

The crystal ball of conservation

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Droplet. ©Evan Leeson

An innovative horizon-scanning exercise, which has just delivered its latest report, highlights emerging topics of relevance to the world's natural environment and the diversity of its species.

Humanity faces a breadth of environmental challenges that will continue to put pressure on policy makers, industry and civil society groups to develop solutions, and on researchers to provide evidence. What if we could look ahead to predict the emerging issues at an early stage, enabling knowledge to accumulate in advance of crucial decision making?

For the past four years, just such a 'horizon-scanning' process has been undertaken in Cambridge by a group of experts from academia, [conservation](#) organisations and government. Led by conservation scientist Professor Bill Sutherland, the Miriam Rothschild Professor of

Conservation Biology, the group aims to spot trends, novel technologies, new issues and even solutions that relate to biodiversity conservation. The idea is to identify serious potential conservation issues and opportunities before they turn into major challenges.

Take biofuel, for instance. Planting crops as a fuel source could help mitigate our dependency on fossil fuels. But when President George Bush announced the United States' commitment to biofuels in 2006, and the European Union followed suit, many of the ecological, climate-change and social impacts of an expansion in biofuels were poorly known and, crucially, not prepared for. "What followed were some actions that arguably caused more damage than the burning of fossil fuels, such as the chopping down and draining of ancient peat-rich tropical swamp forests to make way for biofuel crops," explained Sutherland. "Once the issues were identified, there was then some acrimonious debate and calls for back-peddling of policies that could have been avoided if society had identified the merits and problems of biofuels earlier."

For the horizon-scanning exercise to be really useful, the group must identify emerging issues that are not well known but could have substantial impacts on the conservation of biological diversity. This year, over 250 individuals contributed to the identification of a starting list of 80 issues that were deemed under-considered yet potentially important either for maintaining species or ecosystems or regions of global environmental interest. A 22-strong international panel, including horizon-scanning experts from across a wide range of institutions and agencies, then independently scored each issue to derive a shortlist of over 40 emerging issues of importance. It was these issues that were reviewed at a workshop in Cambridge in September 2011, where another round of voting resulted in a final line-up of 15 issues that have just been published in *Trends in Ecology and Evolution*.

Global conservation issues

Several of the issues identified by the horizon-scanning exercise relate to the deep oceans, which are rarely observable by the public and yet are strongly affected by changes in human activity. Deep-sea temperatures, which have been low and stable for millions of years, are known to be increasing. The report highlights concerns related to the warming seas, including the potential release of plumes of methane previously trapped beneath the sea bed, and the spread of predators, such as red king crabs, which normally live only in the colder parts of the ocean.

Also affecting the oceans are rich deposits of rare earth elements, such as yttrium used for electronics and as a source of green energy, which have been discovered in the deep-sea mud of the Pacific Ocean. The report recognises that increased deep-sea mining could become more frequent in the event of a global shortage of these precious minerals.

The horizon-scanning process also highlights areas that will grow in prominence over the coming years. For example, the experts have identified an increasing demand for two new technologies that may have as-yet-unknown environmental impacts – nuclear batteries and graphene. Nuclear batteries hold promise in providing a safe, cheap and almost endless supply of energy, particularly for remote communities that lack energy infrastructure. Graphene is the thinnest and strongest material ever detected and, given the magnitude of research in this area, could be seen in products in the home within the next few years.

Human behaviour also comes under scrutiny. As a result of an ageing population, there has been an increased release of pharmaceuticals into the environment through waste water and sewage discharge, prompting concerns relating to the spread of antibiotic resistance through the ecosystem.

The full list of 15 issues is as follows:

- Warming of the deep sea
- Mining in the deep ocean
- Methane venting from beneath the ocean floor
- Climate-driven colonisations in Antarctic waters
- Increases in pharmaceutical discharges as human populations age
- Sterile farming to increase food safety
- Transferring nitrogen-fixing ability to cereals
- Increased cultivation of perennial grains
- Rapid and low-cost genomic sequencing
- Electrochemical seawater desalination
- Rapid development and extensive application of graphene
- Nuclear batteries
- Effect of increased cement demand on karst forest and cave ecosystems
- In-stream hydrokinetic turbines
- Arctic tundra burning

Evidence-based conservation

Horizon scanning is a key priority for the Cambridge Conservation Initiative (CCI), many of whose partner organisations are involved in the process that has created the latest report. Fitting with CCI's philosophy, the exercise involves policy makers and practitioners at all stages of the discussion process.

Sutherland is a keen advocate of 'evidence-based conservation' and has created a free web resource (www.conservationevidence.com/) that helps busy practitioners base conservation decisions on hard evidence, without having to keep up with the research literature.

He believes that a forward-thinking shift in focus has an enormous role

to play in conservation: “We can’t hope to spot all potential issues. But if some of the issues prove to be important, then identifying and publicising them early on will better prepare us for future environmental challenges. Our hope is that horizon scanning will foster research to examine the advantages and consequences of possible changes.”

Provided by University of Cambridge

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