Will we wake up to biodiversity?

The International Year of Biodiversity has failed to raise awareness or halt decline as economic crises and political interests have sidelined the environment

Howard Wolinsky

The United Nations' (UN) International Year of Biodiversity in 2010 was supposed to see the adoption of measures that would slow global environmental decline and the continuing loss of endangered species and habitats. Even before, in 2002, most UN members had committed to halting the decline in biodiversity, which is a measure of the health of ecosystems. But the results of these international efforts have been funereal. Moreover, the current global economic crisis, coupled with growing anti-science attitudes in the USA, are adding to the concern of scientists about whether there is the political will to address the loss of biodiversity and whether habitat loss and extinction rates are reaching a point of no return.

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Ahmed Djoghlaif, Executive Secretary of the Convention on Biological Diversity under the UN Environment Programme based in Montreal, Canada, said that of the 175 national reports submitted as part of the International Year of Biodiversity to his agency last year, none reported any progress. "There is not a single report received last year that claimed to have stopped or reduced the loss of biodiversity," he said. "These reports confirm that the rate of loss of biodiversity today is unprecedented and the rate is 1,000 higher than the rate of natural extinction on species, and [his agency's Global Biodiversity Outlook 2010; UN, 2010a] predicts that if business is allowed to continue then major ecosystems, the ocean, the fish, the forests, will reach the tipping point,

meaning that there will be irreversible and irreparable damage done to the ecosystems."

The UN campaign traces its roots to the European Union (EU) commitment in 2001 to halt the loss of biodiversity by 2010. The 2010 goal was incorporated into the UN Millennium Development Goals because of the severe impact of biodiversity loss on human well-being. However, the EU last year conceded in a report that it missed its 2010 target, too. The EU's Biodiversity Action Plan, launched in 2006, shows that Europe's biodiversity "remains under severe threat from the excessive demands we are making on our environment, such as changes in land use, pollution, invasive species and climate change." Yet, EU Environment Commissioner Janez Potočnik has seen some positive signs: "We have learned some very important lessons and managed to raise biodiversity to the top of the political agenda. But we need everyone on board and not just in Europe. The threat around the world is even greater than in the EU," he wrote last year (EC, 2010).

Despite the initiative's poor report card, Djoghlaif was upbeat about the International Year of Biodiversity. "It was a success because it was celebrated everywhere," he said. "In Switzerland, they conducted a survey before and after the International Year of Biodiversity and they concluded that at the end of the year, 67% of all the Swiss people are now aware of biodiversity. When the year started it was 40%. People are more and more aware. In addition, biodiversity has entered the top of the political agenda."

In October 2010, delegates from 193 countries attended the UN Convention on

Biodiversity in Nagoya, Japan, and adopted 20 strategic goals to be achieved by 2020 (UN, 2010b). The so-called Aichi Biodiversity Targets include increased public awareness of the values of biodiversity and the steps that individuals can take to conserve and act sustainably; the halving or halting of the rate of loss of all natural habitats, including forests; and the conservation of 17% of terrestrial and inland water, and 10% of coastal and marine areas through effective and equitable management, resulting in ecologically representative and well-connected systems. By contrast, 13% of land areas and 1% of marine areas were protected in 2010.

However, the Convention on Biological Diversity is not enforceable. Anne Larigauderie, Executive Director of DIVERSITAS (Paris, France), which promotes research on biodiversity science, said that it is up to the individual countries to adopt enforceable legislation. "In principle, countries have committed. Now it depends on what individual countries are going to do with the agreement," she said. "I would say that things are generally going in the right direction and it's too early to tell whether or not it's going to have an impact in terms of responding and in terms of the biodiversity itself."

Researchers, however, have been disappointed by The International Year of Biodiversity. Conservation biologist Stuart Butchart, of Birdlife International in Cambridge, UK—a partnership of non-governmental environmental organizations and colleagues from other environmental groups—compiled a list of 31 indicators to measure progress towards the 2010 goal of the International Year of Biodiversity. He and his collaborators reported in *Science*

(Butchart *et al*, 2010) that these indicators, including species population trends, extinction risks and habitat conditions, showed declines with no significant rate reductions. At the same time, indicators of pressure on biodiversity, such as resource consumption, invasive alien species, nitrogen pollution, over-exploitation and climate change impacts showed increases. “Despite some local successes and increasing responses (including extent and biodiversity coverage of protected areas, sustainable forest management, policy responses to invasive alien species and biodiversity-related aid), the rate of biodiversity loss does not appear to be slowing,” the researchers wrote.

Butchart pointed out that even if the International Year of Biodiversity had an impact on raising awareness and reducing biodiversity loss, detecting the change would take time. He said that the International Year of Biodiversity fell short of increasing awareness in parts of government not dealing with the environment, including ministries of transport, tourism, treasury and finance. It also seems probable that the campaign had little impact on the business sector,

which affects development projects with a direct impact on biodiversity. “People can’t even seem to get together on global climate change, which is a whole lot more obvious and right there,” Peter Raven, president emeritus of the Missouri Botanical Gardens in St Louis, USA, explained. “Biodiversity always seems to be a sort of mysterious background thing that isn’t quite there.”

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Ilkka Hanski, a professor in the Department of Ecology and Evolutionary Biology at the University of Helsinki in Finland, said that studies such as Butchart’s “indicate that nothing really happened in 2010. Biodiversity decline continued and has been declining over the past 10 years.”

Other researchers are more positive, although with reservations. Conservation biologist Thomas Eugene Lovejoy III, Heinz Center Biodiversity Chair and former presi-

dent of the Center in Washington, DC, USA—a non-partisan, non-profit organization dedicated to advancing sound environmental policy—said that economic trends affect biodiversity and that biodiversity efforts might actually be benefiting from the current global economic crisis. For example, the decline in the housing markets in the USA and Europe has reduced the demand on lumber for new construction and has led to a reduction in deforestation. “Generally speaking, when there is an economic downturn, some of the things that are pressuring biodiversity actually abate somewhat. That’s the good news. The bad news is that the ability to marshal resources to do some things proactively gets harder,” he said.

Chris Thomas, a conservation biologist at the University of York in the UK, who studies ecosystems and species in the context of climate change, said that economic depressions do slow the rate of damage to the environment. “But it also takes eyes off the ball of environmental issues. It’s not clear whether these downturns, when you look over a period of a decade, make much difference or not.” Hanski agreed: “[B]

because there is less economic activity, there may be less use of resources and such. But I don't think this is a way to solve our problems. It won't lead to any stable situation. It just leads to a situation where economic policies become more and more dependent on measures that try actually just to increase the growth as soon as possible."

...biodiversity efforts might actually be benefiting from the current global economic crisis

Raven said that in bad times, major interests such as those involved in raising cattle, growing soybeans and clearing habitat for oil palms have reduced political clout because there is less money available for investment. But he said economic downturns do not slow poor people scrounging for sustenance in natural habitats.

To overcome this attitude of neglect, Lovejoy thinks there ought to be a new type of 'economics' that demonstrates the benefits of biodiversity and brings the "natural world into the normal calculus." Researchers are already making progress in this direction. Thomas said that the valuation of nature is one of the most active areas of research. "People have very different opinions as to how much of it can be truly valued. But it is a rapidly developing field," he said. "Once you've decided how much something is worth, then you've got to ask what are the financial or other mechanisms by which the true value of this resource can be appreciated."

Hanski said that the main problem is the short-term view of economic forecasts. "Rapid use of natural resources because of short-term calculation may actually lead to a sort of exploitation rather than conservation or preservation." He added that the emphasis on economic growth in rich societies in North America and Europe is frustrating. "We have become much richer than in 1970 when there actually was talk of zero growth in serious terms. So now we are richer and we are becoming more and more dependent on continued growth, the opposite of what we should be aiming at. It's a problem with our society and economics clearly, but I can't be very optimistic about the biodiversity or other environmental issues in this kind of situation." He added that biodiversity is still taking a backseat to economics: "There is a very long way to go right now with the

economic situation in Europe, it's clear that these sorts of [biodiversity] issues are not the ones which are currently being debated by the heads of states."

The economic downturn, which has led to reduced government and private funding and declines in endowments, has also hurt organizations dedicated to preserving biodiversity. Butchart said that some of the main US conservation organizations, including the Nature Conservancy and the World Wildlife Federation, have experienced staff cuts up to 30%. "Organizations have had to tighten their belts and reign in programmes just to stay afloat, so it's definitely impacted the degree to which we could work effectively," he said. "Most of the big international conservation organizations have had to lay off large numbers of staff."

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Cary Fowler, Executive Director of the Global Crop Diversity Trust in Rome, Italy, a public-private partnership to fund key crop collections for food security, also feels the extra challenges of the global economic crisis. "We invest our money conservatively like a foundation would in order to generate income that can reliably pay the bills in these seed banks year after year. So I'm always nervous and I have the computer on at the moment looking at what's happening with the sovereign debt crisis here in Europe. It's not good," he said. "Governments are not being very generous with contributions to this area. Donors will rarely give a reason [for cutting funding]."

The political situation in the USA, the world's largest economy, is also not boding well for conservation of and research into biodiversity. The political extremism of the Republican Party during the run up to the 2012 presidential election has worried many involved in biodiversity issues. Republican contender Texas Governor Rick Perry has been described as 'anti-science' for his denial of man-made climate change, a switch from the position of 2008 Republican candidate John McCain. Perry was also reported to describe

evolution as a "theory that's out there, and it's got some gaps in it" at a campaign event in New Hampshire earlier in the year.

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Raven said this attitude is putting the USA at a disadvantage. "It drives us to an anti-intellectualism and a lack of real verification for anything which is really serious in terms of our general level of scientific education and our ability to act intelligently," he said.

Still, Larigauderie said that although the USA has not signed the conventions on biodiversity, she has seen US observers attend the meetings, especially under the Obama administration. "They just can't speak," she said. Meanwhile, Lovejoy said that biodiversity could get lost in the "unbelievable polarization affecting US politics. I have worked out of Washington for 36 years now—I've never seen anything like this: an unwillingness to actually listen to the other side."

Raven said it is vital for the USA to commit to preserving biodiversity nationally and internationally. "It's extremely important because our progress towards sustainability for the future will depend on our ability to handle biodiversity in large part. We're already using about half of all the total photosynthetic productivity on land worldwide and that in turn means we're cutting our options back badly. The US is syphoning money by selling debt and of course promoting instability all over the world," he explained. "It's clear that there is no solution to it other than a level population, more moderate consumption levels and new technologies altogether."

The EU and the UN have also changed the time horizon for halting the decline in biodiversity. As part of the Nagoya meeting, the UN announced the UN Decade for Biodiversity. The strategic objectives include a supporting framework for the implementation of the Biodiversity Strategic Plan 2011–2020 and the Aichi Biodiversity Targets, as well as guidance to regional and international organizations, and more public awareness of biodiversity issues.

But Butchart remains sceptical. "I suspect 'decades of whatever' have even less impact than years," he said. "2008 was the International Year of the Potato. I don't know how much impact that had on your life and awareness. I think there is greater awareness

and greater potential to make significant progress in addressing biodiversity loss now than there was 10 years ago, but the scale of the challenge is still immense."

Hanski has similar doubts. "I believe it's inevitable that a very large fraction of the species on Earth will go extinct in the next hundred years. I can't see any change to that." But he is optimistic that some positive change can be made. "Being pessimistic doesn't help. The nations still can make a difference." He said he has observed ecotourism playing a role in saving some species in Madagascar, where he does some of his research.

"We're not going to fundamentally be

"...our progress towards sustainability for the future will depend on our ability to handle biodiversity in large part"

able to wipe life off the planet," Thomas said. "We will wipe ourselves off the planet virtually certainly before we wipe life out on Earth. However, from the point of view of humanity as a culture, and in terms of the resources we might be able to get from biodiversity indirectly or directly, if we start losing things then it takes things millions of years to 're-evolve' something that does an equivalent job. From a human perspective, when we wipe lots of things out, they're effectively permanently lost. Of course it would be fascinating and I would love to be able to come back to the planet in 10 million years and see what it looks like, assuming humans are not here and other stuff will be."

Djoghla, by contrast, is more optimistic about our chances: "I believe in the human survival aspect. When humankind realises that the current pattern of production and consumption and the current way that it is dealing with nature is unsustainable, we will wake up."

CONFLICT OF INTEREST

The author confirms that he has no conflict of interest.

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A new target for personalized medicine

Rapidly growing interest in epigenetics is driven both by its role in evolution and its potential for developing new therapies

Philip Hunter

Interest in epigenetics has taken off over the past few years as molecular biologists have realized the major role it has played in evolution. Indeed, growing evidence that adaptations at the epigenetic level are sometimes passed down to successive generations would explain how species quickly adapt to environmental changes and transfer this information to their offspring. More practically, though, epigenetics also offers new avenues to treat a range of diseases because it adds another layer of gene regulation ripe for therapeutic exploitation.

While the focus of animal, and particularly human, research has been chiefly on the role of epigenetics in disease, many discoveries about the role of the epigenome in adapting to environmental changes have been made in plants. These insights have significance for agriculture owing to their potential to improve yields and enhance tolerance to drought or pests. Plants are also important sources of knowledge about epigenetic adaptation in general because, as they are unable to migrate to greener pastures, they depend extensively on such mechanisms to cope with short-term, but potentially fatal, environmental changes. Research into epigenetics in both plants and animals is now

contributing to our understanding of how external factors lead to the establishment of epigenetic marks that alter gene expression on highly variant timescales.

It is in humans, however, where the most progress has been made to identify genes that are modified epigenetically by life experiences, and that alter behaviour or susceptibility to disease. One of the first genes to yield evidence of the epigenetic regulation of behaviour is the glucocorticoid receptor (GR). A study by Gustavo Turecki and colleagues (McGowan *et al*, 2009) at McGill University in Canada identified a change in the epigenetic status and activity of the GR gene associated with early adversity in suicide victims. There was a clear distinction in expression levels of one particular variant of the GR gene in the hippocampus between those suicide victims exposed to early life adversity—defined as recognized sexual or physical abuse, or severe neglect by parents—and those that were not, with the former producing significantly less GR messenger RNA. "What we do is retrospective, looking at individuals who have died, so we have to have access to their tissues," Turecki explained. "We go through a process of interview as well as accessing medical files from social agencies that allow us to obtain information about the earlier development of individuals whose brain samples we have obtained." Their findings replicated earlier studies in rats and indicate a common response to parental, particularly maternal, care, according to the authors.

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