# Responding to the Environmental Crisis



Aran Martin, Kazuki Kagohashi, Michael T. Seigel, John Pullen, Christian Dimmer, Kazuyo Nagahama and Winibaldus Stefanus Mere

Nanzan University Institute for Social Ethics

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At the workshop on which this report is based, a formulating committee was established whose role was to record the discussion and draw up a draft of this report. The members of this committee were Aran Martin, Kazuyo Nagahama and Steve Mere, and these are the main authors of this report. A large portion of the section on "Poverty, redistribution, Malthus and limits to growth" was written jointly by John Pullen and Michael Seigel. Christian Dimmer also contributed to the writing, particularly the section on "Utopian thinking and the idea of progress". Many other workshop participants contributed with suggestions, comments, and editorial assistance.

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# Foreword

*Responding to the Environmental Crisis* builds on the work of participants at the conference 'Exploring the Origins of the Environmental Crisis', hosted by Nanzan University Institute for Social Ethics, March 4-7, 2014, and organised by Michael Seigel and Kazuki Kagohashi from the Institute for Social Ethics.

Rather than a direct report and reproduction of conference proceedings, what we aim at here is to select a number of the key themes and ideas that emerged from the discussion that took place over four days, and to build on them. The report's target audience is diverse, consisting of academics, practitioners and members of the general public interested in new ways to think about environmental problems. The report does not attempt to offer policy recommendations or provide definitive advice on how to address specific environmental problems.

Most of all, we seek to present a document that we hope will outline the problems and opportunities presented by thinking of environmental crises through proximate causes. By this, we mean that efforts to determine the root causes of environmental crises, attempted several times in the past, often fail to deliver solutions through anything but radical, and ultimately unattainable, societal changes. On the other hand, the contemporary trend towards addressing environmental problems at the point of harm (ie. identifying that de-forestation is a problem, and introducing laws to ban or sanction the cutting down of trees) often risks creating situations where only the symptoms are treated, rather than the underlying disease.

To address this problem, the aim of the March 2014 workshop was: to revisit, evaluate and collate arguments regarding the origins of the environmental crisis and to further explore the historical background of this crisis with a view to coming to an understanding of the crisis that will be conducive to generating concrete strategies for responses. Rather than seeking out deep rooted and fundamental causes, our primary concern will be with more proximate causes—a step more removed than immediate causes such as arguing that global warming is caused by increased greenhouse gas emissions, but still proximate enough to potentially indicate concrete and implementable steps that can be taken to address the situation now.<sup>1</sup>

This publication and the workshop from which it emerges have their genesis in a workshop held by Nanzan University Institute for Social Ethics on 8-9 December 2012 and the working paper entitled *Origins of the Environmental Crisis* drawn up by Michael Seigel as a preparation for the March 2013 workshop. This workshop set the preliminary direction for the research questions that were to follow and was itself the outcome of a series of research projects on related themes. It is worth briefly revisiting Seigel's background paper here as context for the discussion that follows.

Seigel outlined some existing scholarship on the roots of the environmental crisis. This included identifying that the origins of the crisis "lay in a specific understanding of Christianity and in the 'marriage between science and technology'<sup>2</sup>, or the argument of such thinkers as Arne Naess and Fritjof Capra that they lie in a mechanistic worldview that is said to have emerged in the wake of Descartes and Newton."<sup>3</sup> Or alternatively that they lie in "the incompatibility of an economy that necessitates and is dependent on growth with the limitations of the planet, the failure to recognize, in Schumacher's terms, that natural resources are capital and cannot be treated as income, inappropriate economies of scale, or other aspects of the globalised free market economy."<sup>4</sup>

Seigel identified several causative factors that are somewhat removed from the point of harm and are common to a range of environmental problems. These included: **Manufacturing Processes and Products** (the side effects of taking raw materials, creating manufactured products and disposing of the waste products); **Distance** (resources, goods and the harm associated with them are transported to geographically remote locations. This dissociates people from full knowledge of the environmental impacts of their own activities, and disrupts natural cycles through the sheer scale of removing organic and inorganic matter to different locations); **Energy** (the escalation of energy usage and the increasing use of fossil fuels).<sup>5</sup>

In tracing the historical roots of the environmental crisis, it had been widely agreed at the December 2012 conference that many of the core issues that led to widespread environmental harm emerged along with the transformation in the processes of production and trade identified as the Industrial Revolution. This transformation consisted in: a substantial increase in the product of labour (driven by the division of labour and technological developments); a transition in the forms of energy used (from organic solar biomass to fossil fuels); and the emergence of a free market economy.<sup>6</sup>

In addition, several trends and causative factors were identified as contributing to environmental crises that would be worth exploring: the relationship between industrialisation and poverty; population growth; the commodification of labour, land and money; urbanisation; the marginalisation of agriculture; the global expansion of the industrial economy; lack of structures of accountability coterminous to economic structures and ecological systems; the loss of the communal; the Enlightenment and other intellectual developments shaping the ideational relationship between humans and nature; the failure to recognise the ecological limits of a finite earth; and the loss of norms that came with the declining influence of religion.<sup>7</sup>

This background shaped the structure and direction of the March 2014 conference, and helps to define the central problem and research question which we address in this publication, as outlined below:

#### The issue to be addressed:

Current policy making and much academic thinking regarding interlinked environmental crises tends to address and consider results and symptoms, rather than root causes of problems (the underlying disease). This results in interventions which are often short term and of limited effectiveness.

#### The question:

Can we go into the historical development of the environmental crisis (or identify other non-historical factors) to find points of intervention in environmental problems other than a direct (and often costly/painful) solution to an environmental problem at the point of harm?

#### The hypothesis:

A system of thinking about environmental problems that emphasises finding proximate causes—rather than fundamental root causes, or symptomatic end results manifesting in environmental harm—will enable more effective interventions in environmental problems.

# Introduction

The system of thinking we propose in searching for points of intervention in environmental problems finds inspiration from a Japanese proverb:



When the wind blows, the cooper profits

Japanese Cooper: Handcolored Japanese photograph, late 19th century. Image sourced from <u>http://www.flickr.com/photos/15693951@N00/4334727990</u> with kind permission from Wolfgang Wiggers.

In Japanese this proverb is written as: "風が吹けば桶屋が儲かる (Kaze ga fukeba okeya ga moukaru)" and translates literally to 'When wind blows, the cooper profits' meaning that "The world is interconnected even though it doesn't seem to be."<sup>8</sup>

At the heart of the proverb is a longer story outlining a causal chain of events. The story goes that when the wind blows, it sweeps dust into the air, causing people to go blind when it gets in their eyes. Once blind, these people have few options for employment, and seek jobs as Japanese Shamisen (banjo) players; a traditional Japanese occupation for blind people. The increased demand for Shamisen in turn leads to the killing of cats, whose skin is used to make the instruments. The reduced population of cats in the region leads to a dramatic upsurge in the population of rats, and because the rats then gnaw through casks which hold food stuff, coopers profit from an increase in cask sales.<sup>9</sup>

The proverb is interesting in two ways for our purpose. First, it prompts us to think in terms of causal chains—is it the increase in rats which leads to the coopers' profiting? The demand for Shamisens? Or the 'root cause' identified here of the wind blowing up dust? Second, it encourages us to view each causal factor as a possible site of intervention. If, for instance, we want to prevent a plague of rats, we can consider increasing the population of cats artificially (through bringing cats from other areas), by banning their killing, or by finding an alternative material for the construction of Shamisens. Alternatively, we can create new employment opportunities for blind people, thereby reducing the demand for Shamisens, promote the use of eyeglasses or face coverings to prevent dust from having a harmful impact on peoples' sight, or plant ground cover to prevent dust blowing up in the first place<sup>10</sup>.

This story is particularly useful in pointing out the difficulty of addressing root causes. In the context of the story, the starting point, and therefore presumably the root cause, is the wind blowing. However, attempting something like intervening to stop the wind blowing altogether—a kind of geoengineering approach—would be difficult to conceptualise and, even if it could be achieved, would undoubtedly do more harm than good. Planting ground cover to prevent the dust from blowing up, however, could be a relatively simple and effective intervention. Focussing on the anthropogenic causes that lay behind the lack of groundcover and addressing these may also prove effective and may indeed contribute positively to other social and economic outcomes.

By thinking of environmental problems in terms of causal chains and proximate causes in the manner outlined above, it may be possible to identify factors that are amenable to intervention and may contribute to dealing effectively with a range of environmental issues.

One example that was brought up in the conference of what we have

in mind was the issue of population growth rates: it was argued that the most effective way of reducing excessive population growth rates is not to address those growth rates directly but to focus on women's access to education. The more this is improved, the later women give birth to their first child and consequently the less children they have in their lifetime. (See Appendix 1: Women's Education and Population Growth for further details). What we attempt to do in the remainder of this paper is to identify factors that appear to have a large scale and widespread impact on a range of environmental problems, that are relatively straightforward to design policy interventions for over the short to medium term, and that have the potential to generate widespread social consensus over the desirability of intervention.

Prior to this, and to put the problem that we are addressing in context, the section that follows provides a brief overview of the scale of the environmental crisis generated by human activity.

## An overview of the environmental crisis

*"We have now ourselves become a geologic agent disturbing these parametric conditions needed for our own existence."* —*Dipesh Chakrabarty."* 

The scale of the environmental crisis is well known. It is worth providing a few sobering reminders as context for the discussion that follows.

The 2012 UNEP Global Environmental Outlook outlines that, while humans have always had an impact on their local environment, the changing nature of human societies and the scale of their impact on ecological systems has exceeded the carrying capacity of the Earth's atmosphere, land and water. Globalization has been central to this ecological crisis:

Globalization allows goods to be produced under circumstances that consumers would refuse to tolerate in their own community, and permits waste to be exported out of sight, enabling people to ignore both its magnitude and its impacts.<sup>12</sup>

The extent of human impact on the earth has led some academics to classify the current period as a separate geologic era labelled the Anthropocene. Crutzen and Stoermer summarise the rationale for thinking of the modern era in these terms:

> The expansion of mankind . . . has been astounding . . . During the past 3 centuries human population increased tenfold to 6000 million, accompanied e.g. by a growth in cattle population to 1400 million . . . In a few generations [humankind] is exhausting the fossil fuels that were generated over several hundred million years. The release of SO2 . . . to the atmosphere by coal and oil burning is at least two times larger than the sum of all natural emissions . . .; more than half of all accessible fresh water is used by mankind; human activity has increased the species extinction rate by thousand (sic) to ten thousand fold in the tropical rain forests. . . . Furthermore, mankind releases many toxic substances in the environment. . . . The effects documented include modification of the geo-chemical cycle in large freshwater systems and occur in systems remote from primary sources.<sup>13</sup>

Ed Ayres has noted what he calls four 'spikes' that are of particular concern: population growth, consumption of resources, carbon emissions and the mass extinction of species.<sup>14</sup> To these can be added the degradation of the oceans<sup>15</sup> and the output of waste such as nuclear waste and microplastic waste, which accumulates in the food chain and can influence fertility and reproduction.<sup>16</sup> These have an extremely long-lasting impact with farreaching and unpredictable consequences. These spikes cumulatively point towards global ecological collapse.

One of the key features of the environmental crisis is the sheer complexity of humanity's impact on ecosystems.

We are being confronted by something so completely outside our collective experience that we don't really see it, even when the evidence is overwhelming. For us, that 'something' is a blitz of enormous biological and physical alterations in the world that has been sustaining us.<sup>17</sup>

This complexity leads to serious difficulties for societies and individuals in terms of reacting and responding to interlinked crises in a coherent manner.

The Slovenian philosopher Zizek contends that:

What renders us unable to act is not the fact that we "don't yet know enough" (about whether, say, human industry is really responsible for global warming, and so on) but, on the contrary, the fact that we know too much while not knowing what to do with this mass of inconsistent knowledge...<sup>18</sup>

Zizek's prescription to avoid this paralysis resonates with our approach of seeking out proximate causes rather than of focussing on root causes or immediate causes: "The double trap to avoid", Zizek argues, "is thus, on the one hand, to attempt to 'de-ideologize' the issue, by reducing ecological catastrophe to a problem solvable by means of science and technology, and, on the other, to attempt to 'spiritualize' it in the sense of New Age mythology."<sup>19</sup> As with our approach, what Zizek seeks is an approach grounded in "a concrete social analysis of the economical, political and ideological roots of ecological problems,"<sup>20</sup> an approach therefore that is implementable, and whose implementation will make a real difference.

In our approach to environmental crises, which emphasises the identification of proximate factors that have causal links to interdependent environmental problems and that are potential areas for both intervention

and social consensus, we align with the overall objective of avoiding the 'double trap' identified by Zizek and other scholars.

In the second part of this paper, we begin to outline the system of thinking that participants at the March 2014 conference found useful in approaching the problem of environmental crises, and explore a number of potential proximate factors that have wide ranging impacts on the relationship between humans and the environment. Essential to this is a working definition of what is meant by a 'proximate cause'.

# Text Box 1: Definitions of 'proximate cause'

In many disciplines, the term "proximate cause" is used in a somewhat different sense to the way we use it. Biologists use proximate and ultimate causation to differentiate between 'explanations of mechanisms', or how something happens, and 'explanations of adaptive function'—why something happens (Haig, 2013: 781). In the legal and insurance sectors, a proximate cause is understood as "The dominant and effective cause of an event or chain of events that results in a claim on an insurance policy" (Law, 2009). In forensic sciences, a proximate cause is "The event or action nearest to the event in question. … For example, if a stabbing victim arrives at the hospital and dies of shock, the shock is the proximate cause while the stabbing is the legal cause" (Bell, 2012).

In all of these cases, the term "proximate cause" places emphasis on the notion of "proximity" and is used to distinguish these causes from "ultimate", "historical", and "legal" causes.

Our usage is therefore also to be distinguished from uses in the environmental sciences, in which the term 'proximate cause' is used to refer to "The special or effective cause of a particular change, such as the combustion of fossil fuel, which causes increased levels of carbon dioxide in the atmosphere, which in turn causes global warming" (Park, 2007).

Sources: David Haig, 'Proximate and ultimate causes: how come? And what for?', *Biology & Philosophy*, Vol. 28, No. 5, 2013; Jonathan Law (ed), 'proximate cause' in *A Dictionary of Business and Management* (5th Ed), Oxford: Oxford University Press, 2009, available from www.oxfordreference.com, accessed 2 May 2014; Suzanne Bell (ed.), 'Proximate Cause' in *A Dictionary of Forensic Science*, Oxford: Oxford University Press, 2012, available online at www.oxfordreference.com, accessed 2 May 2014; Chris Park, 'proximate cause' in *A Dictionary of Environment and Conservation* (1 ed), Oxford: Oxford University Press, 2007, available online at www.oxfordreference.com, accessed 2 May 2014; Chris Park, 'proximate cause' in *A Dictionary of Environment and Conservation* (1 ed), Oxford: Oxford University Press, 2007, available online at www.oxfordreference.com, accessed 2 May 2014.

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# Definition of key terms

What is a proximate cause? How does it differ from an immediate cause and a root cause in our discussion of environmental crises? Central to the ideas put forward in this paper is the concept that environmental problems have 'root causes', 'proximate causes', and 'immediate causes'. This section attempts to identify with more clarity what we mean by those terms.

The boundaries between these three categories are fluid, depending heavily on individual environmental problems and on the type of problematisation and analysis undertaken for the particular problem. The precise definition of terms such as 'proximate cause' varies between different disciplines (see Text Box 1: Definitions of 'proximate cause'), and therefore our usage must be distinguished from that of other disciplines.

In the section below, a tentative definition of the three categories of causes is advanced as we use them within the paper:

#### Root causes:

Root causes are factors which exist at epistemological and systemic levels. In other words, the deep-seated ways in which humans think about the world and, based on this thinking, create systems of human organisation and activity. Examples of root causes are ideological/religious/intellectual concepts of humanity's separateness from/mastery over nature, or concepts of national sovereignty and the overarching structure of territorially divided human communities possessing national identities defined (usually) in opposition to other groups. In part, we call these 'root causes' because they produce the underlying conditions structuring widespread environmental problems, in part because changing such root causes would have dramatic effects on humanity's overall relationship with natural environments (and not just on a single environmental problem), and finally, because the interventions we can consider to transform 'root causes' are themselves transformative to such a degree as to be revolutionary (and in this way also difficult to implement).<sup>21</sup>

#### Proximate causes:

We deploy the concept of 'proximate causes' here to refer to something less removed from the outcome than a root cause, but that is not the direct and immediate cause of the outcome. These are causal factors therefore that are amenable to forms of intervention which will have widespread impacts preventing environmental harm, but are implementable without radical structural shifts to human society and activity (although they may result in such changes through indirect or longer term effects).

We do not intend the term as it is understood within legal or biology disciplines and terminologies. Our usage of the term is different, since we use it in contra-distinction to both immediate causes and root causes. We seek out causes that are sufficiently closely related to the ultimate outcome that the causal mechanisms can be made clear, but at the same time are sufficiently removed from the ultimate outcome that addressing these causes will enable addressing the activities and structures of human society that are giving rise to the environmental crisis, and will not just be a matter of trying to patch up the problems that occur as a result of these structures and activities.

#### Immediate causes:

An immediate cause is defined within the paper as an event or action directly resulting in the outcome in question.<sup>22</sup> Given that burning fossil fuels directly causes increased greenhouse gas emissions, for our purposes it would be considered an immediate cause. In other disciplines, it may be that it is treated as a proximate cause.

#### "Environmental Crisis" or "Environmental Crises"?

The title of this paper refers to an 'environmental crisis', while within the text reference is often made to 'environmental crises'. The first term is used to capture the idea that there is something fundamentally out of balance in the relationship between human activity and the environment—an overarching environmental crisis which manifests itself in a diverse range of areas. The second term is used to refer to specific areas of serious environmental challenges (deforestation, nuclear waste, climate change, etc.).

# Thinking of environmental crises through proximate causes

During the March 2014 conference, participants identified a range of factors which they felt were not 'root' causes of the environmental crisis, but were highly influential in shaping the relationship between human societies and the environment. Intervention at any of these points, it was contended, could feasibly have widespread implications for a range of specific environmental problems (deforestation, climate change, industrial pollution) at global, regional or local levels.

This section surveys a selection of these ideas. We are guided by the idea that there are likely to be points other than the actual point of harm at which viable and effective interventions can be made, as in the case of improving women's education as a strategy for reducing population growth rates, which has proved far more effective than strategies that make reducing

# Text Box 2: A list of proximate factors to the environmental crisis put forward at the March 2014 conference

- The momentum and self-sustaining logic of money and raw materials
- Warfare and the environmental crisis
- Wicked legacies
- Ownership and legal systems
- Modernity, utopian thinking, pursuit of personal happiness, and the idea of progress
- Externalising waste, exporting harm, creating inter-generational debt
- Information transparency and deliberate blindness
- Compartmentalisation and specialisation
- Decision making and accountability: Sovereignty, nation-states and the international system
- Poverty, redistribution, Malthus and limits to growth
- Adaptability

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population growth itself their direct goal. In other areas too, there are likely to be indirect interventions that are likely to be more implementable and more effective than simply intervening at the point of harm. Our belief is that focussing on proximate causes may be an effective means of bringing such points of intervention to light. We do not intend to be prescriptive (in the sense of identifying concrete policy recommendations), but rather to provide a basis for further discussion and ideas on how to address overlapping environmental crises.

#### The momentum and self-sustaining logic of money and raw materials

To what extent are humans driving flows of goods, money and technology, and to what extent are flows of goods, money and technology driving humans? Are we trapped by our own success? Or are there means of rapidly halting or transforming the massive and exponentially growing material flows which characterise the modern era?

One of the central proximate causes of the environmental crisis is the exponential increase in volumes of material flows that has occurred since the 19th century, underwritten by a massive increase in the expenditure of energy—in particular fossil fuels.

Resources and material flows were seen to exhibit their own form of momentum: Once an industry or system has started and develops its own self-sustaining logic and networks, it becomes very hard to stop. A case in point cited at the workshop was that of industries that were started or that expanded during war time, where war conditions created demand and growth in particular industries which then required new outlets to sustain them after war had ceased (explored in the later section on 'Warfare and the environmental crisis').

The idea that industries produce their own self-sustaining momentum can also be extended to resources. Frank Uekotter put forward the idea that human history can be read as a history of resource flows in which it is difficult to tell whether humans drive resource flows or resource flows drive humans.

Resources sometimes acted as chameleons. As certain patterns of resource use became outdated (due to technological change or availability), the utility of that resource transformed over time, maintaining or increasing the overall rate of established flow. For instance, coal has transformed its utility as a resource many times in the past, ranging from small scale heating and steel smelting, to the primary fuel for steam power, to a dominant electricity generation fuel. Due to changing usage patterns, the production and consumption of coal increased at an average growth rate of 3% per year between 1800 and 2005.<sup>23</sup>

Another example is land use in countries such as Australia. Much of the farming land was originally cleared for sheep farming to produce wool on scales large enough to sustain the British textile industry. A decline in the British textile industry has not resulted in a decrease in land utilisation and an increase in reforestation, however, and instead farming areas have simply been converted to other outputs (cattle, crops, etc.).

In this sense, resource industries can be viewed as active agents in human communities.

A tipping point in this respect occurred in the 19th century as processes of industrialisation and technological advancement spurred an extraordinary growth in the scale of material flows. Due to the dynamic by which resource industries maintained the momentum of their own production and consumption, humanity is now caught in this flow of materials.

The idea of resources as active agents is important. The idea is that group decisions and social decisions regarding resource consumption or production are driven by individual (and therefore uncoordinated) decision making<sup>24</sup> and that this then works as if the resource itself were the driving force. Uekotter is pointing to an important dynamic whereby the massive flows of a particular resource, sustained by production, logistics and the retail industry, exert a pressure on this system of human decision making in such a way that the rate of flow continues despite a changing degree of utility and need at the level of consumption.

A range of bottlenecks exist which limit material flows. These include corporations (who may decide to increase or limit production of a resource based on a resource's price and profitability in a given market), authorities (who may regulate to control the production, consumption, or price of a resource for safety, security, political or environmental reasons), technology (available resource production, refinement or logistic technologies affect the price and accessibility of a resource and the volume that can be mobilised) and consumption (the end use demand for the product). On the other hand, both the environment (limits to the acceptable damage to ecosystems from the resource's production, trade, consumption and disposal) and labour (the available workforce and the conditions and pay that they will accept affected to a significant degree by automation and machinery) have the potential to be bottlenecks, but are not currently considered so. For material flows, technology and consumption have largely been solved as bottlenecks, leaving corporations and authorities as the primary restricting factors.

In addition, the industries that maintain material flows (resource harvesting industries such as mining, logging, etc. that collect the resources, exploration industries that locate and evaluate new stocks of recoverable resources, logistic industries that enable increasingly efficient transport and delivery of resources, and retail and marketing industries that develop new ways to encourage consumption) have become very specialised and isolated from consumers of resources. Partly due to this dynamic, our societies and consumption behaviours are being driven by the production of resources, rather than the production of resources serving us.

Given the huge material flows mobilised since the industrial revolution, what implication does this have for attempts to address environmental crises in a timely fashion? In order to assist in solving environmental problems, it may be possible to find a means of shaping the tendency of money/resources to always go somewhere. One possible site for intervention to limit the sheer scale of material flows may be to more closely examine the identified 'bottlenecks' restricting material flows. There may be some strategy by which the environment and labour can be re-introduced as more influential factors shaping resource flows. Authorities and corporations could also be co-opted in a strategy to undertake this.

## Warfare and the environmental crisis

How does the current system of military-industrial production and activity, along with the militarisation of societies and the actual conduct of interstate and intrastate wars, impact on environmental crises and the options to address them?

Warfare and militarisation of societies was seen by participants as a critical proximate factor to many environmental crises.

#### Stimulation of production and consumption

Warfare (due to the stimulation of demand for goods) leads to increased production in specific industries. During warfare, market constraints do not apply. Financial (and environmental) costs become of secondary importance, removing what would otherwise be limits or constraints on production, consumption and waste. This creates unprecedented opportunities for suppliers. Symbiotic corporations emerge in close relationship with military establishments and governments. They operate with the ability to draw upon all but unlimited public funds. The arms industry itself then becomes an effective marketing agent capturing the agenda of the military, acting to create new products, along with marketing the rationale for their need and deployment.

#### Degradation of cooperative systems and transparency

Within the current international system, warfare (or the spectre of it) also leads to political tension and mistrust. It exacerbates the inability to effectively coordinate global solutions. This feedback loop, where mistrust deters global cooperation, in turn creates greater military industries. Warfare also means that social feedback is constrained. Military specialists with limited outlooks begin to determine policy or have undue influence over decision makers who represent the broader community.

Within warfare itself, environmental destruction has been deployed as an effective strategy to harm the enemy (e.g. Agent Orange), but is also a likely side effect of military campaigns. The tendency towards secrecy in security and military affairs creates a situation where information on environmental impacts of military operations, systems and organisations will also be poor.

#### A point of intervention?

As a proximate factor of environmental crises, warfare may act as a particularly useful site for intervention. We can explore its interaction with systems of national sovereignty to suggest forms of trust building between militarised states to encourage closer cooperative environmental policy making; we can attempt to reduce the environmental impact of national militaries and their operations; we can attempt to promote social cultures which resist and are critical of militarisation and more closely question military budgets, and that foster civil society formation in order to create mutual trust on the grass roots level in order to reduce the susceptibility to nationalism and, as an extension, militarisation.

# Wicked legacies

Complex engineered systems and technologies have in the past created unforeseen consequences which bind all future communities to live with and manage their harmful legacies. Can we design systems to prevent the creation of wicked legacies?

During the March 2014 conference, Verena Winiwarter highlighted that a proximate cause of the environmental crisis is that 'complex engineered systems', which are very attractive in the short term, sometimes create unintended 'wicked legacies' that place responsibilities and burdens on future communities. In this sense, our ability to make things has outstripped our ability to control them. This was true of complex systems prior to the industrial revolution, and has been exacerbated since due to the exponential growth in scientific and technological knowledge.

In this regard, Winiwarter explored three examples of wicked legacies resulting from unintended side effects of human intervention in natural systems. These included the sinking of inhabited land in the Netherlands as a result of communities draining peat bogs for grain production in the region over a period of about 1,000 years dating from as early as the second half of the tenth century AD.<sup>25</sup> This intervention in a natural environment resulted in escalating costs for all future communities in their attempts to retain the habitability of the area, in a manner that was very difficult for the original inhabitants of the region to predict.

The second example was the commercial extinction of Atlantic Halibut fisheries between 1836 and the mid 1880s, which was also presented as a case of a complex system resulting in environmental damage. Atlantic Halibut fisheries were brought to commercial extinction within a single generation –prior to industrial fishing techniques—due to increased demand and changed consumer tastes, innovations in ice storage on ships and rail transportation, and market demand for certain features of the fish (white bellied fish over grey) leading to wastage of over a third or more of the fish caught (due to the low price they were allocated at market).<sup>26</sup>

This combination of demand, market factors (which had been significantly affected by Catholic immigration), and technological innovation resulted in localised depletions leading in turn to overall commercial extinction. Although this can be traced in retrospect, predicting that this combination of factors would assemble in such a way as to produce such a serious outcome in time to prevent harm may have been extremely difficult given information available during the surge in Halibut fishing.

Lastly, the Hanford nuclear site provided a remarkable example of the long term and escalating costs of poorly understood side effects from engineered systems. The problem had its roots in the establishment of the Hanford nuclear plant in Washington State, US, between 1943 and 1945 as part of the Manhattan Project. The number of reactors was increased to nine during the Cold War. The Columbia River was used as coolant for the reactors, with nuclear material in direct contact with the river. The plant remained operational until 1987, with a decision to decommission the site made in 1989. Over the lifetime of the plant, over 67 metric tons of plutonium was produced, of which a nuclear warhead can be made from only 10 kg. The Nagasaki bomb was created with less than 7 kg.<sup>27</sup>

The scale of the nuclear material left behind by the nuclear reactors is enormous. As an indicator, 55 million gallons of radioactive liquid is stored in over 177 underground tanks, 67 of which have developed leaks and discharged up to 1 million gallons of waste into the soil. Over 2,300 tons of spent fuel rods remain.<sup>28</sup>

The legacy of the Hanford nuclear plant, and in particular the unresolved problem of storing and disposing of the nuclear waste produced in its operation has resulted in escalating costs of treatment for an uncertain and very long timescale. Major clean-up operations are predicted to be completed by 2052, with a total remaining cost of US\$112 billion. Meeting the timetable set for the clean-up operation is achievable only in the case that sufficient funding is maintained by the US government.<sup>29</sup>

One of the key points to emerge from this discussion was that the more material and energy we use in our interface with nature, the greater the potential for unintended side effects. Complex engineered systems produce behaviours that are impossible to predict or foresee. They create historical legacies that bind the freedom of future generations. In many cases, these legacies also trap future communities into repeating harmful practices.

In fisheries the trend has been towards greater international coordination and scientific monitoring of fishery levels to maintain long term sustainability and industry profitability,<sup>30</sup> in nuclear industries the trend has been towards increasing efficiency in reactors in terms of the initial use and reprocessing of radioactive material (although the problem of nuclear waste

has not been resolved).<sup>31</sup> And yet, despite these cautionary lessons, all sorts of new complex technologies—biotechnology, nanotechnology, genetic engineering and their unpredictable and unforeseen side effects—hold the potential to produce damaging legacies if implemented on large scales in a similar 'trial and error' manner.

Preventing future wicked legacies may be assisted by enshrining in human group decision making a deep sense of humility in the capacity at any point in time to know and foresee consequences and outcomes. This manifests in calls by scholars for the evolution of systems of 'holoreflexivity' as a critical tool for human survival,<sup>32</sup> and in environmental literature through a focus on the 'precautionary principle'.<sup>33</sup> O'Riordan and Jordan (not conference participants) say of adopting this type of approach that:

In effect, this means that humans must learn to widen the assimilative capacity of natural systems by deliberately 'holding back' from unnecessary and environmentally unsustainable resource use on the grounds that exploitation may prove to be counterproductive, excessively costly or unfair to future generations.<sup>34</sup>

# Ownership and legal systems safeguarding sustainability

Does monetisation and/or including natural systems in economic frameworks and practice represent a way towards increased sustainability? What forms of ownership (communal, state, private) are best suited to avoiding environmental harm?

Linked to the legal division of the globe into nation-states defined by sovereign territorial borders and delimited political representation (explored in a later section of this document) is a concern that existing legal systems and forms of ownership of nature are a proximate cause of environmental crises. The problem is multifaceted. On the one hand, a deficiency in ownership and legal protection of environmental commons was identified. On the other hand, private and state ownership were seen as problematic where it enabled long lasting intergenerational damage to ecosystems of significance for short term private or state gain.

In this way, participants at the March 2014 conference highlighted that ownership of the environment in some form was crucial to its protection. The key question was what form of ownership, and under which legal frameworks and systems of accountability, would best enable this protection.

One concept that was explored was the attempt to quantify and account for nature alongside prominent (and often criticised) economic measures such as Gross Domestic Product (GDP). In this regard, Kazuki Kagohashi explored the idea of sustainable development with a particular focus on the concept of critical natural capital (CNC)-natural systems that are essential to human well-being and survival-as a means to account for the critical functions provided by natural environments. The risks involved in the use of the word 'capital' will be discussed below. The original idea was that CNC should be separated from measures of GDP, as natural systems had characteristics of non-substitutability by any other form of capital asset. Unfortunately, the CNC concept has not been fully operationalised to date due to limited theoretical discussion on, for example, which parts of the natural environment or resources should be counted as natural capital. The relationship between criticality and ownership becomes important in this context. The form of ownership over a natural environment may shape the way in which the criticality of the natural capital in that area is defined, and the criticality of natural capital may create limitations to the rights of ownership.

Following from a discussion on measuring natural systems alongside GDP, participants at the conference highlighted that monetising nature is useful in defining its 'value', but risks placing it within an economic paradigm. The idea is that by placing a monetary value on natural environmental assets (forests, oceans, soil, rivers, etc.), this value will act as a common language within which states, companies, individuals and local communities can account for, protect, or evaluate the benefits of intervention/destruction in ecosystems. This is effective at times, but dangerous in many ways because we begin framing the environment as only understandable in relation to humans-and possibly even only in relation to markets. It may create a bias towards considering areas defined as 'commons' as things that can be exchanged ('everything has a price') and risks placing a precedent on short term value to a current generation over the potential (and unknown value) of natural systems or resources to future generations. For instance, considering the rate of change witnessed in human societies over the past fifty years, will a particular mineral, tree or animal species that appears relatively unimportant or is sold at a negligible price today prove to be invaluable due to technological, climatic or social changes fifty years from now?

Assigning value, defining 'natural' environmental states, and developing legal systems for land use and environmental protection at times becomes problematic without detailed knowledge of local contexts and local participation in decision making. For instance, participants at the conference highlighted that conditions such as 'de-forestation' can at times be diagnosed in an a-historical manner. This is particularly an issue when assessments of whether forested areas are natural are shaped by legacies of colonisation, and where defining current land use as harmful justifies intervention and policing by remote external actors.

One illustration of this is from Australia, where debates over protecting forest areas from logging, firewood collection and extensive burning-off is influenced by arguments that current 'natural' states of forest growth and use are a product of European colonisation, and are the result of the cessation of a lengthy history of extensive indigenous fire management.<sup>35</sup> In other words, by isolating a national or state forest area from human activity, environmental protection may create an a-historical state of nature which may increase the intensity of forest fires.<sup>36</sup>

Another example raised by Kohei Wakimura was the changing attitudes to the tropics by powerful external states and actors, from a view that the tropics were miasmic and disease-ridden to one where they were manageable, fertile and environmentally valuable. Assigning monetary or other value to tropical environmental zones in the 18th or 21st centuries would obviously result in very different outcomes in this context.

National legal systems of private ownership, of state-based environmental protection (or at the other end of the spectrum, of state ownership of subsoil mineral rights, etc.) that do not take into account communal notions of belonging to and identification with a certain landscape or natural system also underlie many of the environmental crises at local levels and at the level of the global commons. These forms of ownership fail to recognize the fluid nature of the natural environment, especially the atmosphere and the ocean. Can anyone in practice protect or regulate a small territorially delineated section of the atmosphere or ocean? If not, why are the atmosphere above each territorial state and the ocean contiguous to it divided into neat (and environmentally nonsensical) territorial units? In particular, the division of sovereignty over the atmosphere and the ocean promotes the externalisation of costs by economic actors. Until recently, it was essentially free for companies to release pollution into the air, despite the exorbitant cost this imposes on present and future generations. In many cases it remains free to release such pollution into the ocean.

Whether monetisation of natural systems and common areas is the answer to this problem of ownership, or whether forms of private, communal, government or transnational/supranational ownership and legal protection of ecosystems can result in better outcomes and preservation of areas valuable to future human communities is a far more detailed discussion than can be undertaken here. Forms of ownership (or the lack of them) and the legal systems that underpin them are certainly a proximate factor underlying many problems of environmental harm however, and experiments in monetisation and ownership such as the concept of wealthy nations purchasing forested areas in other states to prevent deforestation and the associated carbon emissions under climate treaties (the Reducing Emissions from Deforestation and Degradation, or REDD, framework) indicate that this will remain a promising (if far from straightforward) site for intervention in resolving a range of environmental problems.

# Modernity, utopian thinking, pursuit of personal happiness, and the idea of progress

Does the environmental crisis stem from a sense of entitlement that is informed from a pursuit of a human utopia and paradigms of industrial and civilisational progress? And if so, will pursuit towards amended 'sustainable' utopias and directions of progress assist or hinder us in addressing environmental crises?

During the conference, Christian Dimmer highlighted that popular ideas of the 'good life' have become linked to a narrow understanding in which the consumption of more goods equals greater happiness. Western utopias have focused on the structure and provision of more space or freeing of time through technological fixes in order to allow people to realise their supposedly true selves and satisfy their desires outside of the constraints of labour. Both Hannah Arendt and William Morris have noted, however, that human nature is grounded in the need to work (homo faber) and that the problem of modernity is that human beings have become separated from that which is essential to a good life, namely control over the process of making things for their own self-realisation and happiness. Once work had become replaced by alienated labour during the Industrial Revolution, consumerism gradually filled the void that was left by the lack of meaning; people became passive consumers of a 'goodness' that was given to them, rather than actively creating their own.

These models of utopia, in which happiness is created by the consumption of seemingly unlimited goods, are almost certainly unsustainable and are a key driver of the environmental crisis. As a simple measure, if the global population adopted the lifestyle of an average South African citizen, 1.4 earths would be required to sustain that consumption. The lifestyle of an average Qatari citizen would require 4.8 earths to sustain a global population adopting this pattern of consumption, while the lifestyle of a citizen in the United State would require 3.9 earths. The utopian ideas of lifestyle based on these levels of consumption are clearly not viable for the population within the limitations of our planet.<sup>37</sup>

Other, more sustainable ideas of utopia have been advanced. The idea of utopia, like More's *Utopia*, or Ebenezer Howard's *Garden Cities of To-morrow*, has been based around the notion of medium sized towns with a prescribed maximum population that could be sustained within their own geographical limits. Within these utopias, the population would be small enough for people to know their neighbours, alluding to ideas of good governance and a fulfilling community life. These utopian concepts became particularly operative in conjunction with the transformation that came with the Industrial Revolution and were reflected in the ideas that lay behind the French and Soviet revolutions.

Pollution has not always been a marker of dystopia in the context of utopian ideas. During the industrial revolution, smog and smoke stacks were seen by some as a sign of progress. There is some parallel here in the way current day measures of national prosperity are correlated with high rates of energy consumption and consumption of goods (associated with GHG emissions and industrial pollution).

New modes of transportation (rail and subsequently automobiles) during the industrial revolution also fundamentally transformed the idea of space within utopian concepts. To a certain degree they allowed finite cities to become infinite. Developments in transportation allowed the expansion of the city to the borders of the nation-state. Often well-intended utopias that based their versions of the good life on mere technical progress paved the way to unsustainable lifestyles. In this regard, the early 20th century architect

Frank Lloyd Wright's utopian ideas of decentralised households and cities connected by highways prefigured the dystopias of commuter cities choked by traffic in the United States and Japan, while Thomas Edison's concepts of cities with unlimited and cheap electricity supplies have led to a mindset of 'anything-goes' and a sense of entitlement on the side of consumers. This has resulted in dramatic upsurges in green house gases (GHGs) and the problem of climate change. In the 19th century, positivist social engineers working on utopian models had a mechanical understanding of the human mind and society. Based on this they sought to control and intervene in social trajectories to form utopian societies. Within this system, the environment held a clear but limited role, where foliage, sunlight and leisure were seen as ways to pacify the masses. Furthermore, the social engineers envisioned ideal futures and assumed that people would naturally opt into their vision without considering the transition process and without granting the inhabitants an active agency in their making.

Corporation-owned 'smart cities' today seek to provide another form of utopian vision with some inherent problems. Cisco for instance runs a model smart city in Bangalore, India,38 but to live within it requires citizens to place a large degree of control in the hands of one company. Panasonic is building a sustainable smart town in Fujisawa, based on a similar model of life.<sup>39</sup> In many ways these narrow models of utopia (maintaining the same level of consumption but underwritten by renewable energy and focussing on energy efficiency) may still be unsustainable in the long term (can they be replicated for the global population?), and the fact that they place a large degree of control in the hands of corporations is problematic in terms of maintaining democratic social systems. Furthermore, these ready-made smart cities that are built from scratch mostly cater to the affluent and are rarely affordable for the poor who make up the majority of the world population. They also offer no templates for future proofing existing cities. Denuded of any social emancipatory content, these corporate 'smart cities' seem to nourish a strong, different kind of utopia—namely a utopia in which it is possible and desirable to continue our unsustainable lifestyles.

The key question is whether a technological fix will remodel society to prevent environmental crises. Will a new form of electro-mobility or energy source allow us to achieve our utopia?

At the same time, we could raise the question of whether the type of

lifestyle associated with current levels of consumption is really so beneficial and desirable. In Japan, vending machines and Pachinko shops in the Tokyo area are said to consume 260,000 kilowatts and 840,000 kilowatts of power respectively, or slightly more than the output from two nuclear reactors at Fukushima's now damaged No. 1 plant.<sup>40</sup> Rather than locate a new power source for these vending and gaming machines, and keeping in mind the devastating nuclear disaster at Fukushima and the cost attached to it, would a simpler answer be for Japanese society to decommission two nuclear power reactors and agree not to operate Pachinko shops or vending machines?

This brings us to the question of alternative models of utopia, or 'Bhutan re-loaded'—a reference to applying the concept of gross national happiness to national development. The idea here is underwritten by the research of scholars such as Richard Easterlin who contend that the happiness of populations does not mirror greater rates of consumption beyond a certain level of wealth.<sup>41</sup> If this is correct, then measures of 'Gross National Happiness' (GNH) measured by states like Bhutan represent an alternative model of development to those measured by economic output, GDP, industrialisation, the requirement for markets and high levels of consumption, and the associated ecological costs of this model. GNH is a powerful concept in the context of wealthy, consumerist Western and Japanese societies experiencing high rates of depression, suicide and an epidemic of obesity. It is also a somewhat dangerous utopia if applied to communities experiencing abject poverty in the absence of a global system of wealth redistribution.

In terms of a proximate factor to the environmental crisis, it is clear that the Western idea of 'progress' and the materialistic form of consumptionled utopia attached to it is a key cause of environmental crises ranging from industrial pollution to deforestation to climate change. In terms of possible points of intervention, there are at least two to consider. The first is to identify new forms of sustainable utopia and perfect their delivery. The second is to identify the drive towards a utopia as a fundamental problem, and to redirect the aspirations of human communities away from a teleological end point to a journey of adaptive change and evolution.

## Externalising waste, exporting harm, creating inter-generational debt

Placing the burden of environmental problems on the soil, the ocean, and the future.

The ability to externalise environmental damage away from the point of consumption and production is a key issue to consider in addressing why human societies continue to allow harmful practices to occur. In most modern societies, we possess the ability to take the benefit of goods, energy and processes, without witnessing the harm or waste integral to their use.

At times communities know of the harm associated with a good, process, or energy source, and choose not to react to the knowledge of this harm. At times, the problem is a lack of information and transparency linking the practice or product to the environmental harm. In addition, as outlined in the section on wicked legacies, the complexity of the production system or activity sometimes results in entirely unintended consequences that are only apparent after a substantial period of time or after significant investigation.

Externalising waste has major global environmental consequences. Kellenberg (not a conference participant) highlights the scale of the international export of waste:

In 2007, the world traded more than 191 million tons of waste.

... What is more exceptional is the fact that the annual physical weight of waste traded in international markets grew by 67% in 5 years, from 114 million tons in 2002 to 191 million tons in 2007. The physical weight of waste traded is substantial when compared with the physical weight of other large traded goods. In 2007, the weight of passenger automobiles shipped worldwide was 41 million tons, or less than 22% of the physical weight of waste traded. While much of the waste shipped is sent to foreign markets for the purposes of recycling and recovery, mounting evidence suggests that waste is increasingly exported to countries with lax environmental regulations, suggesting the possibility of international waste haven effects.<sup>42</sup>

An important point to note is that waste and environmental harm is externalised, not just geographically, but also by placing the burden of current practices on future generations.

While the concept of intergenerational debt and obligations is not accepted by all scholars, it is widely accepted as an ethical principle that the current generation has an obligation not to destroy the capacity of future generations to enjoy a minimum standard of living and to have sufficient access to natural resources (primarily water, land and air). This obligation finds a clear place in the precautionary principle, which emphasises risk avoidance and "demands that humans take care for themselves, their descendants and for the life-preserving processes that nurture their existence."<sup>43</sup>

Three examples demonstrate the importance of considering intergenerational debt. The first is the sheer timescales involved in dealing with nuclear waste and the sites of nuclear accidents, bombings, or tests. Nuclear waste and nuclear contamination, in the case of reprocessed uranium and plutonium, will remain harmful to human health and ecological systems for a minimum of 50,000 years.<sup>44</sup> It is very difficult to argue that any present day benefits of nuclear use outweigh the costs involved in 50,000 years of waste management, and to continue postponing addressing the issue of waste management is clearly not sustainable. The second is the delayed harm associated with greenhouse gas (GHG) emissions, particularly the increasing accumulation of CO<sub>2</sub> levels in the atmosphere. These gases take far longer to dissipate than they do to create, placing an increasing burden of climatic adjustment on human communities decades and centuries from the decision to derive benefit through electricity generation or transport resulting in GHG emissions in the present. In both cases future generations are essentially held hostage by the decisions of human communities in the present. The third example is the ongoing increase in micro-plastic pollution, which cannot be reversed and has far-reaching consequences, impacting on the smallest microorganisms and accumulating up the food chain. Plastics, which are the source of these micro-plastic particles, are something that every one of us deals with in our everyday lives.

If systems are designed to conceal and externalise the harmful outcomes of goods and services, then those harmful outcomes will be a less effective restraint on consumption. As a simple example, it is unlikely that packaging of goods would remain as extensive as it is if local households were asked to retain and develop systems to dispose of all the containers, wrappers, and labels that were attached to food stuffs and household items. The convenience of receiving fruit or vegetables in pre-packaged containers would quickly be outweighed by the inconvenience of dealing with this waste in a context in which it did not conveniently disappear into landfill or become incinerated. One possible form of intervention may therefore be to increase the localisation of waste systems so the outcomes are more closely connected to the point of consumption.

#### Information transparency and deliberate blindness

Can we increase access to information and awareness of ecological problems and their causes? Or is the problem not that we do not know enough, but that communities and individuals choose to remain deliberately unaware of the outcomes of harmful practices?

The externalisation of waste and the creation of inter-generational debt is a feature of many environmental problems. Linked to this are two views regarding the awareness of human communities and individuals particularly those who benefit most from the processes which create waste or harm: the view that people are unaware of the harmful impact of their behaviour/consumption, and the view that they know, but are deliberately blind to the problem, or may simply be unable to translate knowledge of harm into effective remedial or preventative actions.

The two views result in two slightly different problems and points of intervention. If a proximate cause of many environmental problems is considered to be just a lack of information regarding waste/harm associated with products, energy sources, etc., then a productive site for intervention is the provision of more accurate information and dissemination to publics and expert groups.

In this regard, participants at the March 2014 conference highlighted the desirability of greater environmental monitoring and information services. This was particularly the case in Asia, where the information provided by companies and governments was often seen to be unreliable, and lacked any form of independent verification or review. A peer review mechanism or umbrella organisation for environmental transparency was proposed in the region as one possible solution to this shortcoming.

The second view is that, while accurate scientific information and environmental monitoring is essential, to a large extent the problem is not to provide more information, but to provide a coherent framework for people to make sense of the often overwhelming volume of information on environmental crises, relate this knowledge to their everyday moral and material life, and mobilise and act on specific problems in ways that are made apparent in a fashion that people can observe and that will reinforce their commitment towards change.

Of course, the two dynamics above are closely linked. Providing increased information on environmental problems is of little utility if audiences that matter in creating those problems are not receptive to the information, or do not react to the information in a manner which halts the environmental harm. Similarly, efforts to mobilise communities and individuals, or to create social frameworks within which to create meaning from a large volume of complex information, may produce as much harm as positive change if accurate scientific information is not produced and disseminated to provide a judgement on what constitutes a positive or negative change or what would be an effective response to a given problem or situation. How to communicate scientific facts and complex consequences to non-expert publics is a problem that has been extensively investigated by John Robinson of the University of British Columbia (not a conference participant) and represents a key site for further research.<sup>45</sup>

## **Compartmentalisation and specialisation**

To what degree is the technical specialisation of modern science, governance, economics and society part of the problem of addressing environmental crises, which span social, technological and natural systems?

A proximate factor underlying the failure of human societies to deal with the environmental crisis highlighted by participants at the conference was an escalating trend towards compartmentalisation and specialisation of knowledge and governance.

Specialisation has enormous benefits. Designing scientific, technological and governance solutions to problems are highly assisted by what Niklas Luhmann terms 'Functional Differentiation' in society—the trend towards creating subsystems with a limited focus and specialisation. This trend however, leads to intensifying selectivity within societies as they grow more complex and require greater specialised and focused subsystems to operate.

It is this dynamic which leads to the central problem set out at the beginning of this paper: that while modern society tends to be quite good at identifying specific environmental problems, and at developing and suggesting specific solutions, there is a tendency to focus on addressing these problems through technological or regulatory mechanisms at the point of harm at the expense of developing more deep seated reforms which would prevent them occurring in the first place.

Functional differentiation operates at a number of levels in regard to the environmental crisis. First, the differentiated areas of expertise and governance between, for instance, political, security, economic, science and environmental governance systems at local, national, regional and global levels may result in situations whereby policy makers in each field communicate in terms which are not translatable across each area. Issues of critical importance conveyed by environmental scientists may not translate into issues of high importance to policy makers concerned with national economic governance for instance (and vice versa). In this sense the perceived need to express ever more important policy domains in economic jargon might be considered as one such attempt to connect and translate between knowledge domains (human capital, critical natural capital, social capital, space capital, cultural capital, etc.).

Second, functional differentiation constrains collaboration and information sharing amongst expert and academic communities, and between those communities and practitioners, policy makers, and the general public. The division of the university into faculties and schools which then have tendencies to operate as silos, with limited cross-disciplinary (let alone true inter-disciplinary) research or indeed interaction is a good example of this, as is the trend towards increasingly specialised journals whose requirements for publications promote the use of technocratic and extremely abstracted language that is at times impenetrable to lay readers seeking to translate research into insights for practice or simply to better understand an issue.

Third, functional differentiation shapes the way individuals learn to think of and interact with the world. Education systems have been shaped by and provide skills to operate within a globalised world system that has all but universally adopted market economies and decentralised governance systems. This system makes it less likely that people will challenge ways of thought that presume a fundamental divide between humans and nature, and are more likely to adopt an approach of functional differentiation to incompatible aspects of their lives. For instance a person could be immensely successful in a scientific career designing technological solutions for environmental problems, lead a high status social and material private life which has persistent and significant negative ecological impacts, donate considerable resources to charities for poor rural communities, and support national political parties with policies advocating reducing welfare provision for low income groups and reduced redistribution of resources.

This last point moves away from the concept of functional differentiation as theorised by Luhmann<sup>46</sup> but is at least as important. Through a process of internal functional differentiation, a person can be both effective and logically consistent within the strict barriers defined between work, private, social and political components of their life, but the overall impact of the totality of that person's activities and value system becomes incoherent when viewed as a whole.

In regards to environmental crises, Helga Weisz pointed out that issues such as climate change have both technical and economic solutions that are well known and relatively easy to implement. The problem stems not from an inability to foresee the effect of GHG emissions or to design technological or economic solutions, but from an inability to mobilise action to address the problem within complex communication systems which characterise societies marked by functional differentiation. Within this setting, the complexity and interconnectivity of modern society is very difficult to manage, and causes of problems are very difficult to pinpoint.

Social systems are therefore complex communication systems, and our societies are structured by functional differentiation to such a degree that communication becomes very difficult. This is a key proximate factor underlying our inability to effectively address environmental crises and the challenge is to design means of communication that cut across specialisations, interests and disciplines as a basis for action. Efforts to design conceptual frameworks such as DPSIR (used by the European Environment Agency and the UNEP, see Appendix 2), the sustained interest in inter-disciplinary and cross-disciplinary academic conferences and research projects, the emergence of global issue based epistemic communities that can draw on contributions from diverse areas of expertise, the reframing of environmental issues and areas into economic languages and systems (and vice versa), and the increasing trend towards security actors conceptualising environmental problems as security threats are all (for better or worse) examples of efforts to utilise the benefits of functional differentiation and at the same time overcome the challenges it creates.

Critical to all these efforts are communicative skills of dialogue, or the ability to engage in such a way as to attempt to understand the logic, reasoning and particular meaning of language and terms used by people, groups or ideas dissimilar from our own experience and to very deliberately suspend the application of our own frame of reference too strictly to a new idea or group in a manner so as not to discount the potential value in that contribution.<sup>47</sup> In regarding the functional differentiation of society as a point of intervention in addressing the environmental crisis, the benefits of functional differentiation need to be kept strongly in mind. The dynamic has evolved for a reason and as a response to complexity and scale in human affairs. The challenge is to effectively bridge differentiated areas to mobilise human communities towards effective action in addressing the environmental crisis and environmental crises, while maintaining the benefits that derive from that differentiation.

# Decision making and accountability: Sovereignty, nation-states and the international system

Who should take responsibility for global problems? Are the nation-state and democracy the most effective vehicles for managing complex transboundary environmental crises?

Participants at the March 2014 conference highlighted that there exist globally dominant systems of decision making (often economic) that result in illogical decisions. It is worth attempting to find a system of thinking or decision making to be an alternative to this.

To a large degree, the current dominant system of overall decision making is structured by the international system composed of sovereign nation-states, with strictly defined territorial borders and political communities (to some extent) coterminous with these borders. The dramatic development of transnational, international and supranational forms of governance—including far greater input by civil society and epistemic/ scientific organisations—in the post-cold war era is a direct result of the increasing incapacity of territorial bound state governments to deal with transboundary issues such as climate change, globalised production systems, multinational corporations, not to mention problems such as managing transboundary industrial pollution (smog from Chinese industry effecting Japan and Korea, etc.), balancing global interests in retaining large rainforest zones against local and state interests in the economic value of logging or clearing land, or large scale catchment management in rivers that cross multiple state borders.

Paradoxically, despite the enormous growth in the sophistication and complexity of state bureaucracies, at no time have state governments been less free to implement policy at a national level without significant dependence on global and regional developments. As an example, national economic prosperity (in terms of crude measures of GDP growth, but also more important measures of individual employment and community well-being), is strongly influenced by broader global economic trends (the downturn for European economies due to the 2007 global financial crisis, or the dependence of Australian national economic prosperity on the Chinese economy). And yet the key mechanism for achieving global consensus and implementing policy, the United Nations system, remains deadlocked around issues such as climate change, and is structured in an anachronistic way which gives precedence to the state victors of WWII rather than encouraging a global system of representation and decision making that would capture at least some elements of a global participatory democratic system of decision making and action.

At a local level, participatory systems are essential in designing effective solutions to environmental issues, and in defining what those issues are. Input and assistance by experts and scientists is useful, but it is essential that local context is taken into account, and that an effort is made to connect and transmit knowledge and skills held by experts to local communities in the process. Even in relatively well defined national political communities with strong democratic governance traditions, local engagement and participation in decision making and policy development towards environmental (or other) challenges is often poorly implemented. An example is the very difficult process of 'consultation' undertaken during the development of a catchment plan for the Murray Darling Basin in Australia, or of government responses to flood and storm surge mitigation in Japan that not infrequently have failed to account for preferences of local communities. Given the difficulty of this challenge at a local and national level, is it possible to develop participatory systems at a global level given the existing structures of state sovereignty and national political communities?

The degree to which state sovereignty and the system of nationstates represents a proximate cause of environmental crises is debatable (it may in fact be better labelled a 'root' cause). Doing away with the concept altogether is a far less controversial idea today than even a few decades ago—the experiments in supranationality undertaken by the EU and the increased reliance on transnational governance systems and global civil society networks being an obvious pre-cursor to what a post nation-state system of political community might look like. But given the dominant security function of the state—or at least the dominant manner in which the state has captured the lexicon of security and is able to define what count as both threats and an appropriate response to those threats (maintenance of large militaries and control over territory and populations)—whether this particular proximate cause constitutes a viable site for intervention is an open question.

Responses such as the move to define forms of 'global citizenship' and to create transnational environmental networks, facilitated by the global mobility of academics, teachers, and students in university systems (at least within wealthy sections of the global community), are examples of the types of intervention (short of a revolution in global political community and representation) which can be achieved here. Another example includes the increasing notion of a responsibility of states, corporations and communities to account for the end use impact of products manufactured or consumed within their national borders.

#### Poverty, redistribution, Malthus and limits to growth

What can we learn from Malthus' attempts to accept finite limits to growth and to develop policies which take these limits into account? What can these ideas tell us about the imbalance between agriculture and industry in modern global production and trade systems?

Participants at the conference highlighted that the interlinked factors of poverty, inequality and population growth were critical proximate factors underlying a wide range of environmental problems.

The relationship between inequality and poverty on the one hand and environmental degradation on the other is complex. At a local level, poverty can be a major driver of environmental harm, as, for example, impoverished farmers in some regions, driven by economic necessity, carry out traditional slash-and-burn farming with an intensity that makes it non-sustainable. On the other hand, although increased wealth can lead to a greater degree of local environmental protection, it can also lead to, and in fact is currently leading to a greater degree of externalisation of environmental impacts and increases in global environmental problems (in particular climate change). Overall, wealthy populations and states have a disproportionate impact on the environment compared to poor populations, although this is not to discount the problems of deforestation, soil degradation, and environmentally unsound practices (small scale gold dredging in rivers, etc.) that are underwritten by lack of choice and economic deprivation.

One idea behind the workshop was that a revisitation of the paths not taken in post-industrial revolution economic development may help to shed light on the proximate causes of the environmental crisis. Malthus was particularly considered to be worth attention, both because his attention to population issues encourages a focus on the limits of growth, and because his attention to the need for an adequate economic return to agriculture may suggest an alternative and possibly more environmentally sustainable path in economics.

Malthus had been a focus of attention even in earlier workshops of this series. He had a way of focussing on what happens when two factors that are closely related and impact significantly on each other develop at different rates of growth. The most well-known example of this is, of course, his discourse on population, where, of the two factors of population and food production, population grows in geometric proportions while agriculture grows in arithmetic proportions—leading to a breakdown in the availability of food in proportion to the number of human beings requiring that food. But Malthus was also aware of a disparity in the rate of growth of productive capacity versus the rate of growth of the markets that could absorb the outcomes of that production, resulting in market gluts. He was also concerned about the consequences of industry growing more rapidly than agriculture.

While Malthus may not have described his own ideas in this way, his thinking can be seen as pointing to the third of these disparities, the disparity between industry and agriculture, as significantly impacting on the other two. At least in his later works on population, Malthus was aware of a connection between poverty and population growth rates. If the agricultural sector was disadvantaged in the economy, people in the rural sector would become poorer and consequently birth rates in the rural sector would increase. Since the agricultural sector would not be able to absorb the population increase, the influx of people from the countryside into cities, and therefore the number of people dependent on employment in industry, would increase and consequently the scale of industry itself would increase. With this, the disparity between the quantity of production and the capacity of the market to absorb this would become intensified.

Malthus' response to this was to argue that returns to the agricultural sector should be at a sufficiently high level to maintain a balance between agriculture and industry. Farmers were not to be seen only as producers. They also have the responsibility of maintaining soil quality and handing on good farmland to the next generation. They should be rewarded for both these roles. If the agricultural sector were sufficiently well rewarded and rural poverty minimised, then rural population growth rates and the influx of people into cities would consequently be less, reducing the concentration of people in the industrial sector and maintaining a better balance between urban and rural populations and between the agricultural and industrial sectors. Further, if both the population and the income of the agricultural sector were sufficiently well maintained, this sector, ameliorating the problems arising from the disparity between the amount of production and the capacity of the market to absorb that production.

For Malthus, the money going to the agricultural sector, through revenue from its output supplemented by government support if necessary, should be sufficient to cover costs of production and distribution, to provide a level of profits that maintains economic viability, to stimulate desired growth, and to provide for the workers and their families standards of living and lifestyles commensurate with those of the other sectors, and thus check any tendency to depopulation of the countryside. Insufficiency in this would result in rural poverty, population increase, and an influx into the cities. It would thus exacerbate the disparity between the growth rates of population and food production and also the disparity between industrial productive capacity and market capacity. If on the other hand sufficient income were provided to the agricultural sector, it would result in an amelioration of the problems resulting from these disparities. Since Malthus' ideas were not accepted, we can of course, never know what would have happened if they had been. But there is much in his thought that is of interest today. Certainly, within the developed countries, the agricultural sector—though much diminished in size in terms of the proportion of the population that makes it up—is not particularly impoverished. At a global level, however, and particularly in developing countries, the rural sector is characterised by intense poverty and this poverty is a driving factor behind population growth rates and also behind a good deal of environmental damage. If we are to try to draw lessons from Malthus' thought for the present environmental crisis, then, we might argue that a greater reward to agriculture, particularly agriculture in developing countries, is essential. This would imply developing structures that promote a far more equitable distribution of wealth at a global level and that recognize in primary producers a dual role—one of preserving nature as well as one of producing—and ensure that they have the capacity to fulfil both these roles.

Malthus expected the disparity between the quantity of production and the capacity of the market to absorb this to result in market gluts. Historically, however, it has more often resulted in the quest for new markets and consequently in global expansion of the economy that emerged in Europe as a result of the industrial revolution. As is evidenced by the spread of British colonialism in India, driven at least in part by the need for markets for British textiles, the opening up of China with the Opium Wars and the forced opening of Japan by Commodore Perry, the need for opening up new markets has been a driving force behind colonialism and the global expansion of trade in the period following the industrial revolution. One can only guess at what might have happened if the kind of balance between agriculture and industry that Malthus advocated had been maintained, and if this had indeed led to a slower rate of population growth, reduced rural-urban migration, and a greater capacity of the internal markets of industrialising countries to absorb the industrial output of those countries. In the world today, as we look for an economy less dependent on expansion, it may be time to address these issues again.

The above was the standpoint of the research project even before this workshop began. Most participants at the workshop did agree that redistribution of wealth is at the core of managing population growth and the environmental pressures associated with it. John Pullen presented the ideas of Malthus, particularly regarding the limits of growth and the doctrine of moderation he used to approach issues of humanity and the environment. Pullen highlighted that population growth itself was not the problem, but population growth in a context in which the means to support that population is lacking. His analysis supported the view that, because the voluntary propensity to pro-create diminishes with wealth, a better re-distribution of wealth is key to ensuring population size is managed and does not exceed the carrying capacity of natural systems.

Nobuhiko Nakazawa highlighted the way in which Malthus changed his views on select issues such as the law of nature, in part in reaction to Thomas Paine's work. Malthus opposed Paine's focus on re-distribution because it did not respond to the real causes of poverty and would lead to increased population growth.

In the context of the discussion of Malthus' ideas, Hiroshi Kito outlined the historical cycles of Japanese population growth over different civilizational eras. Japan, and most nation-states, have a trajectory of declining birth and mortality rates, with overall population growth trending downwards.

A discussion of Malthus' ideas leads to a number of interesting connections between the interlinked proximate factors of population, poverty and inequality and the impact of these on environmental crises. Since poverty itself is a direct factor behind population growth and also behind various environmental impacts, then poverty itself, and the causes of that poverty, are to be included among the proximate causes of the environmental crisis that this workshop has sought to highlight.

The poverty affecting various parts of the world is attributable to a variety of causes—such as harsh natural physical endowments, civil unrest, bad systems of government, et cetera—and the difficulties of overcoming such causes should not be underestimated. But at the same time, there are also factors behind that poverty that derive from economic structures and systems, such as price and wage structures that leave the agricultural sector (particularly in developing countries) at a disadvantage, and patterns of ownership and control of natural resources that exclude many (often the residents and the traditional owners of the land from which the resources are extracted, and the very people whose labour has made the exploitation of those resources possible). In this context, attention should also be paid to the globalisation of the food market

and land grabbing by powerful corporations, which, on the one hand, promises to make food production more efficient by utilising economies of scales, but on the other hand disenfranchises former land owners, discards local knowledge about traditional sustainable land management, depletes soils and makes the overall global food supply system more centralised and vulnerable to crises by pests, droughts, oil price rises, etc.

Approaches to coping with the environmental crisis should stress the way in which these patterns of reward and ownership affect economic progress. If the concept of a return that would cover expenses and include a reasonable profit were extended to fairly include all involved in the production process, if the concept of ownership were broadened to recognize some degree of rights for people traditionally and currently closely linked to a particular resource, and if the principle of equal sharing of natural resources is interpreted not as an equal sharing of the physical resources, but as an equal sharing, or at least a more equal sharing, of the value of the natural resources, or of the net profit resulting from the development of the natural resources, then perhaps a fair distribution of wealth will cease to be a utopian and impossible ideal, and become a viable reality. Seeking to achieve this through measures such as taxation (at progressive rates) or redistributive welfare benefits, may be less politically radical and less revolutionary hostile than attempts to expropriate the existing owners, and therefore more achievable and less prone to stimulate conflict.

In this context, we should consider the balance between industry and agriculture at a global level—particularly between wealthy and poor nations as an essential part of addressing wealth re-distribution, population issues, and environmental crises. The imbalance in the type of wealth individuals and communities can generate in rural and remote areas (with economies often based around agricultural production), is a key driver of urbanisation, and all the environmental problems associated with urbanisation, but also a key reason behind the relative lack of political power associated with those communities most in contact with the natural environment and (potentially) in the best position to monitor and prevent environmental degradation at local levels.

Malthus, in the manner in which his opposition to policies such as the Poor Law were perceived as (and to a large degree were) cruel, also highlights the dangers of single dimension/functionally differentiated thinking. Just as population control can be merciless on families if it fails to take into account people's basic humanity, so too relatively straightforward solutions for problems (such as industrial pollution in China) can result in harm if labour and social factors are not accounted for.

Population size and growth rates were commonly agreed at the workshop to be important proximate factors underlying many environmental crises. Both population growth and local environmental damage were seen to be strongly linked to poverty, and in this respect poverty alleviation and development policies such as improving access to women's education were seen as fruitful ways to intervene to prevent environmental harm, rather than stricter forms of population control. This provides an attractive system of logic, but is complicated by the link between increased wealth (associated under modern industrialised lifestyles with increased consumption) and increased rates of global environmental harm and a trend towards externalisation of waste and other environmental impacts. Reducing overall population size through declining birth rates and increasing prosperity will have little impact on environmental crises if all future people adopt lifestyles similar to the average American, Japanese, or Australian citizen.

#### Adaptability

To what degree will people really miss things currently seen as essential to a modern lifestyle? How do we balance the reality of strong human adaptability (quickly adapting practices and lifestyles) with the tendency for individuals and groups to fiercely defend and fight for existing rights, things and wealth?

One of the peculiar features of individual and community responses to environmental crises, is the remarkable adaptability of individuals and communities to external pressures and deprivations on the one hand, and the extraordinary rigidity of individuals and communities facing the prospect of voluntarily relinquishing possessions and practices which they enjoy a right to in the present.

A good example of this phenomenon can be found in drought adaptation. Property holders with water allocations tied to river catchments often prove fiercely resistant to any loss or reduction in their entitlement to draw water from catchments, even when it is clearly established that the overall entitlements are in excess of the sustainable capacity of the catchment. This fierce opposition to change and any voluntary or forced loss of usage rights (whether or not they are being exercised), is in stark contrast to the individual and community adaptation to reduced water availability that is achieved in times of drought. Faced with the loss of adequate water supplies, farmers and farming communities implement far-reaching changes in more efficiently using water for productive outcomes, changing farming practices, and developing cooperative and market strategies to re-distribute and ration water use among stakeholders.

This dynamic of opposition to voluntary or forced relinquishment of rights to current resources or practices paired with adaptability to external pressures is highly relevant to problems such as climate change or fish stock depletion. While, in spite of willingness on the part of many individuals, communities are frequently unwilling to alter economic patterns of energy use. They may, in fact, be more willing to respond to and adapt to the pressures of increased natural disasters, which they frequently do with impressive cooperative effort. Likewise, while communities may not be willing to reduce levels of fishing and economic return from certain fisheries, they may be more willing to accept and respond to a situation of diminishing fishing returns (often by producing more intensive farming and harvesting technologies).

As a proximate factor underlying the environmental crisis, attempts to overcome fierce individual and community resistance to change by harnessing the remarkable demonstrated capacity for human adaptability is the final point of intervention which this paper seeks to put forward.

# Conclusion

Does a system of thinking which emphasises proximate causes to environmental crises assist us in identifying points of intervention?

This report, emerging from the work of participants at the conference 'Exploring the Origins of the Environmental Crisis', Nanzan University, March 4-7, 2014, explores the idea that there is significant merit in attempting to address environmental problems, not at the site of immediate harm, or by looking for root causes, but by identifying proximate causes to these problems in complex systems of interaction between humans and the environment. Intervention at the level of these proximate causes should then have the potential for both wide-ranging impact on an environmental crisis, but also the potential to build significant social consensus on the merits of intervening.

A series of proximate causes of the global environmental crisis, and its associated myriad of specific environmental crises, were suggested, ranging from the momentum and self-sustaining logic of money and raw materials, to the legal and ownership systems protecting nature, utopian thinking and the idea of progress, wicked environmental legacies and unforeseen consequences of engineered systems, externalising waste and creating inter-generational environmental debts, opacity of environmental information and deliberate blindness to harmful environmental outcomes, the compartmentalisation and specialisation of society as barriers to effective environmental action, global and local systems of environmental decision making in the context of territorially defined nation-states, poverty, wealth redistribution and overpopulation, and finally the fierce opposition to voluntary change in lifestyles in the context of remarkable adaptability in human communities when confronted with external pressures.

What are the most promising examples of current environmental crises which are best addressed by intervening at the level of a proximate cause rather than directly addressing the end problem? Can we identify any examples with as clear a causal link as that between increasing women's education rates and managing population growth?

The discussion on each of the proximate factors mentioned above identified a wealth of interventions which may have widespread positive impacts on environmental crises. Many of these were not new suggestions, but highlighted the very productive initiatives already underway in different sectors. This included strengthening environmental and labour constraints on the production and overall flow of materials, promoting a greater emphasis on the precautionary principle in relation to complex engineered systems, increasing the ownership and protection of natural resources through forms of valuation or local custodianship, designing new sustainable utopias centred around concepts such as Gross National Happiness rather than Gross National Product, a re-invigorated idea of the new commons, increasing the local disposal of waste products (including nuclear waste), improving access to and dissemination of data on environmental problems, enhancing interdisciplinary collaboration and communication, and harnessing the ability of human communities to adapt to disasters and change in strategies to address environmental crises.

These suggestions however, are not the central contribution of the report, and should not be read as such. What we have attempted to highlight by exploring the proximate factors to the environmental crisis and the possible points of intervention that these factors present, is that thinking of environmental crises in terms of complex causal chains opens a vast area of options for concerned individuals and groups to consider. Many of these points of intervention provide the possibility of ameliorating or preventing multiple environmental crises. They also provide opportunities to take action in ways that are not directly painful to the communities with an interest in continuing activities which are harming the environment. Increasing the economic returns to the agriculture industry in a way that recognises their role in maintaining cultural heritage and the ecological sustainability of land for future generations, would, for instance, have greater potential for social consensus than legislation banning certain land use practices.

Our contribution has also been to suggest certain types of causal factors whose identification will facilitate determining effective points of intervention. It is clear that attempting to address environmental problems at their point of harm through identifying immediate causes has not been successful. The rate of change and growth in human activity, science, technology and society continues to create environmental crises which outpace remedial actions attempting to safeguard the ecosystems of the planet. Moreover, the uncoordinated application of technological fixes on many scales without properly understanding their long-term side effects has caused new, unpredicted wicked legacies.

At the same time, prior efforts to identify root causes of the environmental crisis failed to provide a basis for designing policy interventions which could have direct impacts on the environmental crises within a timeframe suited to the rapid rate at which these crises unfold. Identifying proximate factors contributing to the environmental crisis, in which interventions can be considered short of revolutionary or unlikely societal changes, provides a way to bridge this gap between band-aid solutions and unachievable aspirations.

What are the next steps for a network of researchers and practitioners in attempts to address the environmental crisis? How can our thinking assist groups in taking concrete and rapid action to address pressing problems? Are there any ideas emerging from a discussion of proximate causes that have consensus appeal for further study and implementation?

This report, and the conference it is based on, should be seen as the starting point for a discussion on ways to address the environmental crisis. We hope that this preliminary work outlining our system of thinking and some of the proximate causes of the environmental crisis outlined above will spur debate, and encourage interested readers to contact us with their feedback. This can be on the definitions of proximate factors and system of thinking adopted, on the specific proximate factors identified, in regard to points of intervention which strike the reader as productive, or in the form of factors which we have not yet considered in the text. The journal *Global Change, Peace and Security* would also like to offer an open invitation to readers to submit for consideration research articles related to the ideas explored here.<sup>48</sup> Of particular interest would be for researchers to take up a specific environmental problem and attempt to develop a map of causal factors and points of intervention in the style proposed here as a detailed case study of the utility of thinking in terms of proximate factors.

There are a number of concrete suggestions that arise from this report on which a network of individuals and groups could take action. One such idea was the formation of a peak body for environmental transparency in Asia, which would draw together existing environmental organisations and academics to lobby for access to data held by governments and businesses on environmental problems, or would collect that data where it is not available. Another suggestion would be the development of new forms of dialogue, building on the work of scholars such as John Robinson, that enable us to translate between the different disciplinary discourses addressing environmental crises, systematically linking these disparate discourses to the meta-environmental crisis, and visualising and translating these primarily scientific rationalities into forms that can be understood and appreciated by non-expert publics. Suggestions are welcome regarding practical actions or further research in any of the points of intervention raised in the paper.

Above all however, our task remains to identify a single factor similar to women's education in the context of overpopulation—that we can point to as a proximate cause of the environmental crisis for which an intervention would both receive widespread social consensus and have a far reaching impact on multiple environmental crises. We have identified potential candidates, but to make this more than simply an exploratory exercise, we need widespread and active input on which factors are seen as the most promising areas in which to direct further research, discussion, and intervention.

Finally, we would like to thank all the participants at the 2014 conference for putting forward the ideas on which this report is based, without which a project of this kind would not be possible.

# Appendix 1: Population, Environment and Women's Education

The United Nations Population Fund (UNFPA) et al. describes the challenge that unsustainable population growth presents for environmental and social objectives:

The world is experiencing major population dynamics including the continued growth of the world population, as well as major changes in age structures associated with youth bulges and population ageing, and significant changes in spatial redistribution associated with migration and urbanization. These population mega trends—population growth, population ageing, migration and urbanization-... put increasing pressures on the planet's finite resources, contributing to climate change and challenging environmental sustainability. ... If the global population grows as projected, humanity would need approximately three planets by 2050. ... Consequently, ... slowing global population growth is not only desirable, it is essential .... Slower global population growth, together with more balanced patterns of production and consumption would help to reduce planetary pressures by slowing the depletion of non-renewable resources, increase the availability per capita of renewable resources and make it easier to achieve many of the internationally agreed development goals.

Source: UNFPA; UNDESA; UN-HABITAT, and IOM, Population Dynamics in the Post-2015 Development Agendas, Report of the Global Thematic Consultation on Population Dynamics, UNFPA, 2013, p. 12 (available from <u>www.unfpa.org</u>, accessed 19 May 2014).

While there is consensus that population growth is a problem, designing a direct solution to address it is far more contentious. At a consultation designed to explore strategies to mitigate population growth, a consensus emerged:

"The stakeholders ... emphasized that efforts to address and harness population dynamics are needed, but they were also unanimous in their rejection of any type of population control. Population control can have deleterious effects on not just individuals, but on society as a whole ..." (UNFPA et al., 2013: 15).

To avoid this dilemma between an agreed problem and the potential for very harsh possible responses incompatible with individual freedoms and human rights norms, participants at the Exploring the Origins of the Environmental Crisis Workshop pointed to the close correlation between the rates of women's education and low birth rates.

#### Women's education and population growth

Supporting the link between women's education and decreased birth rates, Monstand et al. for instance find that "increased mandatory education leads to the postponement of births: there are fewer cases of teenage motherhood and more first births among women aged 35 to 40 years." Eshete similarly argues: "[W]omen's education has a powerful social impact measured primarily in terms of women's reproductive roles, focussing on girls education and decreased fertility, increased child health and decreased child [mortality]." Increasing the rates of women's education, according to Eshete, is found to effect fertility in three ways: "by affecting the "biological supply" of children" [raising the age at which women give birth]; by lowering the demand for children [through increased health, decreased mortality rates, and higher household earnings]; and by increasing knowledge of contraception."

Sources: Karin Monstad, Carol Propper and Kjell G. Salvanes, 'Education and Fertility: Evidence from a Natural Experiment', The Scandinavian Journal of Economics, Vol. 110, No. 4, December 2008, p. 828; Almaz Eshete, 'Population and Women in Development: Gender Issues in the Context of Population and Development', African Development Review, Vol. 4, No. 1, June 1992, p. 91.

Part of the attractiveness of this identified correlation between education and fertility is that not only are increased rates of education also linked to increased economic wealth, but that increasing mandatory school attendance is a relatively well understood policy within the capacity of national governments to implement (Eshete, 1992: 91).

This means that by intervening to increase the level of women's education, particular in poor countries and regions, networks of actors could be mobilised around a consensus objective with interlinked social, economic and environmental benefits, while avoiding the more difficult issues of direct measures to control population. Lutz and KC in Figure 1 model the dramatic effect that intervention in education could have on global population growth.

Of course, intervening to improve rates of education for women living in situations of poverty is far from a straightforward objective, and as participants at the March 2014 conference stressed, poverty alleviation,

Figure 1: "Alternative projections of total world population size by level of education according to the four different education scenarios (with otherwise identical education-specific fertility and mortality rates)"



Table and source data from: Wolfgang Lutz and Samir KC, Demography and Human Development, UNDP Occasional Paper 2013/04, New York: UNDP, 2013, p. 11.

increased wealth, healthcare and social rights were all factors underlying the ability to deliver education to more women and for longer, even though in a complicated relationship, increased rates of women's education was closely linked to improving this same set of factors. In the words of Eshete:

"Effective economic and social transformations ... require the recognition and understanding of this intricate phenomena of gender issues to provide women with the means for economic and social self-determination. Such economic and social self-determination requires rights in the family and society, access to indices for self enhancement—namely education and health care, access to resources and income development and an active role in decision making on issues that affect their lives[,] one of the most critical of which is to control fertility" (Eshete, 1992: 79).

So, while women's education is clearly not a silver bullet to the problem of over-population (intervention to raise education rates is itself a complicated task), it does provide a model to look for points of intervention in environmental problems.

# Appendix 2: A parallel system of thinking: the DPSIR model

Our attempt to think in terms of causal chains and identify sites of interventions with widespread impacts on multiple environmental problems is not unique. One example of attempts to think in this way is the GEO-5 DPSIR conceptual framework used by the European Environment Agency (EEA) and by the United Nations Environment Program (UNEP).

DPSIR stands for Drivers, Pressures, State, Impacts and Responses, and is an analytical framework designed to "identify and evaluate the complex and multidimensional cause-and-effect relationships between society and the environment," and to suggest responses "which can take many forms at many scales from community action to international treaties, not only to the underlying drivers, but also to the environmental pressures and their impacts on ecosystems and human health" (UNEP et al., 2012: xix).

For our purposes, this model is very useful in terms of identifying the relationship between proximate causes and the environmental problems themselves, and also in thinking of causal chains in terms of complex processes, rather than linear sequences. The DPSIR framework is shown on the following page in Figure 2.

The DPSIR framework provides a useful reference point for our ideas. We can also suggest the addition of a new layer of concepts here. Potentially adding to the DPSIR framework in a similar manner to the way in which the 'global', 'regional', and 'local' is inserted in the visual presentation. Here we would instead include 'root', 'proximate' and 'immediate' causes.



Figure 2: The GEO-5 DPSIR conceptual framework

Table sourced from: UNEP (United Nations Environment Programme), GEO5: Global Environmental Outlook: Environment for the future we want, UNEP, 2012, p. xx. Available from <u>http://www.unep.org/geo/pdfs/geo5/GEO5\_report\_full\_en.pdf</u>, accessed 30 April 2014. Responding to the Environmental Crisis

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