

Introduction to Sustainable Development for Engineering and Built Environment Professionals

Unit 1 - A New Perspective

Lecture 2: What has led to a lack of Sustainability?



Educational Aim

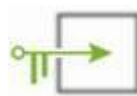
To develop an understanding of the core reasons for the current unsustainable situation. To also cover some of the reasons why there are ever increasing pressures on the planet's ecosystems and natural resources to provide enough for the increasing global population. Fundamentally, modern society's development is unsustainable, as the real cost of these increasing pressures - and further increasing negative social and environmental impacts in the future - are not included in the price of goods and services.




Required Reading

Hargroves, K. and Smith, M.H. (2005) *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*, Earthscan, London:

1. Chapter 1: 'Externalities: Who Pays?' (2 pages), pp 22-23.
2. Chapter 4: 'Collaborative Approaches' (2 pages), pp 60-61.
3. Chapter 11: 'The tragedy of the commons: 35 Years on' (3.5 pages), pp 178-181.



Learning Points

 1. One reason why our economy is essentially on an unsustainable trajectory is because nature has not been directly valued in the marketplace and therefore has not been given prominence by classical economics in the decision making processes of governments and businesses.

As the Australian Treasury department stated,^[1]

Inappropriate behaviour can also arise where government policies fail to provide appropriate incentives. For example, pricing water below the full cost (i.e. including the environmental cost) will lead to overuse, with a resultant increase in salinity and decline in river quality.

→ 2. Classical economics has not been able to adequately consider the effects of industry on ecosystems, biodiversity and natural resources, especially the impacts of industrial waste. There are real challenges in properly costing the value to the economy of ecosystem services. The classical economics of Adam Smith was a significant step forward but it analysed society as a closed system where natural ecosystems were considered to be an infinite source of resources and services and an infinite sink for wastes, which is obviously a false assumption.

→ 3. When the industrial revolution began, it was perhaps understandable that nature was not valued appropriately, because there was so much of it, and our activities seemed so small in comparison. Impacts on the world's ecosystems were largely ignored, as the concept that we could damage the earth's primary systems through our activities was unfathomable. However, as we are now seeing, this is no longer the case.

→ 4. Environmental degradation has also been exacerbated by difficulties in managing the public 'commons', which are resources that are common to everyone. This has led to the 'tragedy of the commons': fisheries for example - since everyone has access to the same fishing grounds, there are no incentives *not* to overfish, since there is only a finite amount of fish and it is in your interest to ensure that your competitors do not take more fish than you.

→ 5. Additional reasons for a lack of Sustainability include:

- Short-term market pressures for business profits.
- Lack of capacity building of professionals, such as engineers, architects, and accountants in how to achieve sustainable development.
- Lack of information for the consumer, such as independent trustworthy labelling, to determine what products are environmentally friendly.
- Lack of collaboration between various groups actively seeking sustainable outcomes.
- Lack of market incentives for innovation to achieve sustainable technologies and practices, while government continues to subsidise existing polluting industries.
- Lack of partnerships amongst the peak bodies of society to help build the political will for sustainable development.
- The short term political cycle of four years tends to provide little reward for long term thinking and planning.



Brief Background Information

The following information provides a brief overview of the related background material, from Chapter 3 of *The Natural Advantage of Nations*.

The Role of Externalities in the Problem Definition

Fundamentally, current modes of development are ecologically not sustainable because

the real costs of damage to the environment are largely externalised from the marketplace. Economists call these externalities. Externalities are present whenever an individual or a firm can take an action that directly affects others and for which it neither pays nor is paid compensation. It therefore does not bear all the consequences of its action. The effect of the action is 'external' to the individual or the firm. Externalities are widespread. Anything from a child creating a mess in a home, to someone smoking in a restaurant, to a factory emitting CO2 into the atmosphere are all creating externalities.

Whenever a firm produces pollution and does not have to pay for it, it is creating an externality that someday will have to be dealt with. Impacts will be felt both at a local level - through costs of soil remediation, waste treatment and toxics storage, to the international scale where for instance, UNEP and Munich Re estimate that the direct costs of global warming will be US\$500 billion per annum to the world economy by 2050.

We go about our lives making many decisions based on cost. All of us base many decisions on a formal or informal cost benefit analysis. When the market price does not reflect the true costs of our decisions these are called externalities. In these situations there is much government can do. Government policies in keeping the price of water for farmers low globally has led to excessive use of water, draining water from underground basins built up over centuries, lowering the water table, and in some cases, leaching out of the soil. For instance, in many countries, much of the timber lies on government lands and the government, in making the land available, has paid less attention to concerns about environmental impacts than it has to the pleading of timber interest groups.

Ken Henry, Secretary to the Treasury, Australia, 2004^[2]

As the Australian Treasury Department has stated, 'people generally are unlikely to produce socially optimal environmental outcomes when they do not face the full benefits and costs of their actions'. Under these circumstances, individuals are likely to place greater weight on the costs they bear themselves, rather than the costs their purchases impose on others.

It would therefore make sense to properly value the importance of ecosystem services to the economy and communities. However, valuing the costs of these externalities is a difficult task. What price is a stable climate worth? How can one put a price on access to drinkable, unpolluted water or breathable air? The challenge of defining values for what are public goods, often not in the marketplace, is in essence what has prevented governments and business (i.e. the marketplace) from properly internalising environmental costs into their decision making processes.

Valuing Nature's Services and Environmental Surprise

Millions of conservationists around the world find motivation every day in the beauty, spirit, and extra-human value of the world. And, as long as life and humans remain on earth, there will be a need for conservationists.

William Lines, Australian philosopher^[3]

Why is applying a financial value to ecosystems so difficult? Because the services nature provides humanity and our economy are 'priceless'. When a group of experts in the field calculated the value of nature's ecosystem services they found it was worth a combined value of at least US\$36 trillion annually. That figure is close to the annual gross world product, which is approximately US\$39 trillion - a striking measure of the value of natural capital to the economy. Ecosystem services in Australia have been valued by CSIRO at AU\$1,327 billion per annum. In addition:

- Some economists calculate the current cost to American agriculture of the decrease in pollination services through the impact on the population of

bees at around US\$5 billion per year. In the mid-USA the single biggest cost to alfalfa growers is the provision of beehives for crop pollination.

- A recent study showed that the provision of adequate clean water to New York City by forests in the Catskill Mountains was equivalent to a capital investment of US\$6-8 billion and an annual \$1-2 billion operating cost for a plant to carry out the same service.

Even calculating the financial cost of the damage currently being done to ecosystems is very difficult, as these systems are highly complex and dynamic. In addition, it is hard to measure the decline of ecosystem resilience because environmental problems are interrelated and often feedback on each other, hence as Professor Norman Myers, an Oxford University ecologist, points out, *'when one problem combines with another problem, the outcome may be not a double problem, but a super-problem'*.

When different phenomena feedback on each other scientists call these 'coupling effects'. The impacts of the greenhouse effect alone may be significantly mitigated, but when these are combined with deforestation and erosion, biodiversity and species loss, intensive modern agriculture with chemical fertilisers and pest control, and increasing urban waste streams, then the stress on the Earth's ecosystem can no longer be ignored. Rather it can lead to events that are becoming known as 'environmental surprises', when thresholds are reached.

'Everyone is aware of the environmental problems of global warming and deforestation on the one hand and the social problems of increasing poverty on the other hand', says Astrid Heiberg, President of the International Federation of Red Cross and Red Crescent Societies.^[4] 'But when these three factors collide, you have a new scale of catastrophe.' The 2001 Red Cross report pointed out that 1 billion people live in unplanned shanty towns, and that 40 of the 50 fastest growing cities are at risk of earthquakes. Rainforests cover only seven percent of the globe, yet 50 percent of the world's rain falls on these areas. Hence deforestation makes these areas highly prone to floods, loss of topsoil, mudslides and general erosion the rainforests would have otherwise mitigated. The impact of Hurricane Mitch on the Honduran economy in 1998 was estimated at equivalent to three-quarters of annual GDP. For small island economies, the relative magnitude of losses can be higher again.

Other Examples of Environmental Surprise include:

- The extinction of the Passenger Pigeon, once the most abundant land bird on the planet - due to habitat loss, forest fragmentation, hunting, and disturbance of nesting.^[5]
- Coral bleaching of the Great Barrier Reef caused by increasing water temperatures change the living conditions for the living algae (which provides the colour to coral) forcing it to leave its home in the coral polyps.
- Introduced Species, such as the explosion of population experienced in 'Cane Toads' in Queensland brought in from Hawaii to eat the 'Cane Beetle'. The toads didn't even eat the beetles and now reproduce at around 30,000 eggs per pair of toads spawning.
- Impacts on the reproductive system of the Bald Eagle in the 1960s and 1970s from the pesticide DDT accumulating at the top of the food chain.^[6]

- The hole in the earth's ozone shield over Antarctica in the late 1980s caused by chemical reactions involving chlorofluorocarbons (CFCs) in the atmosphere and thus increasing the amount of dangerous ultraviolet (UV) radiation reaching the planet.

Global Warming & Environmental Surprise

Dr Colin Butler, Australia's representative for the UN Millennium Assessment writes that,^[7]

In the more distant future, yet not so far away that it can be safely ignored, climate change may have even more drastic adverse effects on civilisation. Three such risks are massive sea level rise from the collapse of the Greenland or Western Antarctic Ice Shelf;^[8] runaway greenhouse gas accumulation from the failure of the terrestrial carbon sink (for example as forest ecosystems change from net sinks to net sources of carbon);^[9] and a significant weakening of the oceanic 'conveyor belt' currents which warms Western Europe.

Furthermore, few people appreciate that it is the loss of ecosystem services from global warming that may end up being the largest cost of global warming.

Why? Simply because so few appreciate the stress the planet's ecosystems will be under once climate change occurs more significantly. While it is true that the earth has gone through climate change before of 1-6 degrees Celsius, in the past ecosystems and species could migrate and move to cope with that stress. By contrast, our 'wilderness areas' are rapidly reducing and becoming largely unconnected pockets. If global warming is allowed to continue, and all the fossil fuel reserves are burnt, the concentration of CO₂ and other Greenhouse Gases will increase six-fold. Ecosystems and species will not be able to migrate as they did during the previous times of climate change. Scientists are already forecasting global warming of 1-6 degrees Celsius, with a doubling of the concentration of CO₂. Already climate change thus far has led to the bleaching of a significant percentage of the world's coral reefs. It will be impossible for ecosystems to migrate while we undertake this experiment with the planet.^[10]

The key point then is that different pressures on the world's ecosystems from different sources have a compounding effect on each other. The impacts of the greenhouse effect alone can be mitigated, but when these are combined with deforestation, the conversion of vast land masses to modern agriculture, increasing poverty, and urban development, the stress on our remaining ecosystems will soon be hard to ignore.

In 2003, a report by the World Bank listed the risks of environmental damage and social unrest as major factors that, if not addressed and significant progress made, will limit the extent to which the world economy can grow. It has been argued by research organisations such as Rocky Mountain Institute and the Wuppertal Institute, that we are facing a new form of 'limiting factor' today, unlike anything our economies have faced before - soon it will be forests not mills, fisheries not boats, that will be the limiting factor for economic growth. Herman Daly, a leading academic ecological economist, previously working at the World Bank, advanced similar arguments over ten years ago.

Recognising the problem of potential global climate change the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) in 1988. The role of the IPCC is to assess the scientific, technical and socio-economic information relevant for the understanding of the risk of human-induced climate change. It does not carry out new research nor does it monitor climate related data. It bases its assessment mainly on published and peer reviewed technical scientific literature. The reports from the IPCC are

used in global climate negotiations and their findings have been corroborated by the USA National Academy of Sciences.[11]



- Bright, C. (2000) *State of the World Report*, Worldwatch Institute, W.W. Norton & Company, New York, London, Chapter 2: Anticipating Environmental Surprise, pp 22-38.
- Carson, R. (1962) *Silent Spring*, Houghton Mifflin, Boston.
- Hughes, D. (1975) *Ecology in Ancient Civilizations*, University of New Mexico Press.
- McNeill, W. (1975) *Plagues and Peoples*, Anchor/Doubleday, New York.
- Scheffer, M., Carpenter, S., Foley, J., Folke, C. and Walker, B. (2001) 'Catastrophic Shifts In Ecosystems', *Nature*, vol 413, pp 591-596.
- Tainter, J. (1988) *The Collapse of Complex Societies*, Cambridge University Press, London.
- Students may be interested in two movie options that explore through images and music, the history of the planet and modern day implications of human activities:
 - 'Koyaanisqatsi' (or 'Life out of Balance')<http://www.koyaanisqatsi.org/films/koyaanisqatsi.php>.
 - 'Baraka'. www.spiritofbaraka.com/baraka.aspx.



- [Worldwatch Institute](#)
- [World Resources Institute](#)

[1] Australian Treasury Department (2001) *Public Good Conservation and the Impact of Environmental Measures Imposed on Landholders*, Economic Roundup - Centenary Edition, CanPrint Communications, Canberra . Available at <http://www.treasury.gov.au/documents/110/PDF/round5.pdf> . Accessed 25 Nov 2006. ([Back](#))

[2] Henry, K. (2004) *Head of Treasury Australia's Speech to the 30th Anniversary of the ANU Masters Program*, Canberra. ([Back](#))

[3] Lines, W.J. (2001) *Open Air essays*, New Holland, Sydney. ([Back](#))

[4] Red Cross (2001) *Red Crescent World Disasters Report 2001*. Available at www.ifrc.org/publicat/wdr2001/chapter8.asp. Accessed 7 June 2006. ([Back](#))

[5] Available at: Science Net Links (2004) *Changing World 1: Endocrine Disrupters*. Available at www.sciencenetlinks.com/lessons.cfm?BenchmarkID=7&DocID=407. Accessed 7 June 2006. ([Back](#))

[6] Ibid. ([Back](#))

[7] Bacon, S. (1999) 'Decadal variability in the outflow from the Nordic seas to the deep Atlantic Ocean ', *Nature*, vol 394, pp 871-4. ([Back](#))

[8] O'Neill, B. and Oppenheimer, M. (2002) 'Dangerous climate impacts and the Kyoto protocol', *Science*, vol 296, pp 1971-2. ([Back](#))

[9] Cox, P. Betts, R., Jones, C., Spall, S. and Totterdell, I. (2000) 'Acceleration of global warming due to carbon-cycle feedbacks in a coupled climate model', *Nature*, vol 408, pp 184-7. ([Back](#))

[10] IPCC (2001) *Climate Change 2001: Synthesis Report, Synthesis of the Third Assessment Report*, Intergovernmental Panel on Climate Change, United Nations Environment Program/World Meteorological Organisation, Cambridge University Press. ([Back](#))

[11] Committee on the Science of Climate Change, National Research Council (2001) *Climate Change Science: An Analysis of Some Key Questions*, National Academic Press. Available at <http://books.nap.edu/html/climatechange/climatechange.pdf>. Accessed 7 June 2006). ([Back](#))