Dispatches

The price of tar-sands oil

Noreen Parks

Each spring, up to 3 billion birds, belonging to nearly 300 species, flock to Canada's 1.4-billion-acre boreal forest to breed. Once a remote and pristine wilderness, over the past few decades this critical habitat has undergone assaults from numerous logging, mining, and hydropower projects. During recent years, yet another environmental threat has been escalating: the production of synthetic oil from bituminous deposits – commonly called "tar sands" or "oil sands" – in the province of Alberta.

Virtually every aspect of this industry affects the birds, according to the 2008 report, *Danger in the Nursery*, a collaboration of the Boreal Songbird Initiative (BSI, Seattle, WA), the Pembina Institute (Calgary, Canada), and the Natural Resources Defense Council (NRDC, New York, NY). Strip-mining the bitumen from near-surface deposits involves draining lakes and wetlands, diverting streams, and clear-cutting forests. The yield: one barrel of bitumen per five tons of earth. Extraction from deeper beds entails drilling and injecting massive quantities of water (as steam) to melt the bitumen.

The oil-sands industry has created a vast network of roads and processing plants to manufacture oil from the bitumen, along with numerous tailings ponds of industrial fluids polluted with heavy metals and other chemicals, deadly to waterbirds. A 2008 study by Environmental Defence Canada (Toronto, Canada) estimates that, annually, over four billion liters of tailings water seep into the environment and contaminate drinking water supplies. Deformities in aquatic life and rising cancer rates in residents of Fort Chipewyan, downriver from tar-sands development sites, are thought to be linked to the industrial activities.

D Dodge, Pembina Institute

Tar-sands oil production – a major source of pollution.

"The magnitude of impacts from the fragmentation and loss of habitat is also profound", says biologist Jeff Wells, lead author of the collaborative report. "Some of North America's most rapidly declining bird populations rely heavily on the boreal region, and species diversity is highest in the southern boreal, where the industrial footprint is greatest", he explains. While current oil production totals about 1.3 million barrels per day, it is expected to triple with the expansion of exploitation over an area the size of Florida, which would eventually decimate as much as 740 000 acres of breeding areas. "All previous evidence suggests that once habitat is gone, species' numbers decrease – the birds don't just go elsewhere", warns Wells. "If [tar-sands] growth continues as projected, we estimate as many as 18 million breeding birds could lose their habitat. Combined with fragmentation effects, this could result in population losses of up to 100 million or more birds over the next few decades."

"As Canada's fastest rising source of greenhouse-gas emissions and a very water-intensive process, oil-sands development has a high environmental cost that is not being addressed currently", adds Simon Dyer of Pembina. "Oil-sands production generates about 3 to 5 times more emissions than conventional oil production." Pembina and the World Wildlife Fund-Canada (Toronto) recently issued a "report card" on 10 oil-sands mining projects in Alberta, based on environmental assessments and company surveys regarding their performance in various areas of environmental management. "The average score among the projects was 33%, demonstrating substantial room for improvement across the industry", says Dyer. The report card lays much of the blame on lax government regulation; for example, over the past 40 years of industrial operations, only 0.2% of the disturbed area has gained certification as reclaimed under government guidelines.

The US consumes about 75% of Alberta's synthetic oil output, which seemingly contradicts commitments made by the US Conference of Mayors and Congress to focus on fuel sources with lower greenhouse-gas emissions. "Tar-sands oil simply doesn't have a place in a clean-energy policy", contends Susan Casey-Lefkowitz, an NRDC attorney and contributor to the BSI report. "President Obama has acknowledged that the industry's large carbon footprint, and the 2007 Energy Independence and Security Act, prohibit the US federal government from obtaining fuel from refineries that process tar-sands oil", she points out, adding that claims by Alberta government officials that technologies for capturing and sequestering CO_2 would solve the emissions problems are disingenuous. "Many emissions sources exist, the technology is expensive, and Alberta's record on environmental protection offers no encouragement that it will enforce such regulations", she argues. NRDC advocates a moratorium on all new tar-sands oil development, until it can prove environmentally sustainable.

For now, the current economic downturn has moderated the pace of tar-sands expansion. Moreover, growing protests over environmental concerns and bureaucratic wrangling have halted projects for new pipelines to deliver Alberta's oil to Canadian coastal locations for overseas transport and southward to US refineries. "We are at a turning point in our fuel choices", says Casey-Lefkowitz. "Now is the time to stop tar-sands expansion while we move forward with clean-energy alternatives." ■

Europe backs ecodesign for taps, showers, and windows

Kathryn Senior

New European legislation designed to encourage the development of homes that produce considerably lower carbon emissions was given a positive vote at the end of April by the European Parliament. The European Commission (EC) aims to reduce CO_2 emissions by 20% between 1990 and 2020, and the new eco-friendly standards for home insulation, windows, showers, and taps are being added to those already in place for products that actively use energy.

"The 2020 targets have a reasonably good chance of success", according to Martin Baxter, Acting Chief Executive of the Institute of Environmental Management and Assessment (Lincoln, UK). The EC is taking a more direct role in the national caps being placed on emissions – by trading-scheme participants – that will help to generate important reductions, says Baxter. Failure to achieve the targets will increase the risk of substantial climate change, with all the social, economic, and environmental consequences that would ensue.

The vote to approve the extension of the Ecodesign Directive was overwhelming (394 for vs 13 against), but is only a first step toward final legislation. The EC must present the second working plan of the Ecodesign Directive by mid-October 2011, and an impact assessment will then be completed in 2012. "The critical issue is whether an agreement is put in place in Copenhagen later in the year – this is the key framework that will enable progress against targets to be assessed", explains Baxter.

But can adding double- and triple-glazed windows and using water-saving taps and shower heads make a real difference? Previous studies suggest that if 30% more windows across Europe were double glazed by 2020, 55 000 gigawatts of power per year could be saved, the equivalent of the annual output of two to three nuclear power stations. "The framework for ecodesign and energy-using products is being extended, but the real difference will only come if there is a market demand for low-carbon products", warns Baxter. "More needs to be done to stimulate resource efficiency, and tied to this will be the need to improve skills in business." ■

Panama's polemic hydroelectric project

Adrian Burton

On April 23rd, shareholders of the AES Corporation (based in Arlington, VA) were told that company plans to build three hydroelectric dams on the Changuinola River in Panama will endanger the nearby La Amistad Biosphere Reserve – a UNESCO World Heritage Site – and have already led to serious breaches of the human rights of the indigenous Ngobe people. The shareholders received this news directly from Peter Galvin, Director of the US environmental group Center for Biological Diversity (Tucson, AZ), who used the novel strategy of buying sufficient shares in the company to guarantee him speaking rights at the shareholders' meeting.

Using supporting documentation, Galvin alleged that the project had been associated with the forced relocation of the Ngobe and would cause irreparable damage to the reserve. Galvin told *Frontiers*: "Many of the shareholders were genuinely shocked to hear of the environmental and social atrocities being carried out by the company they'd invested in".

M Patry/UNESCO

The La Amistad Biosphere Reserve: in danger from dams?

The project has run into numerous problems. For example, in March 2009, Panama's *Defensoría del Pueblo* – an independent watchdog established under Panamanian law – highlighted that the consultation, compensation, and relocation mechanisms used had not considered the rights of indigenous people. This followed an October 2008 hearing by the InterAmerican Commission on Human Rights on the legality of the displacement of the Ngobe tribe and the alleged failure of AES to obtain prior, informed consent (a ruling is pending), and an August 2008 declaration by James Anaya, UN Special Rapporteur on Indigenous Peoples, in which he spoke of arbitrary displacement, the excessive use of force, and the detention of those protesting against the project, including women and children.

However, Humberto González (Manager, AES Changuinola) told *Frontiers*: "In Changuinola, we have been negotiating a relocation program that provides better housing, health services, and education for the Ngobe people. The program was validated by The Nature Conservancy, the Panamian National Association for the Conservation of Nature, and the Audubon Society of Panama. AES fully respects human rights in project development and operations".

"Although the dam is outside the World Heritage site itself, it will likely have an impact on its ecosystems", explains Marc Patry (UNESCO Program Specialist for Latin America and the Caribbean, Paris, France). "We strongly encourage the parties involved to find ways to implement this project that will protect the area's environment and biodiversity." Going further, Galvin says: "AES should immediately halt this environmentally and socially catastrophic venture". ■

Do you want fries with that?

Chelsea L Wood

On April 22nd, cafeterias across the country cut out a few menu choices to call attention to the environmental impacts of meat production. Diners found no beef burgers on Earth Day lunch menus at the 400 corporate and college cafes served by Bon Appétit Management Company (Palo Alto, CA), according to Helene York, Director of Strategic Initiatives for the firm. "Many cafes eliminated all beef…and we've made an ongoing commitment to reduce the amount of beef that we purchase."

Negative environmental impacts of livestock production have long been recognized but are now on the rise, with increasing global demand for meat. The UN Food and Agriculture Organization lists biodiversity loss, water pollution/depletion, land degradation, and greenhouse-gas emissions among those impacts – collectively referred to as "livestock's long shadow".

Bon Appétit Management Company

Chicken is a good alternative to beef for the environmentally aware omnivore.

Harold Mooney, a professor of biology at Stanford University (Stanford, CA), explains that we are experiencing an ongoing "livestock revolution, a transition from extensive to intensive production". Relative to growing crops for direct human consumption, livestock production uses a tremendous amount of agricultural resources. Most intensively produced cattle, pigs, and chickens are fed grain, and this excess demand for grain is often met by expanding agricultural lands, which causes loss of habitat and biodiversity. It can also be met by intensifying production on existing croplands, leading to increased nutrient loads, water depletion, and land degradation. In addition to putting heightened pressure on agricultural lands, the livestock industry also produces large volumes of animal waste, requires vast quantities of water, and contributes nearly 18% of the world's greenhouse-gas emissions.

Mooney has advice for societies where meat consumption exceeds protein requirements: "I think we should consider eating less meat. And when I eat meat, I choose chicken, because chickens are highly efficient at converting plant matter into protein". York concurs: "If we look at any one of the types of actions that businesses like ours or individual consumers can do…reducing beef consumption is as or more significant than almost anything else. If we care about the environment, we have to care about what we eat for lunch". ■

Australia's dry heart beats with life

Claire Miller

Floodwaters from a monsoonal deluge in distant Queensland are filling Lake Eyre in central Australia, creating an "inland sea" in the desert that is attracting hundreds of thousands of birds for a feeding and breeding frenzy.

The rare flood event is especially noteworthy, because many avian species have been struggling for years as their usual wetland haunts dry up in the drought that has gripped the Murray-Darling River Basin, thousands of kilometers to the east.

According to Richard Kingsford of the University of New South Wales (Sydney, Australia), the Basin was the most important breeding place for a multitude of aquatic bird species, because, although prone to drought, historically the Basin also flooded more frequently than the ephemeral Lake Eyre.

This meant waterbirds could breed every 2 to 3 years in critically important wetland systems, such as the Macquarie Marshes on the Darling River. Now, with prolonged drought exacerbated by over-allocation of river water for crop irrigation, the last successful breeding event was almost a decade ago.

"This is why this flood – down through the center of the continent – is so important", explains Kingsford. "This year is very special, because it has been 9 years since the last good flow into Lake Eyre, and [the Basin] is in such poor shape." More than 50 species of birds, including colonies of pelicans, terns, egrets, ibis, and herons, have made their way into the desert to take advantage of the explosion of vegetation and aquatic life occurring across the vast floodplain upstream of Lake Eyre.

The mystery is how the birds know where and when to go. Kingsford explains that there is evidence that some birds retain a mental map if they hatched in the desert. "And birds are more mobile than we ever thought they could be. They can set off and fly more than 500 km on a reconnaissance trip over 10 days, to see what is over the next horizon, and come back. So we think they also wetland-hop."

But Lake Eyre's new lease on life may not be enough for the birds in the long term. "We don't know much about how the signals switch on and off over the generations, and whether there could be a bottleneck. A lot of these birds are not that long-lived – maybe 20 years maximum – so if they are used to breeding every second year and now only breed once a decade, it reduces their ability to bounce back in these highly variable systems", concludes Kingsford. ■

E-waste: reuse, don't recycle

Kathryn Senior

The Brazilian city of Porto Alegre and the British city of Birmingham have independently initiated community projects to reuse computer equipment that could provide a valuable precedent in the search for solutions to the growing problem of e-waste. Only one in five items of electronic equipment that are thrown away every year are recycled; the rest either ends up in landfills near to its source or, worse, is transported to the developing world for disposal by workers put at risk of exposure to toxic constituents.

By the end of 2009, the Computer Recovery Centre in Porto Alegre will refurbish 2500 useable computers and redistribute them to city information technology (IT) projects. Secure IT Disposals in Birmingham has already turned around 15 000 pieces of IT equipment, either passing them on to local training organizations for reuse in some of the most disadvantaged areas of the city or selling them to people in the community, at a much reduced cost. Both projects extend the life of the hardware and offer IT access to residents with limited financial resources in both cities.

Ramzy Kahhat, a specialist in environmental and sustainable engineering at Arizona State University (Tempe, AZ), was fascinated by the reuse initiatives sponsored by the Brazilian government when he attended the 7th Workshop for Digital Inclusion in Brazil in November of last year. "The manufacturing phase of a computer consumes around four times more energy than the typical use phase, so extending the life span of a computer will reduce the negative environmental impacts", he points out, adding that, "These projects also have social benefits – by providing access to technology – and economic benefits, by providing new employment opportunities".

"Other countries around the world are starting similar projects, but much more needs to be done", says Kahhat. "Regulations such as WEEE [the EU's Waste Electrical and Electronic Equipment directive] need to put greater emphasis on reuse rather than recycling as a post-consumer management option", he stresses. In the longer term, Kahhat also believes that manufacturers need to adopt a more cohesive approach to reducing environmental impacts of electronic equipment at every stage of its life. "Companies are complying with regulations that eliminate the use of some toxic elements in electronics, but if these substitutes have a greater environmental impact during the life cycle, the overall advantage is minimal", he warns. ■

Banning energy-hog TVs

Robin Meadows

Although wildly popular for their picture clarity and thin profiles, flatscreen televisions are outperformed by their outdated cathode-ray tube (CRT) cousins when it comes to energy efficiency. On average, liquid crystal display (LCD) and plasma sets consume 40% and 260% more electricity, respectively, than do CRT models, according to the California Energy Commission (CEC, Sacramento, CA). Now, the CEC, which is responsible for optimizing energy use in California, is poised to ban TVs that fail to cut their power use in half by 2013.

The move is prompted partly by an analysis from the utility company Pacific Gas and Electric (PG&E, San Francisco, CA), showing that TVs now account for 10% of home energy use in California. What's in it for PG&E? Saving energy means saving money. "The average cost of energy efficiency programs is half that of building new generation facilities", explains PG&E spokeswoman Katie Romans. In 2006, state energy efficiency programs saved a whopping 40 000 gigawatt hours (GWh), enough to power 5 million homes, avoiding the need to build 24 large power plants. The proposed TV regulations would boost energy savings a further 6500 GWh, enough to power an additional 864 000 homes annually.

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Flatscreen TVs gobble 10% of California's home energy use.

The Consumer Electronics Association (Arlington, VA) is calling instead for energy labeling and efficiency standards education. But the technology to cut flatscreen energy use already exists, and 100 of today's TV models – including some 72-inch (~183-cm) sets – currently meet the proposed standards. Moreover, voluntary approaches, including the US federal Energy Star program, have not been as successful as CEC regulations, which already cover refrigerators and other appliances in California.

"In the past 30 years, California's per capita energy use has been basically flat, while the rest of the country's has spiked more than 50%. We're hoping to drive standards nationally", says Romans. The CEC vote on the TV regulations is expected in the summer of 2009. The next targets for energy efficiency are likely to be desktop computer CPUs and monitors, as well as video game consoles. "Besides being the cheapest way to meet our energy needs, conservation is also one of the cleanest", concludes Romans. "It helps reduce our environmental impact." ■

Solving the supermarket dilemma

Nancy Bazilchuk

Answering the common question, "paper or plastic?", has vexed environmentally conscious shoppers since the plastic bag became a supermarket fixture in the 1980s. Now, in a comparative life-cycle analysis of shopping bag options, researchers at the Finnish Environmental Institute (Helsinki, Finland) have found that biodegradable plastic bags and reusable cotton bags were the worst in terms of greenhouse-gas emissions. For Finnish consumers at least, the best choice turned out to be plastic bags made from recycled plastic.

According to Helena Dahlbo, a senior research scientist with the Institute, the analysis was initiated in response to a public debate about whether single-use plastic supermarket shopping bags should be taxed. Other shopping bag analyses from Europe and Australia were not wholly applicable to Finland, with its substantial pulp-and-paper making industry and use of biomass for energy. So, with principal funding from Tekes, the Finnish Science and Technology Funding Agency, Helsinki, scientists conducted their own assessment.

While a cotton shopping bag seems to neatly sidestep plastic pollution problems, cotton is very energy intensive, points out Dahlbo. "We assumed the use of Chinese cotton, and in China, they use a lot of coal in energy production", she says. "Cotton needs a lot of irrigation, which takes energy."

And biodegradable bags? The impact of this type of bag depends on the degradable additive that's used to give the plastic strength, which in Finland is natural-gas-based. That's bad, Dahlbo says. "When they degrade, they produce CO_2 emissions."

The winners, albeit not by much, were plastic bags made from recycled plastic. Recyclable paper bags were also relatively good, but brown paper bags, which cannot be recycled, were not. Most surprising of all, while Finns use roughly 300 million plastic grocery bags per year, the climate impact of shopping bag choice was relatively small compared with other factors, such as driving to the store or food-item packaging, notes Dahlbo. "We think it is more important for consumers to look at what they put in their bags, rather than at the bags themselves", she says. "There's more plastic [packaging] inside the bag than in the bag itself." ■

Resilient reefs forestall climate change

Virginia Gewin

Improved fisheries management – and a unique reef ecology – make managed coral reefs in Tanzanian waters more resilient to climate change than nearby unmanaged reefs, according to a new study (*Aquat Conserv* 2009; doi:10.1002/aqc.1020). The reef's resilience can be attributed to a series of fortunate events, say the authors, who found that management, including closures to commercial fishing, helped corals recover from a 1998 bleaching event – a temperature-induced expulsion of beneficial algae that wiped out almost half of the region's corals. However, the few sites without increased management in both Tanzania and Kenya remained degraded 7 years later.

Furthermore, Tanzania's complex network of reef structures encouraged a higher diversity of coral species. Previous studies have shown greater establishment of coral larvae, which is necessary to rebuild coral cover, in Tanzania as compared to that in Kenya. It's not easy to tease out which is the more important factor – management or the reef's distinctive ecology, nor is it simple to identify which reefs will be resilient, explains Wildlife Conservation Society zoologist Tim McClanahan (Mombasa, Kenya), the study's primary author. "The take-home message is that we need a combination of nurture and nature to promote resilience."

T McClanahan, WCS

Acropora *spp are one of the main coral groups affected by bleaching.*

Interestingly, researchers studying the recovery of corals in the southern portion of Australia's Great Barrier Reef (GBR) also found that a combination of management and ecological circumstances facilitated coral recovery – astonishingly, within a single year. The rapid regeneration and regrowth of the corals, combined with an unusual seasonal dieback of coral-choking seaweed, helped make the reefs more resilient. Guillermo Diaz-Pulido, a postdoctoral fellow at the University of Queensland (Brisbane, Australia) and lead author of the GBR study (*PLoS One* 2009; **4[4]**: e5239, doi:10.1371/journal.pone.0005239), contends that managing local stresses such as overfishing or poor water quality was crucial in helping reefs to bounce back from global-scale stresses like climate change.

McClanahan is quick to point out that fisheries closures alone cannot ensure coral recovery in the face of climate change. However, corals that prove resilient to such change should be a high priority for conservation action. Understanding resilience has therefore become a hot topic for coral reef conservation. "We need to understand why corals don't collapse, in order to prevent future losses", says Terry Hughes, Director of the Australian Research Council's Centre of Excellence for Coral Reef Studies (James Cook University, Townsville, Australia). "We can help build resilience into a system if we can understand and safeguard the ecological dynamics that boost recovery, but no amount of management will climate-proof reefs." ■

Mangroves reduced storm death toll

Chris Emery

Mangrove forests saved lives by shielding villages from the storm surge of a deadly super cyclone that hit the eastern shores of India in 1999, according to a new study (*P Natl Acad Sci USA* in press).

The storm made landfall on October 29, killing nearly 10 000 people, more than 70% of whom drowned in the storm surge. By comparing the number of fatalities in villages protected by mangrove forests to those in villages where mangroves had been removed, the researchers estimated that the death toll would have been nearly three times higher if the mangroves had not been there.

"We have robust evidence that mangroves save lives during storms", says Jeffrey Vincent, a professor of forest economics and management at Duke University (Durham, NC). "When you lose these forests, you lose the protection they provide." Mangrove forests are composed of trees and shrubs that grow in brackish coastal swamps in the tropics and sub-tropics. Their dense root systems form a woody mesh that blunts the physical impact of storms by absorbing the energy of the waves as they hit coastal areas.

A Das

Mangrove forest in Bhitarkanika National Park, India.

Vincent worked with Indian researchers from the University of Delhi to estimate the width of mangrove forests along the Indian coastline, using satellite photos taken just before the storm. Using US Army maps from World War II to determine which settlements were historically protected by mangroves, the scientists found that, in many places, mangrove forests had shrunk – or disappeared altogether – as they were replaced by croplands. In 1944, for example, villages in the Kendrapada District were protected by, on average, 3.2 miles (~5.1 km) of mangrove forest growing between those communities and the sea; the average width of the Kendrapada mangroves has since shrunk to three-quarters of a mile (~1.2 km).

Vincent cautions that the study does not speak to whether mangroves provide protection during a tsunami – a topic that's been heatedly debated since the 2004 Indian Ocean tsunami – but he believes that these results show that, in addition to economically important roles as fish breeding grounds, fish nurseries, and sites for ecotourism, mangroves provide physical protection to villages during storms. "They are pretty amazing forests", remarks Vincent. "There are a variety of species that grow in them, some in the saltwater and others farther upstream. People want to come and see them. And now we've shown that they can also save lives." ■

Assam rhino population on the rise

Dinesh C Sharma

Populations of the greater one-horned (or Indian) rhinoceros in India's Kaziranga National Park have increased from 1885 animals in 2006 to 2048 as of April of this year, according to a census carried out by Indian state wildlife and forest authorities, in conjunction with the non-governmental organizations (NGOs) Aaranyak (Guwahati, India) and World Wildlife Fund-India (New Delhi). These efforts were in accordance with proposals by the Asian Rhino Specialist Group of the International Union for Conservation of Nature and Natural Resources (IUCN, Gland, Switzerland), which suggested conducting censuses every 3 years instead of every 6 years, so as to better understand rhino population dynamics and trends.

Although researchers believe that rhino numbers are increasing primarily because of growth in the Park's breeding population – a result of sustained conservation efforts – Bibhab Kumar Talukdar, a coordinator with the Asian Rhino Program of the International Rhino Foundation (Yulee, FL), suggests that it also reflects a decrease in poaching within Kaziranga. As a result of human encroachment, much of the preferred habitat in the region has been converted to cropland, pushing existing populations into isolated sites, which are more prone to poaching. Aaranyak, with help from international NGOs like the David Shepherd Wildlife Foundation (Cranleigh, UK), trained government staff working in Kaziranga and provided radios and solar panels to help protect the rhinos from poachers. It was, says Talukdar, "A perfect blend of partnership between government departments with local and international voluntary agencies, as well as involvement of local communities in conservation efforts", which has, he adds, "yielded good results".

A conservation project called the "Indian Rhino Vision 2020" aims to build a 3000-strong rhino population, spread across seven protected areas in Assam by the year 2020. In its first phase, 20 animals from Kaziranga and the Pobitora Wildlife Sanctuary will be translocated to nearby Manas National Park. The International Rhino Foundation and the US Fish and Wildlife Service are helping forest department officials to erect an 8-km-long electric fence in Manas, to discourage rhinos (as well as elephants and wild buffalo) from crossing into adjacent farmlands and thereby coming into conflict with local communities. ■