PRESERVATION OF BIODIVERSITY
A global challenge

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Species and habitats rarely coincide with national boundaries, as in Amazon Basin rain forests, Arctic polar bears or the wild grasses of central Asia and the Middle East.

Many bird and insect species, for example, face vast differences between summer and winter habitat. The Canada-Mexico migration of monarch butterflies is a good example. Migrations may be between countries or continents.

Even within national boundaries, the habitats and the species within them may be altered by the natural phenomena of drought, flooding, hurricanes, earthquake or volcanic eruption.

There are millions of years of history showing drastic natural changes of mountains to oceans, forests to grasslands, ocean floors to deserts, volcanoes spouting disastrous belches of lava, ashes and gasses and ice sheets advancing and retreating toward north and south poles.

The ancestors of grazing and browsing animals were elephant, deer, goats, giraffes and camels and they were changing their environmental landscape as their descendants continue to do today. Life either adapted or became extinct.

Changing relationships between prey and predator exhibit one type of adaptation, with any major change in habitat affecting every creature in a chain, including our ancestors. Some of the changes started by such natural events as soil erosion or desert creation were worsened by the conversion of hunter-gatherers to farmers, herders and city dwellers.

Humans Complicated Things

The picture became exceedingly complicated when humans intervened, either through destruction and pollution of habitat, alteration of plants and animals by breeding and genetic manipulation or the accidental or deliberate transfer of plans and creatures to new, alien environments.

Like the species themselves, many of the problems associated with their conservation cross national boundaries.

North American habitat has been destroyed by imported species such as the weed purple loosestrife, the zebra mussels creating havoc in waterways including the Great Lakes, the beetle attacking elms or the fungus that has virtually wiped out American chestnut trees. European sparrows and starlings are blamed for crowding out native species.

Conversely, Europeans worry about North American nematodes attacking pine forests, Canada geese crowding out native varieties or contamination of food supplies by genetically-altered corn, canola and soybeans. Other examples abound.

Rabbits in Australia, scapie-infected cattle to Europe and Canada, acid rain from eastern Europe to Sweden or flowing both ways across the Canada-U.S. border, the nuclear fallout from the Chernobyl disaster or testing in the Pacific and elsewhere.

Or the killer records of the plague and smallpox, current AIDS and malaria disasters and fears created by the spread of recently-emerged pathogens such as the ebola or hanta viruses and antibiotic-resistant bacteria.

In an era of global travel and trade, only co-operative action internationally can control such problems and few would argue against efforts to eliminate those species causing the worst problems.

Conserving biodiversity today concerns essentially the less-harmful survivors of natural and human activities.

What To Do?

The question is how much can be done about that conservation, by individuals, governments or international organizations.

The easiest to tackle are localized species whose habitats can be preserved if, for example, local governments control developers, polluting industries or farmers draining wetlands and saturating the soil with harmful chemicals.

Senior governments have to become involved in cases where it is necessary to close fishing areas to protect endangered species such as cod, curtail licenses to hunt bears or birds, curb logging or other threats to trees and flowers.

Non-governmental agencies may become involved in conservation efforts by pressure to shape legislation, such as the Species at Risk act, to protect the peregrine falcon.

But who is responsible when Atlantic salmon escape from West Coast fish farms to compete with Pacific salmon? And what about the thousands of snow geese destroying their habitat in northern Manitoba and elsewhere or the impact of Atlantic seals on cod stocks? Which species have priority?

International efforts go farther in regulation of species conservation and habitats across boundaries.

The International Joint Commission regulates Canada-U.S. boundary waters. The Migratory Birds convention is one of many co-operative efforts to protects birds and their habitats and the survival of whooping crane is one example. The Canadian Wildlife Service and American counterparts co-operate closely.

Globally, legislation exists against trade in ivory and skins of endangered animals. Most countries have a list of species that cannot be imported or exported and many developing nations recently have called for measures to protect native plants from exploitation by international pharmaceutical and biotechnology companies.

Control Far From Easy

But biodiversity protection is far from easy.

Apart from smuggling, there exist many seemingly-impossible problems ranging from oil spills in international waters to contamination such as the recent chemical leakage on the Danube or clearance of old-growth forest by logging or fire set to gain farm land.

No one knows, for example, how many species have perished in recent wide-spread Indonesian fires and neither the government nor the international community has been able to do much about it.

Further, new rules may be needed to protect species such as the monarch butterfly. The monarch's Canadian breeding grounds may be endangered by fields of genetically-modified corn, a claim far from proven. But its winter habitat in Mexican mountains is seriously threatened by illegal logging and the thousands of tourists drawn by the monarch's hibernation.

The monarch needs both habitats to survive.

Much of the activism to protect biodiversity on a world-wide basis has concentrated on areas where political pressure might be applied, perhaps because of the sheer size of the needed resources and political commitment. Reproductive technology is one such area.

Regulations now surround human embryology and animal cloning.

Governments now are actively involved in the question of patenting of the human genome when the full analysis of its structure is ready for release in the next couple of years. It seems likely that all sane governments will try to prevent manipulation of human genes for any purpose other than the control of disease or deformity.

Areas particularly subject to pressure from activists are the patenting of altered plant and animal genes, sometimes resulting in the destruction of animal laboratories or of experimental field or forestry crops.

These crops have received the most attention from the militant groups claiming to protect biodiversity on grounds that the escape of these crops into nature could create monster forms endangering natural species.

There is also the argument that most crops are modified for such "wasteful" purposes as animal fodder and are not needed in the human diet.

Particular attention has been directed at genetic modification of crops such as corn, canola, soya and potatoes to make them resistant to weeds, insects and fungi or to allow them to adapt better to climate change.

Fewer Farmers, More Food

This is part of the ever-increasing pace of technological change in agriculture whereby fewer farmers maintain food supplies for an ever-increasing population.

Critics allege that such crops make the farmer dependent on the seed companies; that variability is sacrificed, particularly in Third World countries where several varieties of a food crop may be grown together to prevent the vulnerability of a monoculture; and that reducing the need now for insecticides or herbicides means an increased future need for those chemicals to deal with the evolution of super-resistant insects or diseases.

It has also been argued that the presence of, say, a fish gene in a "super tomato" can be a hidden danger to allergic consumers and that all genetically-altered food should be labeled.

The sharpest criticism has been directed at biotechnology companies such as Monsanto, which yielded to pressure to stop marketing seeds containing a so-called "terminator" gene. That modification prevents farmers from planting a second crop and forces them to buy new seed annually.

Consumers have been urged to boycott such crops and some European countries have banned their import despite a lack of evidence that they harm humans or animals.

For example, irrationality led Dutch authorities in 1997 to dispose of 12,000 tons of sugar after the discovery that some came from genetically-altered sugar beets-this despite the fact that sucrose sugar has the same chemical composition regardless of origin.

The question of crop diversity is, in fact, considerably more complicated than activists contend.

Plants for millions of years have been naturally evolving defences against pathogens and animals and hybridizing as well. Farmers merely accelerated the process when they began cultivating food plants.

Almost every plant eaten today is the result of this process, whether developed by farmers of Middle East wheat, Andes potatoes, Mexican corn or Asian rice.

More recently, scientists at experimental farms have developed a superior spring wheat for northern climates, toxin-free canola and larger prolific rice varieties. Efforts continue to develop crop varieties adaptable to changing conditions using naturally-occurring traits in wild populations whenever possible or even reviving ancestral plants such as einkorn wheat and spelt.

Such breeding experiments may look for wild traits providing adaptation to cold or drought, resistance to disease or, in the case of crops such as cassava or peanuts, breeding out prussic acid or other toxins and breeding in helpful characteristics.

The use of alien organisms is minimal compared to reliance on traditional breeding material. This should be kept in mind.

Watch The Hybrids

Virtually all food crops come from hybrids. Both natural and cultivated hybrids may be just as sterile as a genetically-modified plant. And if it is fertile, it may not breed true.

Those who believe a farmer who plants a highly-developed seed is being exploited by the company that sells the seed often forget that the farmer may prefer the greater certainty of a superior crop to the non-reliability of local hybrids. He may want to plant both as insurance against natural disasters.

If the superior seed can also lead to cutting the costs of herbicides or pesticides, those savings can balance the need to buy new seed each year,

If the farmer sees any adverse effects from his decision, he will change to something else. There are, in short, numerous tradeoffs involved whether the seed is the result of classic breeding experiments or has been genetically modified.

And with a growing trend toward the establishment of seed banks to preserve indigenous plant varieties, one can argue that agricultural practices present less of a threat to biodiversity than the enormous problems created by other human activities.

In the final analysis, the greatest threat to biodiversity continues to be the burgeoning human population, abetted by opposition to birth control by major religions or local cultures.

Population control is accompanied by the inexorable destruction of wild habitat as it is converted to crop land. At the same time, temperate and tropical rain forests are being destroyed to provide lumber for developed countries. Hundreds if not thousands of species of plants, animals and microorganisms are driven to extinction virtually annually.

On the plus side, experts now suggest that the human population could stabilize and even begin to decline in this century.

Many developing countries are also beginning to find a voice in the conservation of their own resources.

Increased efficiency in farming also holds promise that higher production from good land can release marginal areas for a return to nature, something demonstrated in New England with millions of acres now restored to forest. A simple change in the human diet of eating less meat could accelerate change.

It is ironical that some of the world-wide increase in crop yields in the last 50 years may be the result of more efficient photosynthesis caused by increased carbon dioxide arising in turn from increased burning of fossil fuels for homes automobiles, aircraft.

Higher levels of atmospheric carbon dioxide contribute to the Greenhouse Effect-blamed for global warming-and are generally considered a bad thing. But the silver lining could be this-increased food crop yields.

Nothing could better illustrate the complexity of the problems of preserving biodiversity on a global basis.

The authors are research associates engaged respectively in systematic studies of economic grasses and mustards and in cereal plant breeding. Both have a special interest in the potential of wild relatives to improve crop plants.