/sb/d/2066/a/68245;jsessionid=asPWF46Xzci7> (accessed 21 Sep 06)

“The Government aspires to make the idea of the green welfare state a reality. To this end, it will use new technology, construction and planning and pursue an active energy and environmental policy. The goal is to modernise Sweden so as to make our society more resource-efficient, a process of change that will drive innovation, new jobs, growth and welfare. In the green welfare state, our country will reconcile good economic progress with social justice and protection of the environment, to our own benefit and the benefit of future generations. Being at the forefront of development, we will also be in a position to succeed in the export market and support environmentally sustainable social development in countries that are now experiencing strong growth. In this way, national progress is a source of global opportunities. The modernisation of our societies has to help ensure that the resources of our planet are sufficient for us all!

We must pass on to the next generation a Sweden where the major environmental problems have been solved. Welfare includes a healthy living environment with clean air and closeness to nature. This requires clear environmental objectives, effective policy instruments and international cooperation. A cohesive climate and energy policy must guarantee the future supply of energy, limit climate impact and at the same time be a motor for change in Sweden. Society must be steered towards energy efficiency and must in the long run obtain all energy from renewable sources. Sweden must have both a living countryside and healthy cities and suburbs whose development is guided by active planning. This requires a national policy for housing, construction and urban development. Everyone must have the chance to live in good and affordable homes in a secure and sustainable living environment.”