

A birthday for Earth Day

Kathryn Senior

Although the 2009 version of Earth Day is fast approaching (April 22), Earth Day Network organizers are already focusing on next year's event. As Kathleen Rogers, President of Earth Day Network (Washington, DC) explains, "Earth Day 2009 marks the beginning of Earth Day Network's 'Green Generation' campaign, a global initiative that will culminate with the 40th anniversary of Earth Day, in 2010". Working with 17 000 global partners in 147 countries, "we are poised to make 'Earth Day 40' a truly unifying event", she adds.

The Green Generation campaign has two fundamental visions: a carbon-free future, based on renewable energy rather than fossil fuels, and an individual's commitment to responsible, sustainable consumption. "The campaign includes ordinary people who are engaged in individual and collective activities to improve their health and their schools, and to participate in building a solution to urgent national and global issues, such as climate change or the world's water crises", continues Rogers. To further these key goals, the policy demands for Earth Day this year and next include enactment of an expansion in the use of renewable energy, a firmer commitment to a "no coal" policy, a move to create new "green" jobs, and the implementation of environmental sustainability education in schools. Rogers sees these achievements as essential "if we are to move toward a world that has ended its involvement with fossil fuels and where the word 'environment' is expanded to include our health, our communities, our diversity, and our children's future".

This year, Earth Day Network, with its partner Green Apple Festival, is holding simultaneous events in ten US cities over Earth Day Weekend, that will focus on environmental volun-

teerism. The flagship event, Earth Day on the National Mall in Washington, DC, will be a large-scale, free festival, featuring live music, entertainment, speakers, and environmental activities.

However, the annual spectacle that Earth Day has become does not please all environmental activists. Last year, Glen MacIntosh of the Toronto Climate Campaign led a protest to "reclaim Earth Day", arguing that it was now important only for its entertainment value, rather than true activism for change. Other organizations opposed to Earth Day are particularly offended by the amount of corporate sponsorship that the Earth Day Network receives for its work. "Corporations have an obligation to do something for the Earth, just as the rest of us do", counters Rogers, who stresses that such businesses provide funding for the activities, but have no say in the nature of those activities. "I believe that commercial organization, sponsorship, and support for Earth Day celebrations are a good thing", says Robert Neilson, of the Idaho National Laboratory (Idaho Falls, ID), adding that, although Earth Day may have elements of entertainment, "it helps to get the main messages out to a broader audience and recognizes that people are informed in different ways".

David Allan's perspective includes a

large dose of nostalgia, as he was one of the original organizers of the first Earth Day, held in 1970. Allan, now a professor at the University of Michigan in Ann Arbor, says that "perhaps today's events seem commercialized to some, but hey, it's about getting attention". At Earth Day One, in Ann Arbor, performances by Gordon Lightfoot and the Chicago cast of *Hair* filled a 15 000-seat basketball stadium to capacity. "Earth Day events are still extremely important, because they remind us of the importance of the issues", he adds.

This point is taken up by Kevin Trenberth (National Center for Environmental Research, Boulder, CO), who believes that public involvement in environmental issues is ultimately helpful in reducing our collective impact on the planet. "Politicians can only govern and make changes in policy with the support and will of the people; drawing awareness to the problems and the things we can do about them is much needed", he says. Having Earth Day provides a focus for this with regard to the environment, which includes issues of sustainability and climate change. Trenberth does, however, agree with some of the critics of Earth Day concerning one aspect of the event: "If there is a problem with Earth Day, it is that people feel that if they go out and make a show or demonstration one day a year, then they have done their part. Instead, Earth Day should signal the need to do things differently every day of the year." ■



Earth Day celebrations on the National Mall in 2008.

Global agreement to control mercury pollution

Adrian Burton

International attempts to control mercury pollution received a green light in Nairobi, Kenya, on February 20th, as the US joined some 140 other nations in calling for an international treaty to tackle the problem. “During the Bush Administration, the US blocked proposals for any legally binding treaty, calling instead for what was ineffective voluntary control”, explains Susan Egan Keane, a policy analyst for the Natural Resources Defense Council (Washington, DC). “The Obama Administration has reversed that policy, which may have helped [in getting] China and India to sign up too.”

In humans, low-dose exposure to mercury is associated with irritability, tremors, memory loss, and lack of coordination, while high-dose exposure may lead to liver, kidney, intestinal, and brain damage. Fetuses are at particularly high risk – yet mercury pollution is now so serious that, in the US, one in 12 women has body mercury levels considered



Coal-fired power plants produce one-third of all mercury pollution.

unsafe by the US Environmental Protection Agency. In developing countries, where mercury is used in artisanal gold mining, over 10 million people may be seriously exposed; for instance, 70% of gold miners in Mindanao, Philippines, are believed to be suffering from some degree of mercury intoxication.

The major source of mercury pollution is, however, coal-fired power stations, which spew 2000 tons of mercury into the atmosphere every year, accounting for one-third of global mercury emissions. Those living near power stations are not the only ones affected; emitted mercury is carried by wind and water to distant locales and enters food chains, becoming biomagnified in the flesh

of top predators. Pike caught in thousands of lakes in Sweden contain so much mercury they cannot be eaten, for instance, while sharks caught worldwide have been recorded with mercury contents many times higher than recommended food safety limits.

The agreement reached in Nairobi now allows for an international treaty to reduce mercury emissions and international trade in mercury, to tackle the safe stockpiling of mercury reserves, and to address the remediation of contaminated sites. Such is the concern, that accelerated action under a voluntary scheme is to start before the treaty is finalized, hopefully by 2013.

“Only a few weeks ago, nations remained divided on how to deal with this major public health threat, which touches everyone in every country in the world”, explains Achim Steiner (UN Under-Secretary General and UN Environment Programme Executive Director). “Today, we are united on the need for a legally binding instrument and immediate action toward a transition to a low-mercury world.” ■

Biofueling a conservation conversion

Virginia Gewin

In 1985, the US Farm Bill gave the Conservation Reserve Program (CRP) the authority to pay farmers to place highly erodible farmland – often of low production value – into permanent grass under 10- to 15-year contracts. Consequently, the soil quality of thousands of set-aside acres has improved dramatically, as the amount of carbon stored in the soil increased – which has also helped to offset carbon emissions. As the demand for biofuels increases, however, more farmers are opting to place these lands back into corn production for ethanol, prompting concern that the environmental benefits resulting from CRP may be lost.

Now, a recent study suggests that

no-till corn production can maintain soil carbon levels on former CRP land (*Agron J* 2009; doi:10.2134/agronj.2008.0107). “CRP successfully allowed us to maintain these lands until we had the ability to bring them back into production sustainably”, says agronomist Ronald Follett (US Agriculture Research Service, Fort Collins, CO), the study’s lead author. In a conventional agricultural system, lands would be plowed and worked multiple times to prepare a seed bed. In no-till systems, the seed is placed directly into soil and covered with the previous crop’s residues, which helps maintain carbon flow into the system. Follett and his colleagues showed that corn stalks left to degrade can replenish carbon stocks in the undisturbed soil below.

Bill Parton, a research scientist with the Natural Resource Ecology

Laboratory (Fort Collins, CO), says his computer models of soil carbon storage under different management systems corroborate the Follett team’s field-based findings. However, assessing the net benefit of cultivating corn for biofuels is complicated because the net greenhouse gas balance depends on the quality of the land used to grow the crops.

The adoption of no-till farming is uncertain. Bruce Babcock, an economist at Iowa State University (Ames, IA), believes that Iowa farmers may be hesitant to adopt no-till because it is more difficult to establish a corn crop early enough in the growing season. In an effort to find the best match between biofuel crops and farming practices, Follett now plans to study how perennial grasses used to produce cellulosic ethanol maintain soil carbon. ■

Australia's "big dry" traced to Indian Ocean

Claire Miller

The unprecedented 15-year drought gripping southeastern Australia has been traced to a little-studied phenomenon thousands of miles away, in the Indian Ocean. Australian scientists have found that an irregular cycle of warming and cooling, known as the Indian Ocean Dipole (IOD), is driving the extreme conditions that culminated in February's wildfires, in which more than 200 people died. The IOD also explains why a series of La Niña events in the Pacific Ocean have brought rain to Australia's northeastern seaboard, but failed to break the drought in the southeast.

Caroline Ummenhofer (University of New South Wales, Sydney, Australia), co-leader of the research team along with Matthew England,

explains that such droughts had previously been attributed more to El Niño/La Niña variations in the Pacific Ocean. The Pacific and Indian Ocean cycles were similar and complementary, but the research found the IOD was more of a driver for severe, prolonged droughts in the Australian southeast.

When the IOD is in a negative phase, cooler waters off the west coast of Australia mix with warm water from the Timor Sea to drive moisture-bearing winds across the continent. In positive phases, the winds dry up, and so does the rain in the southeast. "During the 'big dry' of the past 15 years, we have seen a noticeable absence of the negative phase", says Ummenhofer. "We haven't had one since 1992, and this is the longest period on record for the past 120 years. If we don't have these wet events interspersed with dry and average years, then we are left with just the aver-

age and dry years. We think this has played a big role in the big dry, as well as in others, like the Federation drought in the 19th century and during World War II."

Ummenhofer believes that negative IOD phases consistently bring rain to the southeast – with even wetter conditions if they coincide with a La Niña event – but a La Niña on its own delivers more mixed results. Two positive phases in a row would be unusual; it has now been three in a row. Higher temperatures linked to climate change have further amplified the impacts, leading to record low river flows, widespread water shortages, and a tinder-dry landscape.

Ummenhofer points out that the Indian Ocean is the least studied of the big tropical oceans, and suggests that further research could help improve climate forecasts for governments and others planning for the future. ■

Rx for oak trees

Robin Meadows

Finally, there's a way to protect trees from sudden oak death (SOD), a fatal disease caused by the water mold *Phytophthora ramorum*, a fungus-like pathogen that has killed about a million trees in California since its onset two decades ago, and which currently infects a million more. New research reported in *California Agriculture* (2009; 63: 10–17) shows that the fungicide phosphonate wards off infection in coast live oaks (*Quercus agrifolia*), which are highly susceptible to SOD. Three other oak species, as well as tanoaks (*Lithocarpus densiflorus*), members of the beech family, also succumb to the pathogen in California.

The researchers treated coast live oaks in the field with phosphonate injections or bark sprays, then periodically sampled branches from treated trees to test them for susceptibility to infection in the laboratory, where the pathogen could be contained. The results suggest that phosphonate can



A tanoak tree (*Lithocarpus densiflorus*) gets its phosphonate shots from spring-loaded syringes.

D.J. Schmidt/UC Berkeley

protect trees for at least 2 years.

The study also debunked the popular alternative treatment of amending the soil with azomite, a naturally occurring, calcium-rich powder mined in Utah. Azomite completely failed to protect coast live oaks, leading primary author of the study, Matteo Garbelotto (University of California, Berkeley, Berkeley, CA), to liken its use to "treating pneumo-

nia with orange juice".

Phosphonate, which is non-toxic and targets water molds, works by boosting the natural defense systems of trees. "It is most effective when applied preventively, before a tree is infected", explains Garbelotto. Phosphonate is most promising for protecting oaks in forests with few bay laurel trees (*Umbellularia californica*), which are primary hosts for the SOD pathogen in California. The pathogen spreads partly by wind, and Garbelotto envisions treating oaks in exposed areas, such as on ridges and along corridors where wind may tunnel.

First introduced to California via the nursery trade, *P. ramorum* also infects trees elsewhere in the world. "In Europe, where beech forests are at risk, researchers are just starting a full eradication program, and phosphonate may be a good tool", notes Garbelotto. But conservationists must be careful to treat only uninfected trees. "Otherwise, phosphonate may just mask the presence of the pathogen", he cautions. ■

Bioengineering in the Baltic

Nancy Bazilchuk

Because of its large drainage area, restricted circulation, and substantial nutrient load, the Baltic Sea is regularly plagued by blue-green algae blooms, resulting in widespread anoxia. In June, the Finnish Environment Institute (SYKE; Helsinki, Finland) and several Nordic partners will start the field phase of a €2 million, 3-year study of whether pumping oxygen-rich surface water to oxygen-starved deep zones will help reduce the occurrence of algal blooms. The study is mainly funded by the Swedish Environmental Protection Agency (Stockholm, Sweden).

“With artificial oxygenation, we can try to help the recovery of eutrophic systems”, says Heikki Pitkänen, coordinator of the project at SYKE. Two areas, a 31-m deep coastal basin in the western Gulf of Finland and a 27-m deep bay 10 km offshore from Stockholm, will be supplied with pumping devices and automatic measuring instruments. The researchers



An oxygenation pump.

will also monitor phytoplankton and benthic fauna biomass and species composition.

Pitkänen and his colleagues will compare results from the two test areas to see if artificial oxygenation is effective in coastal conditions, and whether the method could work on a larger scale. An earlier

Swedish study (*Ambio* 2007; **36**[2]: 280–86) estimated that 100, 0.6-megawatt wind-powered pump stations, at a total cost of €200 million, would be enough to re-oxygenate the main basin of the Baltic to depths of 125 m.

The big question is whether re-oxygenation efforts are enough to overcome the release of phosphorus from anoxic surface sediments, which is largely responsible for the sea's massive blue-green algal blooms. While oxygen levels in near-bottom waters in some areas are satisfactory, the sediment surface itself remains anoxic and devoid of higher life.

Officials also continue efforts to limit the nutrients pouring into the Baltic. The single biggest point source of phosphorus is St Petersburg, Russia, which was responsible for 40% of the external phosphorus load entering the Gulf of Finland in 2004. Ongoing sewage treatment plant upgrades are expected to reduce the city's phosphorus contribution to around 10% by 2012, if construction continues as planned. ■

Nobel laureate urges soldiers to fight desertification

Jen Schoenburg

“Imagine all soldiers marching for the planet”. Nobel Peace Prize laureate Wangari Maathai spoke these words during the UN Environment Programme's (UNEP; Nairobi, Kenya) Governing Council meeting in late February, summarizing her latest effort to inspire everyone – from governments and industry to individuals and communities – to assist with global environmental restoration by planting trees worldwide. “How wonderful it would be if every soldier started seeing himself as a soldier for the planet, holding a gun on one side and a tree seedling on the other”, she continued. Along with Prince Albert II of Monaco, Professor Maathai is a

patron of the Billion Tree Campaign, a cooperative effort between UNEP and the World Agroforestry Centre (Nairobi, Kenya).

Because trees can absorb large amounts of atmospheric CO₂, planting them is one of the easiest and most cost-effective ways to combat global warming. Since the campaign began in 2006, more than 2.7 billion trees have been planted in 165 countries. The current goal is to plant 7 billion trees by the end of 2009. Nick Nuttall, a spokesperson for UNEP, explains that the primary objective is to “catalyze action on climate change and wider environmental issues, such as water shortages, biodiversity loss, and soil conservation, via the simple but powerful action of planting trees. Faced with what can sometimes feel to be insur-

mountable global challenges, the Billion Tree Campaign is about saying to people, communities, companies, and countries: ‘Yes you can...make a difference’”.

Now, the movement has its sights set on recruiting military forces to aid in making that difference. Lucy Wanjohi, of Professor Maathai's Green Belt Movement (Nairobi, Kenya), says that the key message to the military is the need for their assistance in fighting an unconventional enemy – desertification. “The soil is being eroded right from beneath the soldiers' feet, and desert is approaching at an alarming speed for every tree that we cut. This is the enemy we need to fight.”

Information on how to get involved in the movement, including tree planting tips, is available at www.unep.org/billiontreecampaign. ■

Reverse ecology uses genes to predict environment

Chris Emery

A new technique dubbed “reverse ecology” expands the use of genetic data to study not only organisms themselves, but also their current environments and the ancient conditions in which they evolved, according to a recent study (*J Comput Biol* 2009; **16**: 2). The method could help scientists to predict the native environments of newly discovered bacterial species about which little is known, and to better understand how bacteria change over time in response to evolutionary forces in their surroundings. Since bacterial communities are found nearly everywhere, the technique could have broad applications in fields such as medicine, agriculture, and environmental protection.

“You can use [reverse ecology] to

study a system where the ecology itself is not known”, according to lead author Elhanan Borenstein, a postdoctoral researcher at Stanford University (Stanford, CA). “We have a lot of genomic data, but we don’t understand the environments these bacteria live and evolved in. This will tell us more about the interactions between organisms, and [those] between an organism and its environment.”

Reverse ecology uses computers to crunch genetic data emerging from modern genomics research, which focuses on mapping out an organism’s DNA. Genes control the functioning of cells by orchestrating the complex chains of chemical reactions that keep cellular machinery running. Some genes are involved in multiple chemical processes and are therefore linked with other genes in webs of relationships.

Since certain genes, and networks of genes, are better suited for

survival in certain types of environments, Borenstein uses genetic data to predict the relationship a species might have with its surroundings. To test the predictive ability of the technique, he used genomic data to match 569 bacteria species to their respective host species. In these parasite–host relationships, the host serves as the parasite’s environment, fulfilling its metabolic needs for biochemical compounds. Borenstein and his colleagues found that a bacteria species’ DNA was a good predictor of the environment – the host – that can support the species.

“We now know there is a way to learn ecology from genomic data”, says Borenstein, “and we can do this on a very large scale. This will be useful in situations where genomic data are available but ecological data are limited, and researchers can use this kind of approach to try to bridge such gaps.” ■

New biofuels in the pipeline

Alison Gillespie

Researchers the world over are looking for readily available resources that could be used to produce new biofuels, while the ecological impacts of these fuels continue to cause debate. In the southwestern region of the US, for example, a shrubby, silver-leafed, native perennial called guayule has long been known as a source of latex and rubber products. Until recently, however, large-scale production of guayule rubber was not economical, and its agricultural usage remained low. Now, researchers say they’ve found a way to use the leftovers from guayule latex production as biofuel feedstock, which may increase its use as a crop.

“You can harvest it at any time of year”, says chemist Colleen McMahan from the US Department of Agriculture’s Agricultural Research Service (Albany, CA). The only other biofuel available year-round in the



Guayule plants may be a new source of biofuel feedstock.

US, she adds, is municipal waste. Many of the 3000 acres (1214 hectares) where guayule is now grown are former cotton fields.

Yet Joe Fargione, a regional scientist with The Nature Conservancy in Minneapolis, MN, warns that the cultivation of such crops on marginal land may contribute to the conversion of natural ecosystems to croplands. “Unless we develop ways to produce biofuels that don’t require additional land, or unless biofuels can be produced in ways that are

compatible with biodiversity, they will incur a high cost in land area that is likely to come at the expense of natural ecosystems”, he says.

Biofuel production that recycles waste without increasing crop production may be one way forward. In Scotland, for instance, engineers at the Helius Energy company (Middlesbrough, Cleveland, UK) and the Combination of Rothes Distillers (CoRD; Aberlour, Banffshire, Scotland, UK) have developed a combined heat and power plant that will burn leftovers from the production of famous brands of scotch whiskey to generate 7.2 megawatts of electricity – enough to power 9000 homes.

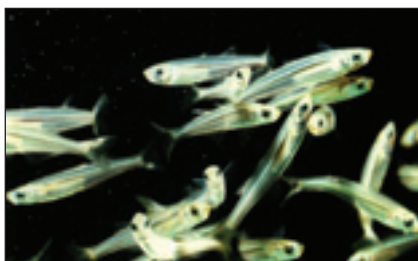
Frank Burns, general manager of CoRD, says the system exploits resources that once went unused. “Not only will it generate renewable heat and power, but it secures additional markets for our distillery co-products”, since some of the leftovers from production will be turned into organic fertilizer and sold to local farmers. ■

Fishing for two-way evolution

Jane Bradbury

“Undesirable” evolution – a genetic reduction in fish size driven by size-selective harvesting – may be reversible, according to new laboratory research. “We found that the changes in fish size caused by selectively harvesting big fish reversed slowly when harvesting stopped”, explains lead researcher David Conover (Stony Brook University, Stony Brook, NY). But, he warns, “it would be much better to prevent undesirable evolution occurring in response to fishing practices than to rely on its reversibility”.

Although the harvesting of small fish is banned in most commercial fisheries, some experts are concerned that selectively harvesting large fish may have evolutionary consequences. To test this possibility, more than a decade ago, Conover and his colleagues established six populations of silversides (*Menidia menidia*) in standardized, experimental tanks and applied size-selective fishing for five generations. In two tanks, the largest 90% of each generation of the fish were removed;



D Conover/Stony Brook University

Stony Brook scientists revealed “undesirable” evolution in the Atlantic silverside, *Menidia menidia*.

in another two tanks, the smallest 90% of each generation of the fish were removed. In the remaining tanks, 90% of the fish were harvested at random. Size-selective harvesting was then halted for five generations.

In 2002, after five generations of harvesting, the researchers reported that the mean weight and biomass at harvest of large-size selectively harvested populations were half those of the small-size selectively harvested populations. Now they report that, within the populations that had evolved a smaller body size during size-selective fishing, there is a slow but significant increase in size once fishing ceases (*Proc Roy Soc B Bio* 2009; doi:10.1098/rspb.2009.0003). Full re-

covery of body size, the researchers suggest, would take about 12 generations, or between 30 to 80 years for a species like cod.

“While this study provides the first demonstration that genetic changes due to size-selective harvesting are reversible under laboratory conditions, the applicability of these results to wild, harvested populations experiencing fluctuating environmental conditions remains unclear”, cautions evolutionary ecologist Stephanie Carlson (University of California Berkeley, CA). Furthermore, she adds, “the apparent snail’s pace of evolutionary reversals implies that such reversals may be irrelevant on a time scale that is meaningful for resource managers”.

Conover agrees that it is difficult to predict the precise evolutionary effects of selective fishing on wild fish based on laboratory experiments. Nevertheless, he says, “because there is strong evidence that wild harvested populations show similar responses to those seen in our experiment, fishery management strategies that take into account the evolutionary consequences of fish harvesting should now be considered”.

Trimming tower lights can save birds

Janet Pelley

Of the many ways that birds die at the hands of humans, collisions with communications towers may be one of the easiest to fix. New research has shown that dousing steady red warning lights on towers – while keeping flashing or strobed red ones lit – substantially reduces bird kills. The US Federal Aviation Administration (FAA) plans to start tests this spring, to ensure that the new light patterns don’t make the towers less conspicuous to airplane pilots.

The US boasts 120 000 communications towers that keep our cell phones connected and radios and TVs blaring. High demand means their numbers increase by 6–8%

each year, according to the Federal Communications Commission (FCC). “We’ve known since 1949 that birds are attracted to, and killed by, communications towers”, says Al Manville, a wildlife ecologist at the US Fish and Wildlife Service (Arlington, VA). On cloudy or foggy nights, migrating birds cue in on the lighted space around the tower, and are killed when they run into the structure or its guy-wires. According to Manville, at least 4–5 million – and possibly as many as 50 million – birds are killed this way each year.

A new study from Michigan (*Ecol Appl* 2009; **19**[2]: 505–14) shows that birds are most attracted to the array of non-blinking, red warning lights, interspersed with white lights and flashing or strobe-like red ones on the sides of the towers. Simply turning off the

steady red lights cuts bird death rates by 71%.

FAA researchers have come up with a plan to have test pilots fly past the Michigan towers during the spring and fall bird migrations while lights are manipulated, to gauge the effect of different light patterns on pilots’ recognition, according to Jim Patterson, an airport safety specialist with FAA. Once the study is completed, at the end of this year, it could take 18 months to develop and issue new lighting standards.

“The federal government has been dragging its feet on this issue for more than a decade”, says Darin Schroeder, a vice president at the American Bird Conservancy, “but now that we have a new administration – one committed to science – it is time for them to act”.