Pioneering Green Economists

In the past few years, the environment has moved to the centre-stage of political debate, and climate change in particular—the most urgent but still only one of a plethora of environmental crises we are facing—has become identified by politicians as the most significant threat facing humanity, greater even than terrorism. It is important to remember, however, that this was not always the case. A mere 30 years ago those who considered that the way we lead our lives might be causing environmental problems were regarded as fringe thinkers and dismissed as hippies or killjoys. Those who identified the central cause of the environmental problem as the interaction between economic activity and the environment were even rarer. This chapter pays tribute to a few of those thinkers—in different fields of work—who were the first to alert humanity to the seriousness of the problems we were facing.

Kenneth Boulding and Spaceship Earth

Kenneth Boulding began his life as a fairly conventional academic economist, teaching at both Michigan and Boulder universities in the USA. His later work, an attempt at cross-fertilisation between biology and economics, can be seen as a precursor to the development of ecological economics. He considered that the discipline of economics chose its subject-matter too narrowly and was ignoring the important environmental impacts of the economic system. Boulding was an early proponent of the call to move towards a non-growth or 'steady state' economy, and is famous for his statement that 'Anyone who believes that exponential growth can go on forever in a finite world is either a madman or an economist'.

Boulding's paper on the economics of 'spaceship earth' was published in 1966 and described the prevailing image which man has of himself and his environment. The 'cowboy economy' describes a state of affairs in which the typical perception of the natural environment is that of a virtually limitless plain, on which a frontier exists that can be pushed back indefinitely. This economy is an open system, involved in interchanges with the world outside. It can draw upon inputs from the outside environment and send outputs (in the form of waste) to the outside. In this perspective no limits exist on the capacity of the outside to supply or receive material or energy flows. Such an economy measures success in terms of flows of materials, which it seeks to maximize. Stocks are not measured, since there all resources are available in unlimited abundance relative to the human need for them. Boulding identified that the planet is in reality a closed system: the only significant input to the economy of the earth is the energy from the sun; the resources we have are fixed and exhaustible.

Boulding suggested as an alternative view that of the 'spaceman economy'. The earth should be viewed as a single spaceship, whose inputs were strictly limited and which must take account of its own wastes:

> Earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution, and in which, therefore, man must find his place in a cyclical ecological system which is capable of continuous reproduction of materials even though it cannot escape having inputs of energy.

Beyond the frontier of the spaceship itself there exist neither reserves of resources nor waste sinks. The spaceship is a closed material system. In order to survive, from this perspective, humans must find their place in a perpetually reproducing ecological cycle. Boulding was writing at a time when the old view was dominant, although he detected some signs of change:

> The shadow of the future spaceship, indeed, is already falling over our spendthrift merriment. Oddly enough, it seems to be in pollution rather than exhaustion, that the problem is first becoming salient. Los Angeles has run out of air, Lake Erie has become a cesspool, the oceans are getting full of lead and DDT, and the atmosphere may become man's major problem in another generation, at the rate at which we are filling it up with junk.

Boulding was also critical of the straight-line thinking inherent in mainstream economics; this he described as 'a linear economy . . . which extracts fossil fuels and ores at one end and transforms them into commodities and ultimately into waste products which are spewed out the other end into pollutable reservoirs'. This way of organising an economy was, he declared, 'inherently suicidal'. His alternative was a prototype for the spaceship earth which he thought he had identified in the traditional village economy of Asia. Rather than a linear form this had a circularity built in—'a high-level cyclical economy'. This was written nearly forty years ago and laid the groundwork for thinking about economic systems that has been since been taken forward by ecological and green economists.

The Club of Rome

In 1968 a group of concerned individuals came together to found the Club of Rome, an informal international association with mixed expertise and backgrounds who shared anxieties about the course the world was taking. They launched the Project on the Predicament of Mankind, one outcome of which was the publication of the report *The Limits to Growth* in 1972.This report lays out in striking figures and compelling text the path of exponential growth that the human race is following in a number of different areas that may appear distinct but are in fact interrelated. As they suggest in the

following parable, 'exponential increase is deceptive because it generates immense numbers very quickly':

> A French riddle for children illustrates another aspect of exponential growth—the apparent suddenness with which it approaches a fixed limit. Suppose you own a pond on which a water lily is growing. The lily plant doubles in size each day. If the lily were allowed to grow unchecked, it would completely cover the pond in 30 day, choking off the other forms of life in the water. For a long time the lily plant seems small, and so you decide not to worry about cutting it back until it covers half the pond. On what day will that be? On the twenty-ninth day, of course. You have one day to save your pond. (Meadows, *et al.*, 1972: 29).

This riddle is used to illustrate exponential growth, which is hard for people to conceive. Figure 2.1 illustrates exponential growth in the case of nitrogen fixing within the earth's ecological system, but it could have illustrated any one of a number of different systems which are experiencing the same pattern.[1] This caused concern to the Club of Rome members for two reasons: by the time the problems became obvious there would be very little time left to solve them; and the pattern was apparent in so many resources and processes that it was clear that there was a system problem. They identified this problem as economic growth, which was causing all other systems to increase exponential in denial of planetary limits (see more on the argument over the environmental consequences of economic growth in Chapter 9).

Figure 2.1. Illustration of exponential growth in nitrogen fixing

The Report was, as would be expected, lambasted by the political and economic establishment, but it set the scene for the rise of environmental concern and its link with economic activity. The authors of the report produced an update in 2004 including a useful summary of their argument:

> Our analysis did not foresee abrupt limits—absent one day, totally binding the next. In our scenarios the expansion of population and physical capital gradually forces humanity to divert more and more capital to cope with the problems arising from a combination of constraints. Eventually, so much capital is diverted to solving these problems that it becomes impossible to sustain further growth in industrial output. When industry declines, society can no longer sustain greater and greater output in the other economic sectors: food, services and other consumption. When those sectors quit growing, population growth also ceases.

Because of the addiction to growth demonstrated by globalised capitalism the rejection of it is somewhat rhetorical. In some ways the warnings were premature and allowed critics of the environmental movement to accuse environmentalists of over-interpreting their data and exaggerating the extent of the threat. However, these warnings are now being

borne out by the accumulation of scientific evidence, making it clear how important an early warning system the Club of Rome report really was.

Ehrlich and 'the Population Bomb'

Much of the early debate about environmental issues saw conflict between physical scientists, especially biologists, and economists. The economists tended to come off better in these intellectual tussles, although the onward march of environmental destruction suggests that they may not have been right. A classic example is the lengthy intellectual battle between Paul Ehrlich, a biologist, and the economist Julian Simon. Although a biologist by training, Paul Ehrlich was so concerned about the environmental crisis that he strayed into demography with his book, *The Population Bomb*, published in 1968 and hugely influential on the burgeoning environmental movement. The book's message was stark and reminiscent of Thomas Malthus in its apocalyptic vision: 'The battle to feed all of humanity is over. In the 1970s and 1980s hundreds of millions of people will starve to death in spite of any crash programs embarked upon now. At this late date nothing can prevent a substantial increase in the world death rate.' He was also, as this quotation indicates, just plain wrong and the reputation for scare-mongering that was acquired by the early environmentalists would allow policy-makers to dismiss as boys crying wolf the later whistle-blowers and their more scientifically grounded alarms about climate change in particular.

Together with environmental scientists Barry Commoner and John Holdren, Ehrlich developed the IPAT equation in the early 1970s (for more detail see Chertow, 2001). The equation is based on an unsophisticated thesis: that the environmental impact of economic activity is a combination of population size, consumption level, and the efficiency of technological processes. A simple mathematical equation including these three variables generates IPAT:

I	=	P	×	A	×	T
Impact	=	Population	×	Affluence	×	Technology

To demonstrate the usefulness of the equation we could consider car use in two European countries: Germany and Albania. According to figures from the UN Economic Commission for Europe (www.unece.org) there are 541 cars per thousand people in Germany but only 29 in Albania.[2] Germany's population is 82.5m. while Albania's is only 3 million. Assuming the same levels of technology, we can therefore calculate the two IPAT equations as follows:

Germany (I) = 82,520 × 541 × 1 = 44643
Albania (I) = 3,166 × 29 × 1 = 91

These figures are not yet meaningful, since they are partly reflecting Germany's larger population, but if we take into account that Germany's population is 26 times that of Albania we can see that multiplying 91 by 26 only gives us a value of only 2366, which is about an eighteenth Germany's value of 44643. In other words, Germany's higher level of affluence, indicated by its much higher number of cars per person generates a much higher level of environmental impact. We might now remember that Germany probably has much more energy-efficient production processes that produce much more energy-efficient cars, but they would have to be 18 times more efficient to match the environmental impact of a country which just has a lower level of affluence.

The response to Ehrlich's arguments came from the neoclassical economists led by Julian Simon. His book *The Ultimate Resource* argued what became known as a 'cornucopian' case (after the horn of plenty borne by Amalthea in Greek mythology). This argued that the resources of the earth were bountiful and that human ingenuity could substitute for any shortage by producing inventive technologies. Simon's thesis is that historical trends suggest that technological progress will avert both the problem of resource scarcity and that of waste limits. Although problems of shortage and pollution do arise periodically, the nature of the world's physical conditions and the ingenuity of people allow such problems to be overcome, leaving us better off than if the problem had never arisen. Hence an increasing population, the driving force stimulating technological development, is a blessing rather than a curse. To test Ehrlich's theory of the impact of population on resource scarcity, Ehrlich and Simon entered into a public wager on the assertion that a range of valuable minerals would dwindle over time: this is described in detail in Box 3.1. but to spare you the suspense I can reveal that Ehrlich lost.

While much of what Ehrlich argued was sensationalist and wrong, he and his colleagues were successful in alerting US policy-makers and world citizenry to the highly damaging impacts of an increasingly indulgent consumption pattern combined with a rapidly growing human population. Ehrlich focused his attention on the population variable of his equation, founding the pressure group Zero Population Growth. The focus on the need to conserve resources was translated into a focus on improved design that would minimize resource and energy use by such organizations as the Rocky Mountain Institute, the Factor 10 Club and the Industrial Ecology movement.

As a coda to this story a green or anti-capitalist economist might draw attention to the fact that, of the three variables that contribute to environmental impact in Ehrlich's original equation, technology is the one

that is most susceptible to variation by policy-makers with minimum social opposition. The alternatives of exercising serious control over population growth, or insisting that people curb their consumptive ambitions are unpalatable to politicians who depend on votes for their continued power. Within a capitalist economy it is also clear that developing a new technically advanced production process can generate profits for a business, while the business advantages in contraception or sales of hair-shirts are seriously limited.

E. F. Schumacher and Small is Beautiful

While E. F. (Fritz) Schumacher is best remembered for his coining of the adage of the green movement 'small is beautiful' (a phrase that some claim was actually derived from his teacher Leopold Kohr), his contribution to economic theory is perhaps better represented by his statement that 'It is inherent in the methodology of economics to ignore man's dependence on the natural world'. He was highly critical of the economics profession and agreed with a view he attributed to Keynes that economics should become a 'modest occupation similar to dentistry' rather than become the dominant subject of modern life. He felt that the economics profession, with its misguided and inadequate method of cost-benefit analysis and its attempt to put a price on what was priceless, was destroying the quality of modern life. He argued instead for an 'economics of permanence'.

Schumacher's thinking about the relationship between the environment and the economy grew out of his two decades of experience as a civil servant working for the British Coal Board: as an economist there he was able to observe how the British economy used resources in a profligate and short-sighted way. He linked this to an economy addicted to growth, and was thus an early critic of economic growth, preferring to consider well-being as an indication of a successful economy:

> It is clear that the 'rich' are in the process of stripping the world of its once-for-all endowment of relatively cheap and simple fuels. It is their continuing economic growth which produces ever more exorbitant demands, with the result that the world's cheap and simple fuels could easily become dear and scarce long before the poor countries had acquired the wealth, education, industrial sophistication, and power of capital accumulation needed for the application of alternative fuels on any significant scale (Schumacher, 1973).

Schumacher was concerned with the ever-increasing scale of production systems, arguing that 'The economics of giantism and automation is a leftover of nineteenth-century conditions and nineteenth-century thinking and it is totally incapable of solving any of the real problems of today.' Rather he believed that development should take place outside the cities and create

an ‘agro-industrial structure’ of small towns based in the countryside. In this his work prefigured many of the proposals made by today’s green economists. He also shared their scepticism about technology, arguing not against technology but against ever more sophisticated technology, almost for its own sake. His own conception was of ‘intermediate’ or ‘appropriate’ technology, which he also referred to as ‘technology with a human face’.

Schumacher’s critical approach to modern economic life was extensive. He despised the individualism that the market system both presupposed and encouraged, and he bemoaned the substitute of quantity for quality that a modern market economy brought in its wake:

> …the reign of quantity celebrates its greatest triumphs in "the Market." Everything is equated with everything else. To equate things means to give them a price and thus to make them exchangeable. To the extent that economic thinking is based on the market, it takes the sacredness out of life, because there can be nothing sacred in something that has a price.

While Schumacher’s original inspiration was derived from traditional economic concerns such as resource scarcity and efficiency, his later work dwelt more on the social and spiritual aspects of economic organization, as in his essay ‘Buddhist Economics’, where he compares the perspectives of a neoclassical economist with that of a putative ‘Buddhist economist’. Building on the concept ‘right livelihood’, which is one of the Noble Eightfold Paths of Buddhism, he questioned how such an attitude to work is possible within an industrialized economy. What, he asked, would this imply in terms of how we organise our economy? How would work within such an economy ‘give man a chance to utilise and develop his faculties; to enable him to overcome his ego-centredness by joining with other people in a common task; and to bring forth the goods and services needed for a becoming existence?’

Howard Odum: Thinking in Systems[3]

Howard T. Odum was a pioneering American scientist who made major contributions to ecology, energetics and systems theory, founding the fields of ecosystems ecology, ecological modelling and ecological engineering. Odum developed methods for tracking and measuring the flows of energy and nutrients through complex living systems; his work investigating the effects of nuclear radiation on such flows in coral reefs, rainforests and estuaries reflected his lifelong quest to find ways of understanding and dealing with man-made impacts on the environment. During the late 1950s Odum became particularly interested in the interface between the economy and the environment, and began to look for ways of understanding the links between flows of money and goods in society and the flows of energy in ecosystems. This eventually led to his development of an ‘Energy Systems

Language' which he claimed allowed the accurate and precise mapping of all kinds of energetic and resource flows—including money—in interlinked human/natural systems.

Chapter 5 will explain how the application of insights from the natural sciences to social and economic structures is crucial to the development of ecological economics. Odum's work has been especially important in clarifying the extent to which social and economic systems are affected by, and must understand and respect the laws that govern energy and resource flows in natural systems. Odum's Energy Systems Language was based on the insight that nearly all the energy available to fuel natural and human activity begins as heat and light from the sun; this solar energy must then be transformed by natural systems (e.g. photosynthesis by plants) and human technologies (e.g. solar photovoltaics) and stored in various forms (biomass, batteries) before it can be used. Odum proposed that a measurement of the amount of transformed solar energy embodied in any product of the biosphere or human society—for which he coined the term 'emergy'—could provide a kind of 'universal currency' which would allow fair and accurate comparison of the human and natural contributions to any particular economic process. This approach was so original that it has still not been fully incorporated into thinking about responses to climate change, where understanding the embodied energy in products is arguably more critical than only considering the direct energy flows in electricity generation or the work of an internal combustion engine.

Odum was also one of the first commentators to clearly identify and measure the absolute dependence of all aspects of modern economies on the vast stores of solar energy embedded in non-renewable fossil fuels - his demonstration (in Environment, Power and Society, 1971) that 'industrial man . . . eats potatoes largely made of oil' galvanised a generation of scientists and activists. In his final book, *A Prosperous Way Down* written in 2001, Odum set out his plans for 'energy descent'—that is, for the humane transition to a society based on the use of renewable, rather than fossil-fuel energy. His studies of the cycles of growth, storage, consumption and depletion in natural systems had convinced him that modern societies have reached the crest or climax of a period of massive growth driven by fossil fuel energy, and that downturn is now inevitable. By suggesting that the concept of emergy could help current and future generations answer the crucial question 'what is real wealth?' Odum claimed to offer a quantitative and scientifically-based foundation for the transition to a low-energy, low-carbon economy.

Odum can be seen as a pioneer of attempts to price the value that ecosystems provide for us, a process now known as the costing of 'ecosystem goods and

services'. Although focusing the attention of economic thinking on the value of natural systems has certainly moved the environmental agenda forward, some ecological and most green economists argue that 'costing the earth' in this way can be highly problematic, seeing it as an inappropriate attempt to put literally priceless services under the control of market forces. Odum's response to this argument was that if economic values were based on measures of the quantity and quality of embodied solar energy, rather than on the basis of monetary worth measured as willingness-to-pay, we would be much nearer to an understanding of what constitutes 'real wealth'—and much less inclined to recklessly squander the precious stores of that wealth available to us in e.g. rapidly depleting fossil fuel deposits. Odum's approach has not only been influential on ecological economists such as Robert Costanza, but has also provided an important foundation for the grass-roots eco-social design movement of Permaculture and its offshoot, Transition Towns.

Murray Bookchin: Prophet of Localisation

Murray Bookchin might seem an unlikely candidate for a list of inspirations for an economic system that is environmentally benign, having his origins in the US Communist movement of the 1930s. However, his work was unusual in responding to the disillusion with Communism as it was practised through the 1930s by moving in a libertarian direction; then, in the 1960s he drew attention to the negative environmental impacts of industrialized societies and proposed small-scale anarchist communes as a socially and environmentally preferable system of social organization. Bookchin's philosophy combined his earlier Marxism with anarchist organizational structures: 'he drew on the best of both Marxism and anarchism to synthesize a coherent hybrid political philosophy of freedom and cooperation, one that drew on both intellectual rigor and cultural sensibility, analysis and reconstruction. He would call this synthesis social ecology' (Biehl, 1997: 4).

Developing his ideas during the apotheosis of US technologically fuelled capitalism, Bookchin's extraordinary insight was to suggest that 'an ecological crisis lay on horizon', suggesting that chemical food additives might be causing cancer and degenerative diseases and that the technological 'progress' might yet have harmful environmental consequences. He identified the profit-driven capitalist system as the cause of the ecological crisis and suggested an anarchist and decentralized solution in his book *Our Synthetic Environment* published in 1962. Bookchin's manifesto was his 1964 essay 'Ecology and Revolutionary Thought', which first outlined what he would later call 'social ecology'. Its central thesis was that 'The imbalances man has produced in the natural world are caused by the imbalances he has produced in the social world.' (Bookchin, 1964/1971: 62). Bookchin's prescience in a

range of areas where ecological concern is commonplace today is striking: he warned of the greenhouse effect as early as 1964, suggested a link between radionuclide pollution and the increase in cancer, and predicted negative health impacts of stressful urban life. His solutions were equally radical and ahead of their time, as in his view of the renewably-powered eco-communities that many greens are striving to create nearly 50 years after he first proposed them:

'To maintain a large city requires immense quantities of coal and petroleum. By contrast, solar, wind and tidal energy can reach us mainly in small packets . . . To use solar, wind and tidal power effectively, the megalopolis must be decentralized. A new type of community, carefully tailored to the characteristics and resources of a region, must replace the sprawling urban belts that are emerging today.' (Bookchin, 1964/1971: 74-5).

The fact that Bookchin has not been widely recognized as a forerunner of modern environmentalism may derive from his stalwart rejection of 'environmentalism' as a form of solving ecological problems without addressing their fundamental social and economic causes. He thus came down clearly against the 'ecological modernization' discourse, as discussed later in Chapter 8, and, of course, before it was defined as such.

In terms of his prescription, Bookchin joins Schumacher in identifying the scale of modern human communities as a root cause of socio-economic and environmental problems. From an organizational point of view, he opposed the excessive specialization of modern production and the 'intensive division of labour of the factory system'. However, his concern for the size of organization was also about the disempowering nature of large structures, both industrial and political:

A small or moderate-sized community using multipurpose machines could satisfy many of its limited industrial needs without being burdened with underused industrial facilities . . . The community's economy would be more compact and versatile, more rounded and self-contained, than anything we find in the communities of industrially advanced countries. (Bookchin, 1965/1997: 25).

This discussion prefigures the debates about localization as a response to the damaging effects of globalization (that are presented in Chapter 12), as his view on political organization and structure anticipate the call for 'resilient local commnities' of the Transition Towns:

I do not claim that all of man's economic activities can be completely decentralized, but the majority can surely be scaled to human and communitarian dimensions. This much is certain: we can shift the center of economic power from national to local scale and from centralized bureaucratic forms to local, popular assemblies. This shift would be a revolutionary change of vast proportions, for it

would create powerful economic foundations for the sovereignty and autonomy of the local community. (Bookchin, 1965/1997: 25).

Bookchin's work was revolutionary not because of its analysis or prescription but because of its original synthesis of concerns for the environmental and social consequences of the modern industrialized economy, and its recognition that these form a nexus which should be tackled holistically before we can build a truly sustainable economy.

Hazel Henderson Attacks the Snake-Oil Doctors

When Hazel Henderson titled a 1982 paper 'Three hundred years of snake oil: defrocking the economics priesthood' she was merely stating in florid terms the widely held view amongst heterodox economists, as opposed to the neoclassical brotherhood, that the discipline is more akin to a faith than a science. Her contribution to the development of an environmentally sensitive economics is to identify the political nature of the economics profession, and to blow apart the myth of economics as an objective science: 'The word is out that economics, never a science, has always been politics in disguise. I have explored how the economics profession grew to dominate public policy and trump so many other academic disciplines and values in our daily lives.'

Henderson has always been critical of the 'free market system' (the quotation marks are hers) and quotes Karl Polanyi as identifying that the so-called laissez-faire market is in fact a social construct. In her highly critical view, such market systems are symptomatic of what she calls 'flat-earth economics'. Her view of a sustainable economy is one where the power is stripped away from global corporations and reinstated again in enterprises owned and controlled by their own workers based in strong, mutually oriented communities: 'The rise of worker-owned self-managed enterprises, and of bartering, sharing, self-help and mutual aid' (1988: 101). Such an economy will be focused on provisioning based on a culture of relationship rather than on markets mediated through money.

She illustrates this through her image of the global economy as a cake (see Figure 2.2). Conventional economics only considers the upper layers of the cake, which is the market economy that operates on the basis of work and monetary exchange. But this layer is only superficial and relies on the uncounted work of women, producers in poorer nations, the reciprocal or community economy and its relationships of trust, and below that the planet itself. It is because we neglect these fundamental bases of our economies that our communities and our planet are threatened. Thus the message at the heart of Henderson's work is one which is increasingly relevant as the tension between a globalised capitalist economy and the planet becomes more apparent:

> The Solar Age signifies much more than a shift to solar and renewable resource-based societies operated with more sophisticated ecological sciences and biologically-compatible technologies. It entails a paradigm shift from the fragmented 'objective' reductionist knowledge and the mechanistic, industrial world-view to a comprehensive awareness of the interdependence of all life on earth' (1988: xxi).

This chapter has presented thumbnail sketches of the work of a few of the insightful and wise thinkers who first noticed that the global, industrialized economy was on a collision course with our environment. It is worth noting, I think, how long it has been since these alarms were first raised, and how long it has taken policy-makers to undertake anything like a serious response. This book focuses on economics and the different ways that economists have approached this agenda. I suppose that right here we should notice that the most significant aspect of the response has been its unfeasibly slow pace. Over the past 60 years or so economics has been divorced from 'political economy', and it seems to me (as it does to Hazel Henderson) that the absence of the political dimension might help to explain the snail's pace with which economics has responded to the energetic warnings of the whistle-blowers. We do not reach the work of economists whose work might be considered to be a revival of political economy until Chapters 6 and 7. Between now and then we have three chapters outlining the work of more conventional academic economists.

Notes

1. Data is from the International Geosphere-Biosphere Programme; much more disturbing evidence of the same pattern can be accessed from their website: www.igbp.net.
2. Data is from 2005 and relates to 2001 for Albania and 2002 for Germany.
3. Thanks to Dr Steve Harris of Glamorgan University, who introduced me to the work of Howard Odum and wrote this section.

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