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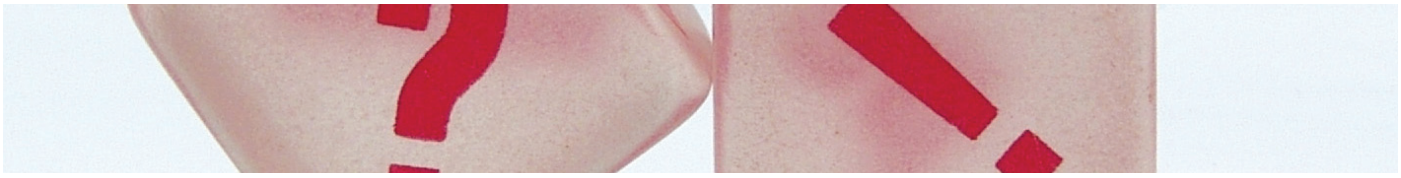
People Focus



Managing our environment on three fronts

VICKY HAMPTON

The environment in which we live is impacted by everything that we put into and take out of it. And of course we do not exist in it alone; the other species both on land and in our seas have an important role to play. Research Trends interviewed three experts in the fields of biodiversity, waste management and oceanography to find out their points of view on environmental management.

Professor Michel Loreau

Biodiversity and ecosystems: Professor Michel Loreau

Prof. Michel Loreau is Canada Research Chair in Theoretical Ecology at McGill University in Montreal. He has published 128 papers that have been collectively cited 7,079 times. His *h*-index is 33 – which means that 33 of his papers have been cited 33 times or more. His most cited paper, "Ecology: Biodiversity and ecosystem functioning: Current knowledge and future challenges", published in Science in 2001, has received more than 850 citations. Sixteen of his papers have been cited 100 times or more, and only 11 remain uncited to date.

Michel Loreau, Canada Research Chair in Theoretical Ecology at McGill University in Montreal, is interested in biodiversity's impact on ecosystems. It is well known that the number of species is decreasing, resulting in declining biodiversity, but do our ecosystems really need all these species to ensure our own survival? And can we manage our environment in order to influence biodiversity? The short answer to both of these questions is "yes", according to Prof. Loreau.

The relationship between biodiversity and ecosystems is a relatively young research field. Experiments over the past 15 years have shown that the more species in an ecosystem, the more resources they are able to capture and utilize, making the system more productive. However, modern agriculture discourages biodiversity by growing one crop and managing the ecosystem with fertilizers and pesticides. This can have harmful side effects, such as polluting groundwater. Biodiversity experts have propounded the concept of "ecosystem service" – the idea that we depend on ecosystems' free service, but that if we destroy it, there are hidden costs for which we must compensate.

The question now, therefore, is whether we should manage such ecosystems or leave nature to take its course. This has resulted in conflict between the "managers", who favor high productivity and low biodiversity, and the "conservationists", who want to preserve biodiversity at the expense of the economy.
A current trend is emerging that bridges this gap: in contrast to classical conservation, experts are seeking ways in which to preserve biodiversity and productivity. So far, this is carrying through into a limited number of governmental and non-governmental policies that are attempting to involve local communities in a combination of development with conservation. "In Costa Rica, for example," explains Prof. Loreau, "the government is paying farmers to protect their water sources and slow the rate of deforestation. One of the ways in which they're doing this is via ecotourism, but in general this does not generate enough income alone."

He believes that, "we need to engage in productive debates about biodiversity in the same way as we have about climate change in recent years. Developed countries have a moral imperative to compensate for their destruction of ecosystems – past and present. We should be looking for the equivalent of carbon credits and other mitigation strategies."

This may be one possible future solution, but what else lies in store? "Globally, we are experiencing more 'natural' disasters than ever before," Loreau says. "The first step is to realize the magnitude of the problem. The second step is to find solutions that lie within the realm of the human social system – slowing population growth, for example, decreasing the rate of consumption and reducing environmental impact through cleaner technologies. Environmental science has shown us the implications of over-stretching natural ecosystems, but it's up to us to manage *ourselves* more than to manage our environment. We are part of a system that we cannot fully control, and we have the mistaken idea that with technology we can control everything. We can't. But we can educate people to change their lifestyles so that we're treating the cause of our environmental problems, and not just trying to manage their symptoms."

Dr Hans van der Sloot

Recycling waste: Dr Hans van der Sloot

Dr Hans van der Sloot is Associate Editor of *Waste Management*. He recently retired from the Energy Research Centre of the Netherlands and now works as a private consultant. He has published 89 papers that have been collectively cited 1,131 times; his h-index is 16 – which means that 16 of his papers have been cited 16 times or more. His most cited paper, "An integrated framework for evaluating leaching in waste management and utilization of secondary materials", published in *Environmental Engineering Science* in 2002, has received more than 90 citations. Six of his papers have been cited 50 times or more, and only two remain uncited to date.

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Associate Editor of Waste Management, Hans van der Sloot, recently retired from the Energy Research Centre of the Netherlands, and now works as a private consultant. He looks at the ways in which waste can be managed and – by extension – at its impact on the environment. In the recent past, waste management initiatives focused on the disposal of waste. This has been of particular importance since criteria were set for the European Landfill Directive in 2002, which are still being implemented by the EU member states today.

However, more recent developments have concentrated on the recycling of waste, or on reusing the by-products of industrial processes. These waste products are known as "alternative materials". For example, the bottom ash from incinerators can be used to make aggregate in concrete, creating a new building material from the "waste" produced by another process.

This all sounds like good news, but it also brings potential problems. Van der Sloot explains: "Alternative materials need to work from several perspectives: economically, their use must be beneficial from the point of view of both the company producing the material as a byproduct and the company reusing it. From a technological perspective, materials must be fit for purpose. And finally, environmentally, we need to ensure that there is as little risk as possible attached to the use of such new materials – harmful gas emissions or pollution of groundwater, for instance. While the first two are usually adequately addressed, the latter is often approached in an all-too-simplistic manner."

An additional challenge is presented by the fact that regulations are rarely the same between different locations, sectors and products. So part of the work of waste management researchers like van der Sloot is to standardize environmental assessment and testing approaches for the use of alternative materials at international level. Unification of the tools used to assess these materials has resulted in the adoption of new standardized protocols in Europe and the US – a good sign, claims van der Sloot. "Companies need to understand where environmental issues relating to waste recycling come from and how they can comply with regulations about soil, groundwater pollution, gas emissions and energy-related issues. There are a limited number of more elaborate leaching tests for the characterization of long-term behavior applicable to a wide range of materials and products. And these characterization tools have other benefits: they can give us management control over the release of hazardous substances from those materials, too.

"Zero emission is not a possibility," van der Sloot continues; "the question is rather, what is an acceptable level of release? Many materials are perfectly acceptable for use – but proper evaluation is needed upfront in order to guarantee this, also in the longer term. Specifically, when multiple recycling streams start to converge, there may be unexpected cumulative effects. To ensure that alternative materials made from the byproducts of industrial processes are not harmful, the byproduct itself needs to be treated as a marketable product, and to go through a proper (technical, as well as environmental) quality control process. But this takes time – and of course money."

Van der Sloot suggests a solution: "the key is to share knowledge. Individual companies cannot take on the full environmental characterization related to their product type themselves; that would entail considerable and unnecessary duplication of work. Material and products within a specific type or class tend to show consistent release behavior under a range of exposure conditions. Once characterization is available, simplified testing against this background data is a cost-effective means of satisfying environmental safety needs. One of my ambitions is to create a central database where everyone can access all this testing data for reference purposes, against which simpler data can be judged for conformity. Companies need to focus on the common ground between them – what we do know about the chemical processes applicable to a particular material type – rather than on the differences."


Professor Edward Durbin

Oceanic issues: Professor Edward Durbin

Edward Durbin is Professor of Oceanography working with Global Ocean Ecosystem Dynamics (GLOBEC). He has published 63 papers that have been collectively cited 1,357 times; his *h*-index is 17 – which means that 17 of his papers have been cited 17 times or more. His most cited paper, "Growth and development rates of the copepod Calanus finmarchicus reared in the laboratory", published in Marine Ecology Progress Series in 2001, has received more than 134 citations. Seven of his papers have been cited 50 times or more, and only 21 remain uncited to date.

Professor of Oceanography Edward Durbin is part of the Global Ocean Ecosystem Dynamics (GLOBEC). Initiated on Georges Bank, New England, in 1994, it looks at the effects of climate variability on ocean circulation and marine populations. The program is continuing today with comparative studies of different regions.

"The environmental issues impacting on oceans can be broadly split into two categories depending on our ability to manage them: large and small scale," he begins. "The large-scale problems include rising sea levels, ocean acidification and overfishing. A general warming of the ocean and associated expansion of water has resulted in a rise in sea level. More ominous is the possible melting of Greenland's ice cap causing sea levels to rise by 20ft (6 meters), which would have disastrous effects worldwide.

"Then there's the acidification of sea water, whose pH is becoming one or two tenths more acidic due to the increased CO_2 concentration in the atmosphere. This affects the ability of organisms, such as reef-forming corals and shellfish, to calcify. Coral reefs will grow less rapidly and erode more easily as a result. Ocean acidification is a long-term problem because even if CO_2 emissions into the atmosphere are reduced it will take hundreds of years before the acidity in the water begins to change.

"A third major issue is over-fishing, which has an effect on the biodiversity of the ocean's ecosystem.

"There's very little that we, as oceanographers, can do to manage effects of these problems in the ocean. In each case, international cooperation leading to government policy changes is the most important factor in managing the environment."

But there are smaller-scale issues too, that can more easily

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be managed on a local level. "Coastal pollution due to the release of fertilizer into the sea is becoming a problem," Durbin continues. "For example, so much fertilizer has made its way into the sea via the Mississippi River that huge quantities of phytoplankton are growing in coastal waters. The decay of this is using up all of the oxygen, creating what we call 'dead zones' where nothing else can live; these are becoming more prevalent worldwide. To combat this, coastal states need to manage the release of these excess nutrients into the sea."

But what, if anything, can the layman do about all of this? "The public cannot directly make a large impact," says Durbin. "But, if they educate themselves, they can pressure politicians to change their policies. Locally, there are opportunities for people to be directly involved in activities such as monitoring and conservation. For example, in Rhode Island, the US, people are monitoring the temperature and salinity of seawater in coastal ponds and replanting sea grasses to conserve coastal ecosystems.

"Despite great advances in our knowledge, there is still much that is unknown about the ocean and there's plenty of opportunity for scientists to get involved in understanding how the ocean functions."

Source for bibliometric data: Scopus