Can Markets Manage Ecosystems?

Some preliminary thinking …

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Speaking Frankly

The failure of communism has taught us that no centre, however powerful, can know enough, in enough detail, to manage an economic system successfully. Instead, that tiny scrap of information – prices – is infinitely more effective than the largest state machine.

Communism's failure has supported the assumption that the market will also manage the next great challenge: restoring and maintaining the long-term ecological health of the planet. Environmental laws need simply to be tacked on to existing systems and a good injection of new technology will accomplish the rest.

This article comes to a different set of conclusions. First, there is a fundamental mismatch in the way human and natural systems operate. Second, our economic systems are based on an implicit subsidy from the natural world, which is now as unsustainable as were the state subsidies of the communist system. Third, this natural subsidy is not a dismissable "externality", but something deeply embedded in our economic choices. Therefore, if we want to alter these choices, we need to create positive, not punitive, incentives for healthy ecological behaviour. To create such incentives will in turn require a deep alternation in existing subsidies, taxation systems, and property rights. However the negotiation of such changes poses political challenges that are already vast and formidable.

Distinctiveness of Natural Systems & the Paradox of Control

There are those who argue that markets cannot manage ecosystems, because ecosystems cannot be managed by anyone or anything; they evolve in their own way through complex and adaptive responses to everything around them. The best that markets can do is to support ecosystems rather than undermine their resilience and adaptive capacities.

While this change of language does not suffice to explain what exactly markets can or cannot do, it does highlight the distinctiveness of ecosystems. Four aspects of ecosystems are particularly important when we consider their interaction with markets.

- Nothing stands alone.
- Multiple and cumulative interactions exist.
- Consequences are displaced in time and space.
- Threshold effects are common.

The last fact is particularly important, as thresholds are those phenomena where there seems to be very little appreciable change in the balance of things for a long period of time, after which things change very rapidly.

(missing diagram: Ecosystem Cycle, after Holling)

C.S. Holling sees such thresholds as a normal part of eco-system behaviour that cycles through four important stages. There is an initial period of pioneering ***Exploitation*** by invasive species, which is then followed by an era of ***Conservation*** marked by a high

accumulation of energy and resources. These resources are then ***Released*** in the third stage through fire, pests or storms, leading to a fourth stage of ***Reorganisation*** when a new cycle begins again.

(missing diagram: Resilience & Vulnerability & the Paradox of Control)

One of the great beauties of this cycle is that over time mosaic landscapes are created as different areas are at different stages of this cycle, often with different mixtures of species. This creates landscapes which are very resilient to crises, since any one crisis can only affect that part of the landscape which is vulnerable at a particular moment in time.

However, as mankind makes more and more extensive use of the resources of the natural world, mosaic landscapes are being replaced with highly productive homogenous landscapes – plantations of mono-crops are the most vivid example, but we can also think of cities and highways as homogenised landscapes. Economically, we have discovered that these homogenous landscapes are very productive. However, they lack the resilience of mosaic landscapes and the more we try to control events to avoid the inevitable crisis of an ecosystem's ***Release*****,** the more devastating is that ***Release*** when it finally comes.

(missing diagram: Mismatched Human & Natural Systems)

This paradox of control highlights one of the fundamental inconsistencies in the interaction of human and natural systems. Natural systems will always be variable, unpredictable and subject to periodic releases of energy by pests, fires or storms, but we want predictable production, not variability.

So how can we meet our own needs while recognising the vital variability of ecosystems? And where might market mechanisms fit in?

Experiments in Changing Human Behaviour

Our first attempts to integrate the environment in decision-making have largely been outside the market, beginning with an increase in government regulation. However, regulation has met with increasing resistance, being seen as less effective than hoped and expensive to administer. Regulations have also been largely punitive – leading to fines on a business or even to the shutdown of a business that failed to comply. As a result, while environmental care has increased, it has also been perceived as a cost, something to be shirked or evaded, rather than seized as an opportunity.

To compensate for the weaknesses of regulation, there has been a growing call for voluntary changes in behaviour, such as using bottle banks, riding a bicycle or joining a green consumer campaign. However, these efforts have had a more limited impact than hoped. The cost and bother of environmental habits is seen by many to be too great, while the impact of any individual's behaviour is seen to be too small to be worth attempting.

One of the less visible effects of these calls for voluntary efforts can been seen in a growth of interest among businesses to design products and processes which respect ecological limits. These business people are rejecting the tendency to see environment as a cost and instead see it as an opportunity. However, they rely on a 'change in consumer values' the encourage people to pay a premium for environmentally-sensitive products. So far, this change of values has been limited to elitist, rather than mass markets and therefore has had only minimal impact.

A more direct use – and redesign – of markets has been seen in the use of tradable permits for sulphur emissions in the USA, saleable fishing quotas in the European Union, and ethical investment funds with a strong environmental bias. They are important test beds for the principle that markets have a role to play in supporting ecosystems, but they still represent only a tiny fraction of all market decisions and have thus had only a limited impact on environmental quality.

In short, our environmental efforts so far have had an inadequate environmental impact despite their relatively high costs and inconvenience. Does that mean, then, that our market system cannot learn to manage – or support – ecosystems?

(missing diagram: Key Elements of a Market)

Key Elements of a Market & the Implicit Subsidy

There is a clear market for eggs, fruits and vegetables. The buyer knows the quality of food she is looking for and the amount of money in her purse that is available to pay for it. The seller knows what costs she has to cover, what profit she would like to make and what price the other sellers in the street market are asking for produce of similar quality. The market is simple and straightforward: the seller has something to sell, which has a knowable value, and she has a title to the produce that can be transferred to the buyer. In a small open street market there is also near perfect information about price and quality and the availability of similar products. As long as the price is right and the rewards are there, farmers will continue to grow the food we eat, distributors will distribute it, sellers will sell it and we will buy it to cook our supper.

But what is the market for ecosystems? Or for any part of ecosystems? Where are the markets that operate not simply by punishing poor environmental care with fines and closures, but by rewarding acts and businesses that enhance ecological resilience?

By comparison with our simple market for eggs, fruits and vegetables, the market for ecosystems simply does not exist. In fact, it has never existed because our human economic systems have benefited from an implicit subsidy from the natural world which has absorbed our wastes, provided raw materials, and given us the soil and water we needed to raise food. So long as the human population was relatively small, this implicit subsidy at little economic cost to ourselves. Nor was a market needed, as subsidies by their very nature do not require markets. It is only when resources become scarce that markets come into their own.

Now the situation is changing. Arguably ecological resilience is approaching scarcity as the suddenly up-turning graphs of human population show a threshold may have been reached beyond which the human pressure on natural systems will lead to very unpredictable consequences. In this situation, it can be argued, that the time has come for new market mechanisms to be invented, ones that are able to allocate the use and non-use of those scarce ecological resources of our times: sinks, raw materials and biodiversity.

(missing diagram: 1960-2000: The Age of Accelerations)

But what might be the contribution of market mechanisms to this change? What would they look like and how would they function?

Steps in Developing Market Mechanisms that Support Ecosystems

It is impossible to imagine the full evolution of something as complicated as new market mechanisms able to realign our economic and natural systems. However, several important steps can be clearly identified now.

1. Remove current distortions.
2. Perfect information.
3. Agree rights and titles.
4. Learn how ecosystems work.
5. Redesign the process of political agreement.

(Missing diagram: First Step: Remove Current Distortions)

Step One: Remove Current Distortions

Over the years, a number of interest groups have become dependent on price subsidies that encourage the wasteful use of natural resources. Two good examples are the highly subsidised use of energy in the former Soviet Union and China and the use of irrigation water in many agricultural systems, including that of the United States. By removing such subsidies, important distortions in the market will have been removed and behaviour will change to reflect the revised costs.

Another distortion of the market for ecosystems exists in the ways governments assess land for property tax. Wetlands, woodlands and farmland that had avoided transformation into suburban development when property taxes were low, have been destroyed when local governments revalued the land based on its development potential, rather than its woodland or wetland character.[1] In order to pay the much higher taxes, landowners have been forced to cut their woods or sell off parts of their property to developers. New property tax valuations systems that help preserve natural habitats will therefore be needed, especially if governments need to maintain their revenues.

In seeking new sources of government funds, there is a much more radical proposition heard in many green debates: tax the use of resources, not labour[2]. While there are considerable taxes on some resources, tax systems around the world have largely been based on taxing the income from the work people do, rather than taxing the resources they use. As a result, natural materials have often been substituted for labour. As many people in advanced Western societies know, the high cost of labour means that it is usually cheaper to buy a new portable radio than to ask someone to repair the one that has broken. If, however, tax systems were designed to minimise taxes on labour, but maximise taxes on the use of new raw materials, then it could become cheaper to repair the old radio rather than buy a new one. In this way, another important distortion in our ecosystems markets would have been corrected. This proposition is more speculative than simply removing existing subsidies and its consequences are still unknown. However, "Tax resources, not labour" could well be the kind of idea that grows in a world that wants markets to manage ecosystems. More generally, it points to a significant realignment of taxation so that ecological objectives are supported by the tax system, rather than undermined.

In short, the first step in creating ecosystem markets is to "Remove Current Distortions" in public subsidies and taxation.

(Missing diagram: Second Step: 'Perfect' Information)

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[1] See Chapter 10 of Property Rights in the Defence of Nature by Elizabeth Brubaker, Environment Probe, Earthscan Publications Limited, London & Toronto, 1995.

[2] The Dutch government is currently revising its tax system for the 21st century and giving this idea serious consideration.

Step Two: Perfect Information

If markets are to support ecosystems, 'perfect information' will be needed for two purposes – first markets will need good information on the health of ecosystems; second, they will need a way to compare the ecological record of one organisation to another.

One of our difficulties in understanding (and therefore managing) ecosystems is our paucity of information. How much water is actually left in the underground reservoir and how quickly can it be naturally renewed? Where did a particular pollutant in the air originate and who is responsible for its discharge? What is the real level of fish stocks and are they declining or are they safe? All these are issues of measuring and monitoring, for which better and better techniques are being developed by scientists around the world. This is an important kind of new information – and information management – that is already developing rapidly.

Equally, however, there is a need for comparable organisational audits. Already we have seen increasing emphasis on Environmental Audits. There has also been a growth in ethical investment funds specialising in ecologically benign or beneficial businesses. Both trends suggest that financial markets could play a role in encouraging sound environmental practices. However, the great majority of companies never use environmental audits. Nor do most brokers consider environmental audits any guide to whether or not a business is a good investment. As a result, the financial markets have made little or no contribution towards rewarding businesses that behave in an environmentally supportive fashion.

One of the reasons environmental audits have been useful internally in companies but done little to alter the behaviour of financial markets, is that most such audits are simply an intelligent review of company behaviour and its environmental impact. Many of these reviews are a form of good housekeeping. Others are done with one eye on public relations. So far, however, there is no environmental auditing system which is capable of creating a "Green Statement of Accounts" that is comparable to the financial accounts produced for companies every quarter or every year. The biggest and vital difference between green accounts and financial accounts is that there is no "green accounting unit" (comparable to the dollar or the pound sterling) which would allow the ecological efficiency of organisational behaviour to be audited, summarised across different types of activities, and compared between one type of activity and another or between one organisation and another.

This brings us back to "Perfect Information". If financial markets are to learn to support ecosystems, they must first have accurate information about the state of ecosystems themselves. Second, they also must be given audited accounts which allow financial traders to compare the ecological efficiency of one organisation against another and relate that efficiency to the profitability of the company itself. While better measuring and monitoring of ecosystems is being developed all the time, we have yet to see audited eco-accounts suitable for use in the trading rooms. In their absence, the economist's requirement that markets need 'perfect' information to function effectively is not being met and the market for ecological sustainability is not being developed.

For this reason, our second step is to "Perfect Information".

(Missing Diagram: Third Step: Agree Rights & Titles)

Step Three: Agree Rights and Titles

Even if there is 'perfect' information and the removal of state-based distortions, it is unlikely that our contemporary markets will be able to support ecosystems. That is because

there are still few financial rewards accruing to those people who follow good environmental practices. In fact, many of the incentives run in the opposite direction: so that it is often cheaper and more convenient to use a motor car, for example, than it is to take public transport. There is financial gain in destroying a habitat to gain access to the minerals beneath the topsoil, but no financial gain for protecting the habitat and keeping the minerals under ground. In these two examples, the financial incentives are stacked against the environment because no one can claim a right or a financial interest in the ecological resources that are being destroyed: whether it is the city's clean air or the badgers' habitat above the coal mine.

That being the case, how might such financial interests be established? In a beautifully concise book titled *Property Rights in the Defence of Nature*[3], Elizabeth Brubaker argues that existing property rights as defined by the English common law are some of the most powerful tools available for protecting the environment. In particular, she cites a long history of cases in which English common law rights prohibiting trespass, nuisance and the obstruction, diversion or corruption of water were used by individual property owners to limit or reverse environmental damage.

Elizabeth Brubaker also details, however, some of the limits to making more effective use of these rights. First, there is the cost of enforcing them – especially high where a small property owner is suing a large industry, for example. Second, there is the complexity of diffused environmental degradation where many players are involved – as is the case with the multiple polluting engines of motor cars and the thousands of homeowners who presumably object to the trespass of noxious gases onto their property. Third, there is the difficulty of tracing the source of any pollutant and proving it has caused particular harm. Whose sulphur was it, for example, that caused the acid rain that has damaged a single hectare of Norwegian pines? Third, many people are ignorant of their common law rights and either do nothing or turn to government to impose solutions. Brubaker also notes, however, that government itself is part of the problem – in its tax systems, its statutory overriding of common law rights in the name of higher public interest (usually jobs), and as a resource owner itself. When the government owns all the trees and the government decides to cut them down, there is no competing property owner who can claim an interest in preserving the trees as standing timber or a wood. In short, all of these factors limit the effectiveness of property rights "in the defence of nature".

More pertinent to arguments here, is that existing property rights have so far not created market mechanisms that support ecosystems. Instead, they have been used tactically to stop certain destructive behaviours. They have, therefore, functioned as a defensive tool rather than a market tool. This simply perpetuates the "punitive" model of ecological management rather than an "incentive" model. To become a market tool that creates positive incentives rather than punitive prohibitions, new rights will probably need to be defined. They will also need to be translated into a title that can be transferred from one owner to another and integrated into a system for transferring that title on a temporary or permanent basis. Such a system might, for example, lead to motorists in London paying cyclists to cycle so that the motorists can use the cyclists 'clean air allowance' for the month. Agreeing the rights and rules that would underlie such a system, however, is an enormous political task.

Thus we come to our third requirement: if markets are to learn to manage or support ecosystems, a much broader set of property rights and transferable titles will need to be agreed.

Step Four: Learn about Ecosystems

[3] Property Rights in the Defence of Nature by Elizabeth Brubaker, Environment Probe, Earthscan Publications Limited, London & Toronto, 1995

In the book he wrote with Roger Lewin, titled The Sixth Extinction, Richard Leakey, the former director of Kenya's Wildlife Service writes: *"How do you manage wildlife? Put like this, the question sounds trite, but, as I've hinted earlier, it is not easily answered, given our limited temporal perspective of ecosystems, and our limited knowledge of how they work."* [4]

In working on the ideas in this paper, it has become clear that we are only beginning to understand the world we live in. Ecosystems, which have taken thousands of years to evolve to their present form, have often been outside our grasp. For many years – so long as the earth's subsidy was small and affordable – our ignorance was no great handicap. Now, however, it is becoming a serious limitation and we are limited in two very important ways. First, there are the limits of current basic science. Just as the early pioneers of the industrial revolution did not understand some of the basic principles of physics, biology and chemistry, so too the early pioneers of the next economic era are struggling to identify and understand the basic principles of complex ecological systems. Fortunately, talented people around the world have been working on these issues for several decades and our understanding has grown with their time and efforts. But there is still an enormous amount of basic knowledge to be acquired.

As importantly, all the basic knowledge in the world will not suffice to create ecological markets unless that knowledge is widely shared. For that to happen, critically important ecological principles need to be learned by the public at large, so that the daily decisions of every individual in a market can build an effective ecological economy. During the first industrial revolution, the widening ability to read, write and calculate helped to diffuse new technologies into every day life. A comparable diffusion of ecological knowledge and technologies will be needed for eco-markets to succeed.

For all of these reasons, therefore, the fourth critical step is for all of us to learn how ecosystems work.

Step Five: Redesign the Process of Political Agreement

The invention of market mechanisms that support rather than devour ecosystems will create a new set of institutional rules which will inevitably disrupt existing economic advantages. The political challenge of making these changes is obviously substantial as the affected groups will be tempted to destroy any emerging institution before it can mature and function effectively. Our ability to engage such groups will therefore be crucial. We will also need to redesign the political process itself so that, for example, long ecological time scales can be given a fair hearing in short-term political deal-making. We will also have to invent new spatial scales for political decision-making, given that ecosystem boundaries rarely follow political boundaries, which were created by different imperatives. These new ecopolitical boundaries are likely to be first negotiated around watersheds and water basins, but will also need to reflect the movement of air currents and climate. More broadly both public and private institutions must be able to understand the variability of natural systems while still meeting human and institutional needs. That understanding will then need to be reflected in the process of decision-making at all levels.

These are tasks for which we are perhaps least prepared, although it is likely that important political experiments already exist, but have yet to be noticed. That we need to build new knowledge and new skills is clear; what is less clear is how quickly that can be accomplished.

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[4] The Sixth Extinction, by Richard Leakey and Roger Lewin, Anchor Books 1995, p. 204

Nonetheless, our fifth and final critical step is to redesign the process of political agreement.

In Conclusion - How Quickly Can We Learn?

In recent years, there have been a number of experiments encouraging our current market-based and regulatory system to respect ecological objectives. These, however, have been less successful than many hoped and force us to conclude that, **as they are presently structured,** markets are unable to manage or even support ecosystems. This failure largely derives from the legacy of human systems based on an implicit subsidy from the earth's ecological resources. Until this subsidy has been removed, markets will be unable to manage an ecological economy of any kind.

(Missing diagram: How Quickly Can We Learn?)

However, the process of removing the Earth's subsidy from our economy systems will entail a substantial rewriting of the institutional rules governing tradable goods in the market place. Goods that had not previously been traded – such as an individual's right to clean air – need to be bounded, titled and assigned before any ecological market mechanism can evolve. The availability and transparency and accuracy of information will be critical in this process of definition. The political discussions that define new rights and markets, together with the diffusion of popular knowledge to inform those discussions will also be vital.

All of these steps (and there will be many more) are analogous to the social changes seen wherever societies have made the transition from agricultural to industrial economies. As is well known, that change was very slow when first undertaken by Britain between the 17th and 19th centuries, but accelerated rapidly in many Asian countries which were able to learn from the experience of others. This being so, we can reasonably ask ourselves: "How quickly can we learn?" to make the transition from industrial to ecological economies? Will our learning be as rapid as it was in Asia or are the issues so distinctive that the pace of change will reflect the slower learning of an earlier age?

The evidence to help us answer this question is likely to argue the case both ways. That being so, our capacity to learn quickly will remain a worrying uncertainty. Equally worrying is the fact that we do not know when we might hit critical ecological thresholds with our accelerating populations and consumption. It is true that compared to the evolutionary pace of natural selection, the evolution of human societies can be remarkably quick. But against the threat of unpredictable thresholds, the ability of human societies to change can seem alarmingly slow.