

Regreening projects – are they sustainable?

Kathryn Senior

New research concludes that two massive environmental regeneration projects, put in place by China almost a decade ago, have been successful. “The Natural Forest Conservation Program (NFCP) has led to a cessation of commercial logging in natural forests and, by the end of 2006, the Grain-to-Green Program (GTGP) had converted almost 9 million hectares of cropland into forest/grassland and afforested 11.7 million hectares of barren land”, reports lead author Jianguo Liu (Michigan State University, East Lansing, MI).

Although funding for the GTGP has been extended for another 8 years, “it is unlikely the government will continue funding the projects forever”, says Liu. To achieve sustainability in the long term, he recommends providing retraining for farmers and better education for their children, and calls for funding from the projects’ commercial beneficiaries. Local hydropower plants, insurance companies and other businesses – and even neighbouring countries that benefit from the reduced environmental degradation – could and should contribute financially. “The benefits they will continue to gain from the projects will more than pay for their contributions”, continues Liu.

Lack of sustainability is also impacting an expensive regreening project funded by the Egyptian government. The objective in the Western Desert is not to reclaim degraded land, but to convert desert into habitable farmland, using the water reserves of the Nubian Sandstone Aquifer System, discovered in the 1950s. “Over 100 000 acres of land have now been developed, and the rural population in the three main oases of the New Valley has grown to over 200 000”, explains Tina Jaskolski (American



Water collection systems help to regreen the Egyptian desert, but for how long?

University, Cairo, Egypt). It is not clear, she says, how long the aquifer will continue to provide water, because it is a finite water source; some estimates say 300 years, but many believe it will be less than that because of wastage. “In the past 2 years, up to 50% of the water pumped out of the aquifer has been lost due to inadequate and badly kept canals”, says Jaskolski. Failure of the government to provide adequate servicing is partly responsible, but a major factor is the lack of personal incentive among oasis inhabitants, who expect the government to provide the necessary infrastructure in reclaimed desert areas.

John Lemons (University of New England, Biddeford, ME) is convinced that such projects, no matter how substantial their financial backing, cannot succeed without workable programs that “provide for the well-being of local people on a sustainable basis and involve them as important and significant stakeholders.” This, says Lemons, is too often overlooked.

Such was certainly the case in the dryland Shinyanga region of Tanzania, just south of Lake Victoria, during the early 1980s. Until the 1920s, the area was rich woodland but, by the 1970s, land overuse and degradation had created a barren landscape. Urgent action was required. Initial conservation attempts by the World Bank and other organizations failed, because they did not encourage local ownership. In 1986, the Tanzanian government

launched the HASHI (an acronym for soil conservation in Kiswahili) community project, which focused on reviving the *ngitili*, an ancient and indigenous resource management system. Research carried out 18 years into the project showed that more than 350 000 hectares of land have been occupied by restored or newly established *ngitili*, and that the local economy and environment have benefited greatly. “Key factors in the success of the Tanzanian project included a visionary project manager and a forest department with a long-term perspective, sensitively applied donor support over many years, and the forethought to develop a project that respected what rural people want to do and that did not impose external solutions”, comments Edmund Barrow (IUCN, Eastern Africa Office, Nairobi, Kenya).

Evidence that action by local people can make a huge difference also comes from Burkina Faso and Niger. In the past 20 years, 3 million hectares of fragile drylands in the Sahel region have been covered with trees planted by local farmers, on their own initiative. As a forestry expert working in the area for many years, even Mahamane Larwanou (University of Niamey, Niger) is astonished by the economic and ecological benefits generated by local farmers, with the full support of their communities. “There is no doubt about the success and sustainability of their actions”, he says.

Despite these notable success stories, Lemons cautions that choosing the best methods for protecting ecosystems in dryland regions is likely to get more difficult. Current problems, he says, are compounded by the threat of global climate change, which imposes many layers of scientific, political, economic, and other uncertainties. “Two billion people live in the drylands of Asia and Africa, and half of them are mired in poverty; dealing with dryland ecosystem conservation requires them to be fully involved. We cannot leave them to deal with the problem alone”, he concludes. ■

States' ocean policy overhauled

Virginia Gewin

Last month, the West Coast Governors' Agreement on Ocean Health laid out a detailed action plan to protect coastal ecosystems and economies. Avoiding offshore oil drilling, restoring coastal habitats, and establishing monitoring efforts necessary to combat climate change are among its top priorities. This joint effort between the California, Oregon, and Washington State administrations will act upon many of the recommendations from the 2004 US Commission on Ocean Policy and the 2003 Pew Oceans Commission, which have been largely overlooked at the federal level.

The adoption of a holistic management approach – ecosystem-based management – is a key part of the plan, and is one of its biggest challenges. Most state agencies have a single, narrow focus related to ocean ecosystems, but the west coast states are now committed to intersections of

management issues, such as how land-use change and fisheries management are connected.

The first hurdle involves coordinating tri-state efforts at such a broad scale. “Given recent difficulties managing even single species, managing an entire ecosystem may seem harder at first, but I think it will ultimately prove easier than the sum of all the single-species management plans”, says Steve Palumbi, a marine biologist at Stanford University (Stanford, CA).

Jane Lubchenco, a professor of marine ecology at Oregon State University (Corvallis, OR), applauds the west coast states' leadership, but fears that current resources are woefully inadequate to accomplish the task. “We urgently need better information about how systems are changing, to inform future management decisions”, she says. For example, identifying the extent and potential drivers of annual hypoxia events occurring in waters off Oregon and Washington was possible only with

privately funded, long-term monitoring up and down the coast. “To date”, continues Lubchenco, “private foundations have largely underwritten the monitoring efforts that should be part and parcel of state efforts”.

Although the west coast is leading regional efforts, the Gulf of Mexico and Gulf of Maine are among other regions exploring ways to protect natural resources and economic futures. While the sense of self-sufficiency at the state level continues to grow, Palumbi acknowledges that the West Coast Governors' Agreement on Ocean Health has to succeed before much-needed federal action can occur.

“If the west coast states really uphold their commitment to this regional approach, it will embody the kind of governance that the ocean commissions advocate”, comments Laura Cantral, spokesperson for the Joint Oceans Commission Initiative, a Washington, DC-based organization that focuses on ocean policy reform. “Everyone is looking at the west coast as a model”, she concludes. ■

Birds flock to (and from) warmer British Isles

Chris Emery

British bird watchers are going to need new field guides. As the climate changes, so do the types of birds calling the UK home. With warming temperatures, species from balmy parts of Europe are flocking to the British Isles, according to researchers at Durham University, the Royal Society for the Protection of Birds (RSPB), and Cambridge University (published online in *Biol Lett-UK*, 2008; doi:10.1098/rsbl.2008.0052). The change is also driving cool-climate species away from the northern regions of the UK.

Using the Rare Breeding Birds Panel, a database of bird sightings in the UK, the researchers analyzed population trends between 1980 and 2004 for 42 species that rarely breed in the British Isles. They found that birds from southerly climes, such as the circl bunting and Dartford war-



Adult male circl bunting, *Emberiza circlus*.

bler, are becoming more common in Britain. Meanwhile, northern species such as the fieldfare, redwing, and snowy owl are becoming rarer. Richard D Gregory, head of species monitoring and research for RSPB (Bedfordshire, UK), says that some cold-loving species – the redwing, for one – are emigrating to Finland and other Scandinavian countries. Other species may not be so flexible.

Gregory cites the Scottish crossbill, a bird endemic to a narrow range in the pine forests of Scotland, as vulnerable to extinction. These

birds could conceivably find a similar niche in Iceland, he says, but would be unlikely to survive a trip across the ocean. “It’s a problem of European geography for these birds”, he continues. “North of the UK, there isn’t much landmass for these birds to retreat to.”

The study provides empirical support for so-called climate “envelope models”, mathematical models that predict how the boundaries of a species’ range will shift as the climate changes. “This is some of the first hard evidence that these models are working quite well”, notes Gregory. “Before, we were making a leap of faith. This paper really puts bones to that reality.”

Using the models and sightings records, the researchers produced the *Climatic atlas of European breeding birds*, which maps out the ranges of various species. Gregory believes that the envelope models and the atlas can now be used with confidence in conservation planning. ■

Buggy Creek virus found in house sparrows

Leslie Bienen

At the Wildlife Disease Association Conference (3–8 August Edmonton, Canada), postdoctoral student Valerie O'Brien (University of Tulsa, OK) presented award-winning data showing how a non-native species – house sparrows (*Passer domesticus*) – can foster emergence of new diseases. O'Brien and colleagues' research indicates that the sparrows are disrupting the complex relationship between cliff swallows (*Petrochelidon pyrrhonota*), the cimicid swallow bug (*Oeciacus vicarius*), and Buggy Creek virus, an alphavirus hosted by the swallow bug. Buggy Creek virus is closely related to the western equine encephalitis virus complex, a group of mosquito-borne viruses that infect humans, horses, and numerous other hosts.

"One of the most exciting aspects is that our study is field-based", explains O'Brien. "We've always known that



A. Ginger

Cimicid swallow bugs on a nest.

invasives are important, but they will become more important as we continue to encroach on habitats, bringing our human commensal species into areas where endemic, low-level circulating pathogens exist."

O'Brien took blood samples from 935 cliff swallows and 813 house sparrows nesting together in colonial cliff swallow nests, and found that the house sparrows had ten thousand times higher titers of Buggy Creek virus than the cliff sparrows; 26.1% of house sparrows were infected, as compared with 2.4% of cliff swallows. The unadapted house sparrows experienced substantial morbidity and mor-

tality due to the virus, unlike the virus-adapted swallows.

Because house sparrows are more competent hosts for Buggy Creek virus than cliff swallows, O'Brien points out, "more virus equals more replications, equals more chances for mutations". An RNA virus doesn't proofread itself like a DNA virus, so the chances are higher that an RNA virus can jump to new vectors or new vertebrate hosts. O'Brien's research also showed that the presence of house sparrows in nests increased the amount of circulating virus sufficiently for it to be able to overwinter in more of the swallow bugs.

Buggy Creek virus is not known to replicate in mosquitoes, which probably explains why it hasn't been found in humans, but it may end up being one of very few viruses that are studied before becoming established in human populations. "We feel lucky to have received funding for this work", continues O'Brien. "This virus hasn't emerged yet." ■

No accounting for farm chemicals

Bette Stallman Brown

The May 2008 chemical usage reports, produced by the US Department of Agriculture's National Agricultural Statistics Service (USDA NASS), may be the last of their kind, despite the importance of these data to researchers, policy makers, farmers, and chemical industries.

Since 1990, a NASS program has documented the agricultural use of fertilizers, pesticides, and non-chemical pest management practices. However, annual appropriations have not kept pace with inflation, according to Joseph Reilly, Associate Administrator of NASS (Washington, DC), necessitating cuts. Reilly acknowledges that stakeholders were not asked for input before the program's cancellation, but he says such input would have made little difference. "The trade-off would have been cancelling one of the

principal economic indicators or the collection of data used for disaster payments to farmers", which NASS considers more important.

Carol Pilcher, an Iowa State University (Ames, IA) researcher, uses the chemical usage data to track adoption of integrated pest management (IPM) practices by farmers. Increased Midwestern corn production for ethanol has boosted continuous corn acreage, and Pilcher argues that, with the program's cancellation, "we won't know how much chemical is being used for continuous corn. Millions of acres are sprayed with pesticides against soybean aphids, and now we have no way to measure that". For intensively managed crops like apples, the program's cancellation may result in considerable data gaps.

Although the US EPA has used NASS data for pesticide risk assessment, the Agency also purchases chemical usage data from private companies. But such proprietary

data are prohibitively expensive for researchers like Pilcher. In letters to the USDA, protesting the program's cancellation, many farming and conservation groups have questioned both the data quality and the undisclosed collection methods.

In its July 2008 report on the fiscal year 2009 agriculture appropriations bill, the Senate Appropriations Committee recommended that NASS continue chemical usage data collection. However, Reilly contends, "having the language in there without any additional money does not really help to reinstate the program". In the absence of congressional appropriations, the program could be resurrected with money from private industry or other agencies.

Even if the program is re-established, Pilcher fears that information on the 2008 growing season will be lost forever. The NASS data "are truly the only national-level data we have on IPM practices and pesticide use". ■

Canada moves toward sustainability

Janet Pelley

Under Canada's Federal Sustainable Development Act, Canadian federal department heads will have to meet environmental targets or lose bonus pay. Experts believe that the new law – the first of its kind in North America – could revolutionize the way government deals with environmental issues.

The legislation directs the minister of the environment to draft a sustainable development strategy, based on the “precautionary principle”, which states that lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. “This is Canada's first step in catching up with European nations that are...making strides toward a sustainable future”, says

David Boyd, an environmental lawyer at Simon Fraser University (Vancouver, Canada).

Canada's sustainable development strategy must set out goals and measurable targets contributed by ministers of various departments. Deputy ministers will sign performance-based contracts that commit them to meeting the targets. Although the legislation does not currently specify any targets, if Canada follows the lead of European nations (eg Sweden and the UK), future targets could consist of short-, medium-, and long-term goals for reducing pollutants by a certain percentage, Boyd explains.

The action comes 16 years after Canada first made an international commitment – at the 1992 Earth Summit in Rio de Janeiro, Brazil – to formulate a sustainable development strategy, Boyd continues. It is long overdue, given that Canada has one of the worst environmental records

of any developed country, according to a report from the David Suzuki Foundation.

The new law could pay big dividends, based on the success of other measurable targets. In 1990, Canada agreed to the Rio goal of establishing 12% of the country's territory as protected area; so far, over 100 million acres have been set aside. “Measurable targets are difficult for the government to ignore, because they increase transparency and accountability”, points out Boyd.

However, a lot depends on what kind of targets will be set in upcoming regulations to implement the law, Boyd cautions, adding that Canada would do well to emulate Sweden, which, in 1999, pledged to achieve sustainability within a generation. Sweden has since slashed greenhouse gas emissions to 7% below 1990 levels and is on track to meet half of its 72 other environmental goals. ■

Kenyan biofuel project goes to judicial review

Kathryn Senior

In mid-July, the Malindi High Court in Kenya temporarily halted a US\$370 million sugar and biofuels project in the coastal wetlands of the Tana River delta and gave local environmental groups the go-ahead to apply for a judicial review.

The National Environmental Management Authority had cleared the project but it met with fierce opposition from environmental groups. The Kenyan sugar milling company, Mumias, which is partly owned by the Kenyan government, was to plant sugar cane on 20 000 acres of land in this coastal wetland, aiming to create 20 000 jobs. According to Nature Kenya, an environmental impact assessment was carried out, but was hurriedly produced and lacks vital information. “Despite the projected loss of semi-natural habitat in an area of recognized high value for biodiversity conservation...there is no development and conservation master plan



Malachite kingfisher from the Tana Delta, an area rich in avian biodiversity.

for the area, and no gazetted conservation areas”, points out Paul Matiku, Executive Director of Nature Kenya (Nairobi, Kenya).

According to Jeremy Woods (Imperial College London, UK), although it is untenable to maintain the status quo with regard to land use – due to drivers such as population growth, oil and gas depletion, per capita wealth creation, and technological change – “there is an urgent need to implement good practice for land management and production”.

Woods adds that projects like this highlight the conflict between government needs (to enhance rural development and food security), environmental needs (to conserve natural resources), and the needs of local people with vested interests in the land.

The controversy over the Tana River delta project has coincided with the publication of the Gallagher report by the Renewable Fuels Agency in the UK, which concludes that “there is a future for a sustainable biofuels industry, but feedstock production must avoid agricultural land that would otherwise be used for food production. This is because the displacement of existing agricultural production, due to biofuel demand, is accelerating land-use change and, if left unchecked, will reduce biodiversity and may even cause greenhouse gas emissions.”

Matiku stresses that, “the current assessment is biased toward the sugar cane project, without considering lost opportunities for ecological goods and services and direct benefits from ecotourism and other environmentally friendly investments.” ■

Coral reefs and climate change

Jane Bradbury

By applying engineering principles, computational ecologist Joshua Madin (Macquarie University, Sydney, Australia) and colleagues have quantified the ecological effects of severe storms and ocean acidification associated with global warming on coral reefs (published online in *Biol Lett-UK* 2008; doi:10.1098/rsbl.2008.0249). “Our work suggests that, in the future, coral reefs will be dominated by species with simple, robust colony shapes, and will support a lower diversity of other organisms than present-day reefs”, says Madin.

Coral polyps are supported by elaborate calcium carbonate skeletons. “A healthy reef contains an array of differently shaped colonies. It is rather like a cityscape of differently shaped buildings, some of which are more likely to collapse during a storm because of their less sturdy shape and relatively weaker building materials”, explains Madin, who previously developed a mathematical model that predicts colony dislodgment based on colony shape and environmental conditions.



Acropora hyacinthus – vulnerable to climate change.

The researchers now use this model to investigate the ecological responses of species (with different characteristic shapes) to mechanical damage by storms. They also test how reducing the strength of the coral skeleton’s building materials will affect this vulnerability – as the oceans acidify because of increased amounts of atmospheric CO₂, reef-based carbonate materials will become weaker. “We found shifts from top-heavy corals with narrow bases, which provide habitat complexity that is critical to reef biodiversity, toward mechanically robust, mound-shaped species, which provide less complexity”, continues Madin.

“By examining both the physics and biology of reefs, this study suggests that climate change will deliver a ‘double whammy’ to coral reefs, changing the mix of species within them”, comments Terry Hughes, Director of the Australian Research Council Centre of Excellence for Coral Reef Studies (Townsville, Australia).

“This innovative application of ‘ecomechanics’ to the study of coral reefs puts numbers to ideas that have been around for some years”, adds Mark Denny (Stanford University, CA), who is investigating the mechanical effects of waves on the ecology of rocky shores. “The finding that the species composition of corals (and therefore the whole community structure) is likely to shift to a less diverse assemblage because of climate change is interesting and important.”

Madin and Hughes both believe that, in the short term, improving water quality and rebuilding fish stocks might make reefs more resilient to climate change. But, warns Hughes, “these actions cannot protect reefs from climate change in the longer term. To do that, we need immediate and sharply targeted reductions in emissions.” ■

Czech entomologists arrested in India

Dinesh C Sharma

The entomological world is up in arms over the recent arrest of Czech researchers Petr Svacha and Emil Kucera for collecting insects in Singhalila National Park (Darjeeling, India), with the alleged intent to smuggle them abroad. After being in jail for over a month, the two were released on conditional bail on July 25, and now face prosecution. Over 1200 entomologists worldwide have petitioned the Indian government for their release, while dismissing charges of biopiracy. The episode has brought into focus national laws governing biodiversity that place restrictions on the exchange of biological material.

Taxonomists from around the world

depend on the loan and exchange of insect specimens for their studies. But the guidelines of India’s National Biodiversity Authority (NBA) specify that such exchanges with foreign institutions be routed through government ministries. This would not only result in delays, but would also pose logistical problems. “No museum would send a specimen to a government ministry, to hand over to an entomologist after scrutiny by officials who know nothing about its importance or how to handle it”, says K Divakaran Prathapan (Kerala Agriculture University, Thiruvananthapuram, India).

Priyadarsanan Dharma Rajan (Ashoka Trust for Research in Ecology and the Environment, Bangalore, India) believes that Indian authorities are trying to apply the conservation mea-

asures for large species, such as elephants and tigers, to insects. An Indo–American project to prepare an inventory of 200 000 insects found in Western Ghats could not take off because of NBA’s refusal to allow specimens to be taken out of the country.

“Fears of biopiracy are baseless, irrational, and counterproductive. Issues of patenting arise only when the biological material has a commercial value. What is the commercial value of a few insect larvae?”, asks Prathapan. But Ashok Kumar of the Wildlife Trust of India (New Delhi, India), which is pressing for prosecution of the Czech entomologists, argues that, “Insects play an important role in pollination of flora, especially in high altitude vegetation. They are as much a part of nature as any other wild species.” ■

As CO₂ climbs, so do lianas

Ken Ferguson

Global warming may be bad news for many tropical species, but at least one type of rainforest plant could flourish with the changes expected to occur as atmospheric CO₂ levels rise.

For the past several years, Stefan Schnitzer, an Assistant Professor at the University of Wisconsin–Milwaukee (Milwaukee, WI), has been studying lianas – woody vines that reach the forest canopy by attaching themselves to tree trunks – in central Panama. In a presentation at the 93rd ESA Annual Meeting (3–8 Aug, Milwaukee, WI), Schnitzer synthesized multiple published datasets that suggest that lianas have become both more abundant and larger in recent years. He believes that these changes may be linked to a changing climate, although addi-

tional evidence is necessary to confirm this. Elevated CO₂ may allow lianas to grow faster “because lianas have a higher leaf area ratio [the ratio of leaves to whole plant biomass], and increasing CO₂ may allow them to add a greater proportion of photosynthetic tissue – leaves – to support tissue than will trees. So lianas will grow more with increasing CO₂,” he explains.

According to Schnitzer, the onset of drier conditions in tropical regions, projected to occur under most climate change scenarios, may also be an important factor driving the changes in liana growth patterns. Compared with trees, lianas have a much greater capacity for growth during seasonal droughts, and as precipitation decreases in tropical regions, lianas should benefit. “Lianas have a dry-season growth advantage, and the increasing

length and severity of seasonal droughts in tropical forests result in an environment that is conducive to liana proliferation”, Schnitzer notes.

An increase in liana abundance could potentially impact rainforest systems in several different ways. “Lianas reduce tree growth, reproduction, and recruitment, but it is likely that not all tree species will be equally affected. So, at the community level, greater liana abundance and biomass may alter tree species’ relative abundance”, explains Schnitzer. “At the ecosystem level, by reducing tree growth rates, lianas can lower tree carbon sequestration and so alter forest-wide carbon dynamics. Lower carbon sequestration in tropical forests would result in more atmospheric carbon, which could have further negative effects on tropical forest community- and ecosystem-level dynamics.” ■

Fungal footbaths for bees

Adrian Burton

Honeybees may soon have new fungal allies in the war on the varroa mite (*Varroa destructor*), a common ectoparasite of bee pupae, and will be armed with a range of spore deployment weapons – including a fungal footbath.

At the 41st Annual Meeting of the Society for Invertebrate Pathology (3–7 Aug, Warwick University, Coventry, UK) delegates discussed the ailing health of honeybee colonies. The varroa mite, originally from Asia, is believed to be responsible for much of the recent worldwide decline in bee populations. This large parasite reproduces in the cells of hives, feeding on the circulatory fluid of developing bees, an insult that triggers infections; in the UK, losses of 30–50% of colony populations have been recorded. Worryingly, chemical control of *Varroa* is failing because the mites are developing resistance; the effect of declining bee populations is costing British agriculture alone an estimated £163 million (~US\$312 552 500) per year.



Varroa mites on a bee pupa.

“That’s why we looked for a biological way to control them”, explains Dave Chandler, a Research Fellow in entomology at Warwick University. “We screened about 50 fungal pathogens of insects and mites, looking for candidates with certain properties. Obviously, these included being able to kill the mites and not the bees, but we also needed fungi that could withstand the warm, dry conditions inside beehives. We now have four candidates, and are developing ways of efficiently delivering them to hives.”

One method involves placing a fungal footbath at the hive entrance

that returning bees must cross to gain entry, picking up fungal spores on the way. “The bees then pass these spores on as they come into contact with one another and move around the hive”, explains Chandler. “The spores germinate on the mites, and the mycelium grows inside them, eventually causing them to burst.”

“Bee footbaths were originally designed so that bees would take beneficial fungi to flowers”, explains Joseph Kovach, Associate Professor of Entomology at Ohio State University (Wooster, OH), who has a patent on the apparatus. “This idea is the reverse, with spores going into the hive. It is an efficient way to inoculate a hive...the footbaths [allow the bees to carry] the spores on their legs and disseminate them throughout the hive.”

Chandler and colleagues at the Rothamstead Research Station (Harpenden, UK) are also interested in developing other delivery systems, such as spore-impregnated paper (bees love to chew paper), granules, and powders. ■