S&E
SCIENCE AND THE ENVIRONMENT
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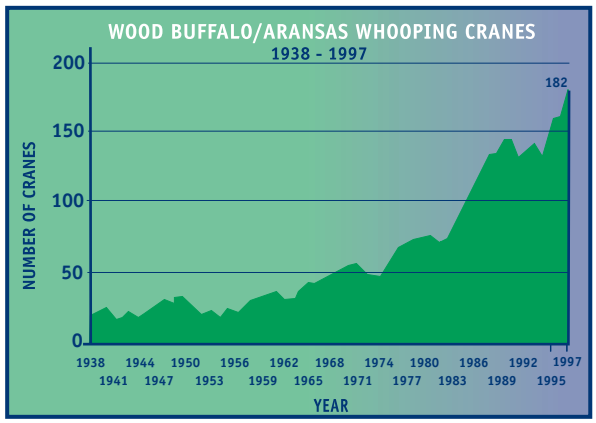
WATCHING WHOOPERS: MONITORING CRUCIAL TO RECOVERY EFFORTS

Protecting the feeding, nesting and wintering habitats of a species is essential to its survival. In the case of migratory species, whose ranges can span thousands of kilometres and many borders, tracking where and when they travel on their journeys is a complex task that requires widespread and often international cooperation.

Migration monitoring is crucial to endangered species such as the whooping crane, whose numbers total fewer than 200 in the wild. The only wild breeding flock of "whoopers" flies 4,000 kilometres each spring and fall between Wood Buffalo National Park in the Northwest Territories and Aransas National Wildlife Refuge near Corpus Christi, Texas. Aware that even the slightest impact anywhere along this route could devastate the tiny population, scientists with Environment Canada and the U.S. Department of the Interior are studying the flock's migration under a joint Canada-U.S. recovery program.

Adult whooping crane

Environment Canada's Canadian Wildlife Service became involved in whooping crane monitoring in 1954, when the nesting site of the last migrating flock was discovered in a remote corner of Wood Buffalo National Park. The 21 members of the flock were the last whooping cranes in the world, a smaller non-migrating flock in Louisiana having died out in the previous decade. In 1986, Environment Canada established a Whooping Crane Hotline for volunteer observers to report their sightings. Hunters, farmers, bird watchers and others remain the foundation of the monitoring program today.



In addition to maintaining a computerized database of observations, there have also been efforts to collect whooping crane eggs for captive breeding programs, band or fit birds with transmitters, conduct nest counts by airplane, and visit sites where banded birds from

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Top photo: Whooper chicks shortly after leaving the nest

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Environment Canada Environnement Canada
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the Wood Buffalo-Aransas flock have been spotted. Because more than half the breeding pairs have at least one banded member—the oldest a 21-year-old female—scientists have valuable information on the history of the species' habitat use, including the discovery that families tend to use smaller wetlands than non-breeding birds and often return to the same site year after year.

This information is used to discourage development near wetlands used for feeding, nesting and wintering, encourage farmers to protect the harvested grain fields whoopers use for food during migration, restrict the hunting of look-alike sandhill cranes when whooping cranes are passing through, and scaring birds away from areas where there has been an outbreak of avian cholera or other contagious disease.

Since recovery efforts began, the whooping crane population has made a slow but steady comeback, doubling in size over the past 13 years. But the battle is far from over. Concerned that a toxic spill could occur on the shipping canal that runs through Aransas Refuge, scientists are working to establish two new breeding populations elsewhere in the United States. A non-migrating flock of 56 captive-bred birds has already been established in Florida, but the birds are too young for scientists to determine whether they will breed. The next challenge—to put a migrating flock in place in Wisconsin—has scientists on both sides of the border experimenting with the use of trucks and ultralight planes to teach captive-bred cranes the migrating behaviour they would normally learn from their parents.

The ongoing trials and tribulations of the whooping crane recovery project are chronicled on the Journey North website at *www.learner.org/jnorth/index.html*

a tool used to teach students about the migration patterns of various species. S&E

Brian Johns, Whooping Crane Coordinator for Environment Canada, checks the water depth at a whooper nest site in Wood Buffalo National Park. One of the reasons that more chicks survive in years with higher-than-average water conditions at nesting time is that fewer land-based predators can reach the nests.

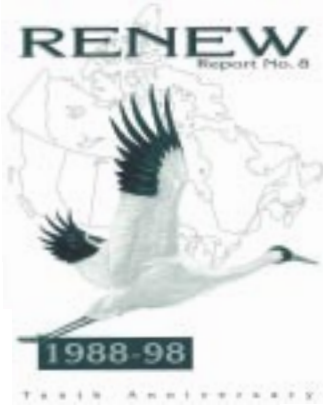
THE CHALLENGES OF RECOVERY

Sometimes, even the best efforts of wildlife administrators, naturalists and private landowners are not enough to bring an endangered species back from the brink of extinction. Over the past 20 years, 16 of the 307 species designated as at risk in Canada have been de-listed or moved to a lower category of risk, while the same number have moved the opposite direction.

Hunting and harvesting bans, habitat conservation and captive breeding programs are some of the tactics recovery teams use to help restore populations, but none guarantee the conservation of a species over the long term. With a species whose population has declined significantly, other less easily controlled factors—such as competition for food or habitat, severe weather, natural predators, parasites, and collisions with vehicles—become increasingly important.

Because wildlife populations are influenced by a combination of factors, successful recovery efforts require an understanding of all aspects of how a species interacts with its environment. This has spurred efforts, in recent years, to address recovery not only through a single-species approach but also through recovery plans that consider the needs of other wildlife species and humans in the ecosystem.

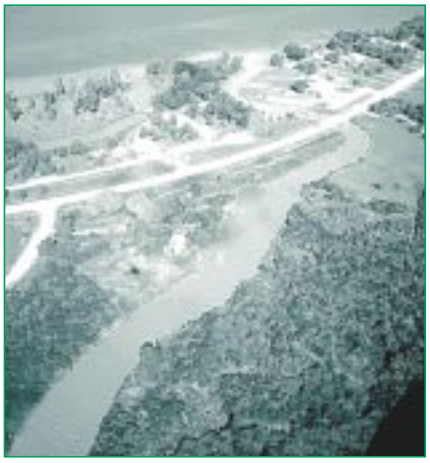
Recovery efforts are highlighted in the 1988-98 RENEW Report, as well as on the endangered species website at *www.ec.gc.ca/cws-scf/es/endan_e.html*



The Whooping Crane's recovery is noted in the latest report issued by RENEW, the Committee on the Recovery of Nationally Endangered Wildlife.

WORMS DIG ENVIRONMENTALLY FRIENDLY FARMING

Listen closely as you walk through the harvested corn and soybean fields of southwestern Ontario on a chilly fall morning and you will hear faint popping sounds. This "pop" symphony is actually music played by worms, the notes created as their bodies are sucked back into their burrows. Not only is this network of underground tunnels growing, but so is the number of worms using them, thanks to an innovative agricultural technique that has been in the works for the past decade.



Pollutants, excess nutrients, and loose soil washed off from tilled fields were entering the St. Clair River. The problem led to Cleanup Fund's involvement in encouraging the use of no-till farming in the region.

The technique is known as no-till and is designed to benefit the environment and farmers. With traditional farming, landowners would disc and plow their fields prior to planting their seed. However, with no-till, land preparation is reduced or not done at all. The result is that plant residue from the previous crop is left lying on the surface. These stalks and leaves not only protect the field's nutrient-rich topsoil from wind and rain erosion, but also provide critical habitat for small animals.

More importantly though, farmers say the soil structure of their fields is improving because of no-till. The key to this development, many of them say, is the protection provided by this technique to the local worm population. The plowing of a field in traditional farming not only killed many of the worms, but also destroyed the maze of tunnels these creatures had constructed throughout the soil. These tunnels are important to farmers for many reasons. The tunnels provide a means for air and water to travel through the soil. Aeration of the soil is important in that plants need oxygen to grow. The underground network also provides a means of watering the crop while improving the soil's drainage. As well, the worms use their series of tunnels to spread nutrients, such as plant residue and their own manure, throughout the soil.

One area benefiting from increased worm populations is the St. Clair region in southwestern Ontario. In 1994, no-till farming was used on 46 per cent of the 471,000 acres of workable farmland in St. Clair according to the Lambton County Soil and Crop Improvement Association. At that time, Environment Canada's Great Lakes 2000 Cleanup Fund joined local stakeholders in supporting a project aimed at encouraging further use of no-till farming in St. Clair. The result is overwhelming. It is believed that 85 per cent of the region now uses no-till farming.

The environmental benefits are many. Firstly, the amounts of soil, pollutants, nutrients and pesticides entering the St. Clair River have

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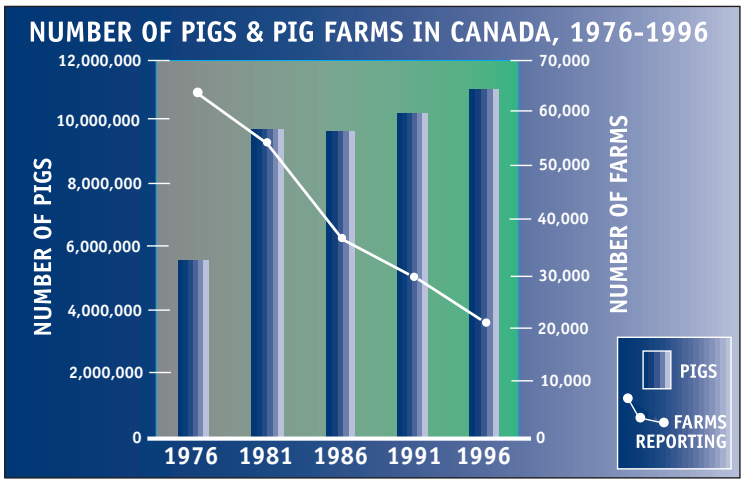
No-till equipment, like this seed-planter, helped boost the use of this environmentally friendly farming technique in the St. Clair region. Photo: Cliff Evanitski

ENDOCRINE DISRUPTORS & HOG MANURE

Hog farming is a significant agricultural activity in Canada, with the size of operations expected to increase substantially in the near future. This will not only mean more pork, but also more hog-generated organic waste, which is traditionally disposed of as manure for field crops.



Source: Statistics Canada, Historical Overview of Canadian Agriculture, 1997

The concern, according to Environment Canada scientists, is that pig manure can contain high concentrations of endocrine-disrupting chemicals, including natural estrogens. These chemicals have been proven through various studies to have long-term adverse effects on the growth, development and reproduction of fish and wildlife. Runoff from fields treated with pig manure can enter adjacent streams or other bodies of water, resulting in eutrophication or even acute toxicity.

Scientists from Environment Canada's National Water Research Institute (NWRI) and Agriculture and Agri-Food Canada in Ontario joined forces earlier this year to determine the persistence of endocrine-disrupting chemicals in soil after manure application and to establish the identity, exposure and effects of chemicals entering adjacent aquatic environments. Studies completed this spring confirmed the presence of high concentrations of these chemicals in hog manure, and showed that they begin to enter nearby waterways soon after manure has been applied to fields. Studies are currently under way to isolate and identify several unknown compounds that were detected to determine if they also pose a threat to aquatic environments.

The current collaboration will be broadened to include ongoing projects among NWRI (Saskatoon), Agriculture and Agri-Food Canada and other partners in Saskatchewan. The expanded study will include determining the potential impacts of other animal wastes on aquatic organisms and possible remedial or best management practices to minimize exposure and risk to the aquatic environment. S&E

Top right photo: Charles Ebbs

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been reduced, improving local water quality. Watercourses are clearer, allowing for more sunlight to help aquatic plants grow. These plants in turn give off oxygen in the water, helping to enhance fish, amphibian, and reptile habitat. Back on the field, farmers are finding that the plant residue left on the ground because of no-till is providing more protected habitat for growing numbers of field mice and rabbits. These animals in turn are attracting more hawks and foxes, increasing the area's biodiversity.

The farmers are noticing the economic benefits too. No-till farming requires less tractor work, so cost-savings result from using less fuel and making fewer repairs. This technique also reduces the amount of nutrients washed off the fields; therefore, the farmer doesn't have to apply as much fertilizer the following year. This helps to save money and reduce the volume of chemicals in the local environment. The Lambton County Soil and Crop Improvement Association says 99 per cent of the farmers in its region either have tried the no-till system, or know someone who has used it successfully. S&E

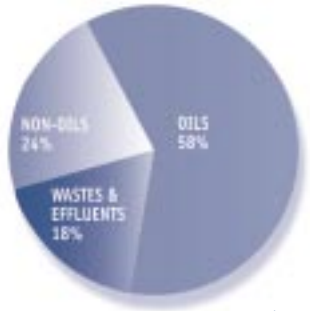
UNDERSTANDING SPILLS FOR EFFECTIVE EMERGENCY PLANNING

It can happen at a railroad crossing at midnight on a -30° winter night, or in the middle of a sweltering workday afternoon in an industrial plant: an environmental emergency resulting from a leak, explosion, fire or release of a substance. These incidents are given the general term of "spills," and information about spills is gathered through reporting hotlines at provincial agencies, regional Environmental Emergencies offices and the National Environmental Emergencies Centre.

Collecting information about spills helps to better understand how, where and why they happen, and leads to more effective pollution prevention programs. Examination of spill data and resulting trends also helps emergency response organizations design ways to clean up spills as quickly as possible so that environmental impacts are minimized.

TOP 5 REASONS FOR SPILLS	TOTAL # Of SPILLS	% OF TOP 5 REASONS
EQUIPMENT FAILURE	14 941	40%
HUMAN ERROR	9 346	25%
CORROSION	7 048	19%
STORM, FLOOD	4 004	11%
MATERIAL FAILURE	2 024	5%
TOTAL	37 363	100%

BREAKDOWN OF SPILLS BY BROAD MATERIAL CATEGORY

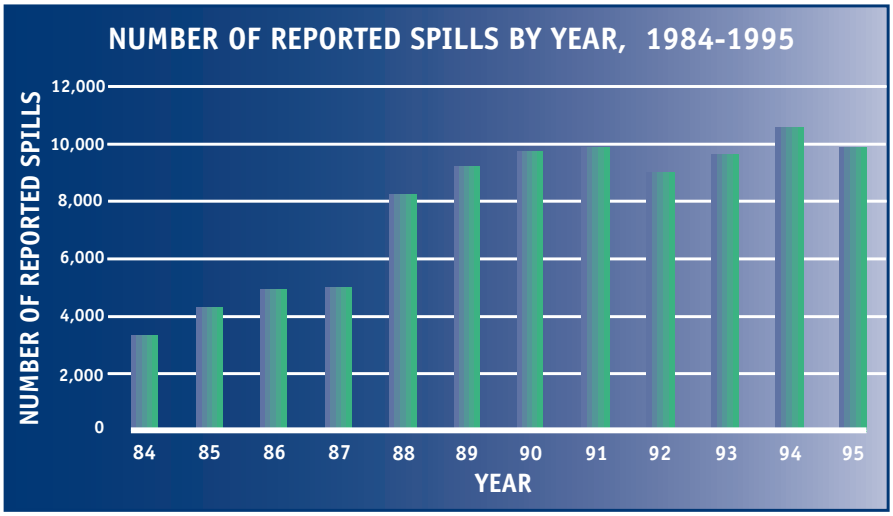


Seven sectors were examined: chemical, government, metallurgy, mining, petroleum, pulp and paper, and service industries. The top five reasons for spills in these seven sectors are equipment failure, human error, corrosion, storms or floods and material failure.

Some of the overall findings include: smaller spills of less than one tonne account for 44 per cent of reported spills; the largest-quantity spills are often the result of overflows caused by a storm or flood and involve sewage or effluent; and oils account for 58 per cent of the total number of reported spills.

Understanding trends in spills can help to prevent them by assisting in design of pollution prevention programs and spill response plans by government, industry and the public. Comprehensive pollution prevention not only benefits the environment, it is far more economically effective. SOE

The latest look at spill statistics and trends is found in the newly published *Summary of Spill Events in Canada, 1984-1995*. The report shows that during the period from 1984 to 1995, the number of spills reported has more than doubled. This doesn't necessarily represent more spills, but reflects the fact that provincial reporting legislation was implemented during this same period. There was also increased awareness of federal and provincial spill-reporting requirements.



THE SCIENCE OF ICE

Each year, Canada's freshwater and saltwater pack ice advances and recedes over an area half the size of the country's land mass. Where it is, how long it will be there and important characteristics such as thickness and concentration are critical information to many industries that rely on marine transportation.

A "dry dock" iceberg

The Canadian Ice Service of Environment Canada collects accurate and up-to-date information on ice conditions in all regions of the country affected by this cycle through a network of satellites, airborne radar and visual observations. In the summer, efforts focus on the Arctic and Hudson Bay regions; in the winter and spring, they turn to the Labrador Coast and east Newfoundland waters, the Gulf of St. Lawrence, the Great Lakes and the St. Lawrence Seaway.

Using sophisticated computer models and a trained eye, analysts transform this information into a variety of products—a process that takes only two hours from the time a satellite observation is received. These products are varied: satellite and radar images; bulletins warning of ice hazards and icebergs; detailed analysis charts describing ice type, pressure, thickness and concentration; and forecasts that project ice formation, drift, and breakup. At its peak, the Canadian Ice Service makes nearly 12,000 deliveries a month to clients that include the Canadian Coast Guard, Department of National Defence, port authorities, and the shipping, fishing, marine insurance, offshore resource development and tourism industries. Ice Service personnel also maintain historic climatological data on ice and iceberg patterns, and help guide ships through dense pack ice.

Ice observations have changed significantly since they were launched during the Second World War to extend the shipping season

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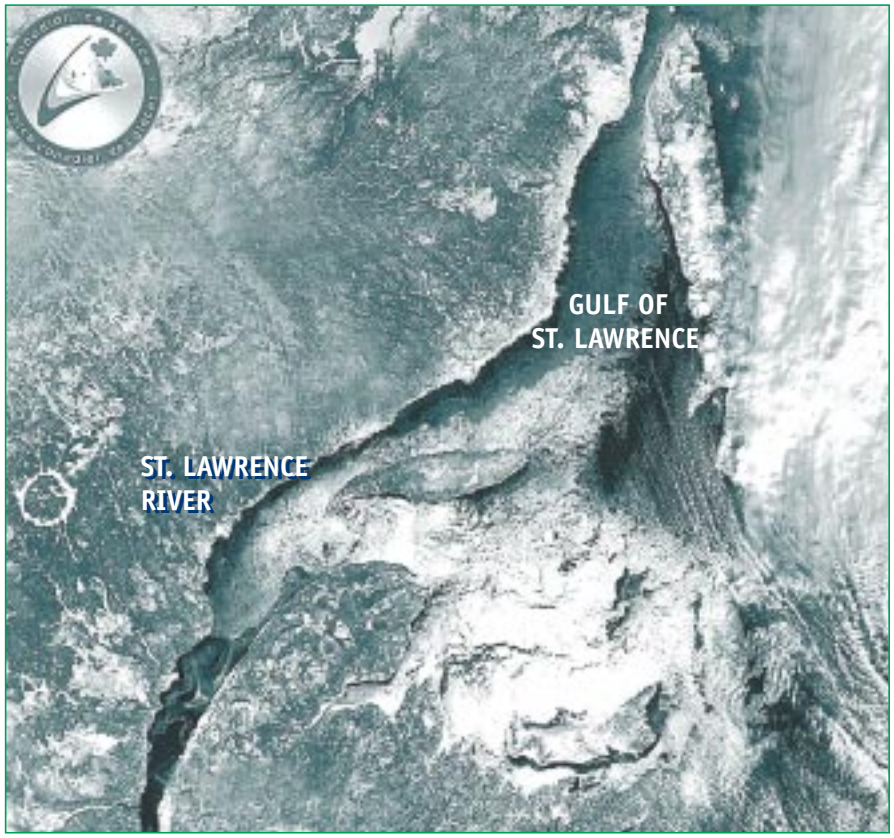
An icebreaker at work

on the St. Lawrence River. For nearly four decades, data were collected solely through human observations—a task that required hundreds of hours of flying time and did not yield the amount of data that can be gathered with today's technology. Remote sensing expanded the scope of these observations with the operational use of the side looking airborne radar (SLAR) in 1978 and the synthetic aperture radar (SAR) in 1990, both of which have a range of hundreds of kilometres.

The most recent advance came about in 1996, when a SAR was mounted on Canada's RADARSAT. The Ice Service is now the world's heaviest user of real-time data from the satellite. Using the polar orbiting satellite enables the Service to collect 15 times more data than it could by plane for a third the cost, visiting sites in the north on a daily basis and elsewhere in Canada once every three days. It scans a swath 500 kilometres wide and transmits some 3,500 satellite images to the Ice Service each year. Additional data are provided by European and American satellites.

The success of a recent effort to track oil spills using satellite imagery has Ice Service scientists hopeful that, in the future, data collected for ice observations could also be used to detect other potentially hazardous phenomena—particularly those requiring an immediate response. S&E



Satellite view of ice in the Gulf of St. Lawrence, February 20, 1997

Equipped with side looking airborne radar (SLAR), this 1985 de Havilland Dash-7 is used not only to take radar images of ice, but also for the human observations scientists rely on to interpret imagery from space.

S&E GUIDE

Science and the Environment Bulletin **is published regularly to bring leading-edge environmental science and technology work to Canadians.**

More information is also available on Environment Canada's Green Lane at *www.ec.gc.ca* Many of the publications mentioned in the *Bulletin* are posted on the Green Lane or can be ordered from the Inquiry Centre at 1-800-668-6767.

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CAN BIRDS AND GREENHOUSES CO-EXIST?

The greenhouse industry in southern British Columbia is growing rapidly, and Environment Canada scientists are working with government, industry and environmental groups to ensure that it doesn't threaten the survival of millions of migratory and wintering shorebirds, waterfowl and raptors living in the Fraser River Delta.

American Wigeon feeding on open land in the Fraser Delta
Photo: Rob Butler

An internationally significant habitat for over 300 species of birds, the Delta is unique because it possesses three distinct habitats: vast intertidal mudflats, coastal marshes and open-soil farmland. Unfortunately, the fertile soil, abundant sunlight and moderate temperatures that make the region ideal for wildlife also make it prime for development. As natural habitat has gradually disappeared, many species of birds have come to rely more and more on open-soil agricultural land for food and cover.

But now even the farmland is changing. Twenty-two thousand hectares of land in the Delta-Surrey area designated as an Agricultural Land Reserve because of its high-quality soil have gradually been encroached upon by urban and recreational development. In recent years, industrialized farming practices that don't offer the same benefits to wildlife as traditional open-soil agriculture have also intensified. The highly lucrative greenhouse industry is one of them.

Although greenhouses currently occupy only one per cent of Fraser River Delta farmland, scientists say the rapid rate at which they are expanding could cause irreversible damage unless steps are taken now to keep things under control. While only 5.3 hectares of this land was under glass prior to 1996, plans have since been approved for another 95 hectares—much of it within two kilometres of the environmentally sensitive foreshores of Roberts Bank and Boundary Bay.

THE FRASER RIVER DELTA

Source: Canadian Wildlife Service

According to scientists, these mammoth structures—some the size of 18 football fields—have numerous potential negative impacts. By shrinking available habitat they force birds onto fewer fields and exacerbate any crop damage they cause. They also fragment the residual landscape, leaving small, disconnected spaces that are useless to birds that require larger, more open habitats. Greenhouses, roads, airports and increases in human traffic disturb flocks, while high-intensity lights used to grow some crops may disorient migrating birds or make them easier prey for predators at night. The burning of waste wood chips for heat and the use of chemical fertilizers threaten to pollute the air and groundwater.

Scientists have advised the municipal council in Delta that the fragmentation issues are not addressed by a draft by-law recommending greenhouse coverage be limited to a maximum of 40-60 per cent of farmland and structures be screened by landscaping. A preferable solution, they say in their report, would be to bank at least an equal and contiguous hectarage of high-quality habitat for traditional, open soil agriculture for each hectare placed under glass.

Although the issue is still under discussion, the success of land acquisition and stewardship programs elsewhere in the province has Environment Canada scientists optimistic that a solution can be found that enables the greenhouses and birds to co-exist. S&E

Top left photo: The Common Barn-Owl is considered rare in Canada; the Fraser River Delta has the highest population of this species in the country. The owl's survival in the delta depends on maintaining barns and old fields as habitat.
Photo: Rob Butler