

## **OUR WAY INTO THE FUTURE**

**Speech presented by Jacqueline McGlade, Executive Director European Environment Agency, on April 28<sup>th</sup> 2004 at the Bridging the Gap Conference, Dublin**

The presence of humans on the planet earth in the opening years of the twenty first century has left its mark everywhere, even in the interstices of the polar ice caps and the depths of the ocean. Nowhere is immune.

In the outermost corners of the known universe, we can see the beginnings of our evolution but where are we going?

Through time there have been great cosmological and historical moments, for example when the star out of which our solar system was born collapsed in enormous heat, scattering itself as fragments in the vast realms of space. In the centre of this star the elements had been forming through a vast period of time until in the final heat of this explosion the hundred or so elements were present. Only then could the sun, our star, give shape to itself by gathering these fragments together with gravitational power and then leaving some nine spherical shapes sailing in elliptical paths around as planetary forms. At this moment Earth could take shape; life could be evoked; intelligence in its human form became possible.

This supernova event of a primary generation star could be considered a moment that determined the future possibilities of the solar system, earth and of every form of life that would ever appear on the earth.

In human history there have also been defining moments. The occasion in northeast Africa some 2.5 million years ago when the first humans stood erect and a cascade of consequences was begun that eventuated in our present mode of being. Whatever talent exists in the human order, whatever genius, whatever capacity for thought, whatever physical strength or skill, all this has come to us through these earlier peoples. It was a determining moment. In our occupation of the terrestrial sphere, we have continued to experience these moments of significance: when human first controlled fire, when spoken language became embedded; when gardens were cultivated and writing and alphabets invented. We have had times of great storytellers – Homer and Valmiki – and historians Ssu-ma Ch'ien, Thucydides, Ibn Khaldun.

So now in this transition period in the twenty-first century we are experiencing another moment of significance, but it is different from any previous one. For the first time the planet is being disturbed by humans in its geological structure and its biological functioning in a manner akin to the great cosmic forces and glaciations. We are also altering the classical civilizations and indigenous tribal cultures that have dominated the intellectual development of vast numbers of persons throughout these past five thousand years. These civilizations have governed our sense of being and established our norms of reality and value and designed the life disciplines of the peoples of the earth. But the teaching and energy they communicate are unequal to the task of guiding and inspiring the future.

After some four centuries of empirical observation and experiment we see the universe as both a developmental sequence of irreversible transformations and as an ever-renewing sequence of seasonal cycles. We find ourselves becoming something of a cosmic force!

### *Greenlash and the primacy of ecosystems*

Few now doubt that degradation of the natural environment poses one of the deepest challenges to modern society. But whilst many governments and institutions have accepted that action must be taken to tackle the most urgent problems, the inexorable drive to produce and manufacture goods and improve the living conditions of so many people, means that society is pushing up against a wide range of environmental limits.

Take for example the flow of materials from nature to society and back - the materials cycle - a fundamental part of all economies. In some places, the sheer scale of the cycle is quite remarkable: even in the most modern and efficient industrial economies, the average per capita requirement is 45 - 85,000kg of natural resources per year - the weekly per person equivalent of 300 shopping bags filled with materials - the weight of one large luxury car. Given the latest estimates of population growth, our use of resources will have to become ten times more efficient by 2030, just to keep environmental degradation at its present levels.

It is through this ability to manipulate and alter the fundamental relationships underpinning the planet's ecosystems, that we have begun to expose ourselves unnecessarily to *greenlash* – where a variety of gradual and unexpected ecological changes lead to the loss or severe decline of the very ecosystem services we depend on.

In the past, environmental decision-making has been made on an *ad hoc* basis, solving each particular problem in isolation from others. But now a more profound thinking is required, about production and consumption patterns and how we can support different societies without engendering significant unintended shifts in the biosphere. The premise behind this thinking is that renewal and sustainability have primacy in ecosystems, just as justice has in social institutions. And as laws and institutions, no matter how efficient or well-arranged, need to be reformed or abolished if they are unjust, so overexploitation and misuse of ecosystems must be prohibited if they cause harm to fundamental ecological processes.

Ecosystems are made up of mixtures of organisms, supported within sets of environmental conditions. Changes in these conditions, for example through shifts in climate, can result in the local extinction of certain species. If these changes occur over several generations, then other species adapted to the new conditions will be able to take over their roles.

However, when changes occur rapidly this is much less likely to occur. One reason is that embedded and often hidden within ecosystems are keystone species, which hold together vast networks of feeding relationships. The removal or loss of these keystone species can cause irreversible changes to an ecosystem. In the Sea of Azov, large-scale hydrographic changes caused by increased use of freshwater from rivers for domestic, industrial and agricultural purposes led to significant increases in salinity

which caused the loss of the key planktonic food items for the major fish species and the collapse of many fisheries.

Removal of top predators, through fishing or hunting, is also critical in maintaining ecosystem integrity. For example, the continued exploitation of cod in the North Sea over the past century has led to a decline in larger codfish; these larger fish prey on a small bottom dwelling fish which in turn eat juvenile cod. The small prey fish resemble stones on the bottom; they sit and wait for the juvenile cod to “hide” behind them and then eat them. With the demise of large cod, control over these bottom-dwelling predators has been unleashed leading to an increase in predation on juvenile cod and a reinforcement of the decline of cod population.

Unfortunately, these and similar experiences seem to have taught us nothing, for we can now cite case after case where a single action has had widespread, catastrophic effects. We have also witnessed the untrammelled spread of rabbits following their introduction into Australia; the purposeful introduction of African bees into South America where they have cross-bred with local species to produce a killer bee and so on. It seems that the road to ecological disaster is littered with good intentions.

There have also been instances of non-intentional introductions which have created enormous human health problems. The 1991-1993 Latin American cholera pandemic was caused by the introduction of the *vibrio* into rivers from ballast water taken on board in Indian coastal waters; the occurrence of cholera and hepatitis in shellfish from the coast of Alabama was caused by discharges of ballast water into Mobile Bay; and the massive 1993 Milwaukee epidemic which was caused by the introduction of a toxic algae into the drinking water. It has been estimated that the 40,000 major cargo vessels transfer 10 billion tonnes of ballast water globally each year, with 3000 - 4000 species transported daily across the world.

We have strong evidence that the accumulation of small, seemingly insignificant changes can lead to “flips” or dramatic shifts in the very structure and dynamical behaviour of ecosystems. Changes in climate, levels of toxic chemicals and nutrients, groundwater reduction, habitat fragmentation and loss of biodiversity often appear to alter gradually, but the response of ecosystems can be striking and sudden, moving an ecosystem into a very different, alternative state.

For example, lakes can suddenly lose their transparency from excessive inputs of nutrients, and go from clear waters which are sustained by submerged vegetation and high levels of phytoplankton grazers, to turbid waters, where there are low levels of submerged vegetation, where levels of phytoplankton grazers are kept down by fish, and where turbidity is maintained by sediment resuspension caused by fish searching for food along the bottom.

To go from one state to another requires that some critical level is exceeded, but many of these changes can occur without any early-warning signals; they are then often hard if not impossible to reverse. Predicting which types of change will occur and over what time and space scales is fundamental to protecting our environment. Ecosystems have different levels of *resilience* – the rate at which they recover from short, sharp or transient shocks, *resistance* - the degree to which they remain unchanged when their component parts are altered and *hysteresis* – the degree to

which conditions need to be reversed before an ecosystem will flip back to an alternate state. Long-term data series can help to resolve which responses are most likely to occur, but as these are often unavailable, comparative analyses are usually the only basis upon which observed phenomena can be interpreted, so that what will trigger a particular ecosystem response is not always clear.

Unfortunately, in many of today's environmental institutions there is still a belief that models coupled with management intervention can lead to predictable outcomes. This supposition occurs because managers have models that allow them to simulate or in a crude way anticipate the future. The implication is that all the interactions within the system are adequately understood, and that the processes directing the forward evolution of an ecosystem are known. But this is not the case.

Firstly, well-structured theories, common in many branches of science, are conspicuous by their absence in environmental management, thus many of the models used include only a limited number of possible future states. Secondly, they rely on data that are highly qualitative and heterogeneous and rarely reflect the fact that complex living systems are open and hence have significant exchange of materials across their boundaries, sometimes from the other side of the planet. In the meantime we have been forced unremittingly into accepting advice based on the belief that we know enough about how ecosystems work to intervene.

Environmental degradation and changes such as global warming, the depletion of the ozone layer and the presence of toxic polychlorinated biphenyls in Antarctica have arisen because of activities within national boundaries, often thousands of miles away. But in response, national policy development has been from a standpoint of determinacy rather than complexity. The thinking is that exact predictions under highly complex circumstances can be made, a thinking which has led those involved in decision-making towards a misdirected sense of concreteness in overall policy judgement.

Greenlash undermines this confidence. Embedding resilience, resistance and hysteresis within current management regimes, requires a shift in thinking from dealing with ecosystems as static entities and on an *ad hoc* basis to one where ecosystems are seen as highly linked, complex dynamical systems.

Which brings us to the critical element in any discussion on sustainable development – that of people, governments and nation states.

One of the most striking aspects of today's world is the shift in balance from national to regional and global economies. Invisible on maps, a new geography of the world is slowly taking shape; it is a geography of shifts in economic and political activities, determined in large part by human migration rather than any reflection of physical or natural processes. Increasing numbers of political and economic refugees are now migrating towards urban centres in politically stable regions, and it is these mass movements of people that have exacerbated transboundary disparities in sustainable development, access to natural resources and environmental quality.

The hollowing-out of nation states, caused by the simultaneous spread of globalisation and decentralisation, means that these issues are unlikely to be properly dealt with to the detriment of many ecosystems and the people living in them.

The social consequences of this are quite explicit. Without strong institutional frameworks and clear leadership, pathological syndromes such as NIMBYism (Not in my Backyard) and IMPism (Isn't My Problem) will flourish and lead to further significant environmental problems and disparities in ecosystem health. Accepting that environmental change is a reality, creates a need for states to co-operate in understanding the effects on ecosystems of intentional and non-intentional transboundary interventions. It also gives us a framework on which to build a more stable ecological future in which renewal and sustainability have primacy.

### *EEA*

The EEA aims to respond to the challenge by ensuring that information is made available at the right time in the right form wherever possible in the all 24 languages of its members and the citizens of Europe. At this meeting we will be launching our multilingual website to celebrate the arrival of 10 new members to the European Union. But we will try to do more than simply translate information; our aim is work with policy-makers and the environmental leaders in each country to provide early warning signals of environmental change and emerging issues that will affect us all.