

REVIEW

Canada: Exploring the Frontiers of Biodiversity

"All life on Earth is part of one great, interdependent system. It interacts with, and depends on, the non-living components of the planet: atmosphere, oceans, freshwaters, rocks and soils. Humanity depends on this community of life - this biosphere - of which we are an integral part." (Global Biodiversity Strategy).

If variety is the spice of life, then biodiversity is the web of life. Just as multiculturalism can enhance the life of a community, biological diversity can ensure the longevity of natural systems. And, just as tolerance for others and co-existence with different ways, attitudes and beliefs improves the cultural life of a nation, so does ecosystemic diversity improve overall survival for a diversity of species. It is also said that the "variety of life is the backdrop against which culture itself languishes or flourishes."

Inevitably, interdependence between the human species and ecosystems is at the basis of human survival. So closely is biodiversity intertwined with human needs, that it can be considered an element of national security and at the very basis of future global prosperity. The ecological dimensions of national security cannot be ignored when jobs are at stake (the Canadian fisheries, farming and forestry crisis are witness to this phenomenon) or at the global level, when countries fight over access to water or who will harbour the next flood of environmental refugees fleeing famine and the devastation of war.

Biodiversity is more than just endangered species and spaces as it is often perceived to be. It is beyond the "family of protected areas". Some call it the "web of life" likening it to a spider's web as Campeau so aptly puts it. It is all encompassing, seeking to maintain the human life support systems provided by nature and the living resources essential for development. Attitudes

and ultimately policies for biodiversity conservation will entail a shift from a defensive posture to an offensive effort which will seek to meet peoples' needs from biological resources while ensuring the long-term sustainability of the Earth's biotic wealth.

Over half of the world's species are found in forests, but perhaps less than a tenth of them have been identified, and far fewer have been scientifically studied for possible useful application, according to E.O. Wilson. More than 120 compounds in the world's pharmacopoeia have been derived from plants, of which three-quarters were found through ethnobotanical research - looking at the ways in which traditional societies use plants as Danna Leaman discovered. We all acknowledge that science has an invaluable role to play in ensuring a growing and critical base of knowledge for biodiversity. However, ecosystemic interdependence is not always scientifically measurable and when in doubt, one should err on the side of safety.

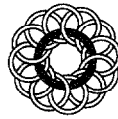
Overall, emerging trends in business are encouraging and may well be ahead of the policy community's view of biodiversity. Companies such as Merck have recognized the importance of intellectual property rights. As the world's largest pharmaceuticals company, Merck and Company recently joined forces with Costa Rica's new National Biodiversity Institute to study forest plants for medicinal uses. The idea behind this arrangement between a multinational company and a government is that Costa Rica will gain payments for conserving its tropical forests while Merck will gain exclusive rights to plants for screening.

The contributors to this thematic newsletter on Biodiversity provide some strategic options (Miller, Smith, Buckley, Parkes, Patterson and MacKenzie), the philosophical and ethical basis (Diabo, Rugumayo, Campeau,

Hummel and Thomson), as well as the practical and scientific reasons (Leaman, Beland, Arnold/Peabody, Vardy, Rubec, Embree/Street, Pippard and Mooney) for pursuing a National Biodiversity Strategy in Canada. Unfortunately, we have not been able to accommodate a full range of views on the issue of biodiversity or of biotechnology. Future issues will include an assessment of the importance of cumulative impact assessment on a bioregion and its importance in assessing biodiversity in the North's "fragile ecosystem". The wealth of policies which will serve to underpin a National Biodiversity Strategy will also be covered in a next issue. Further discussion of the toxicological impacts on biodiversity as well as the pharmaceutical industry's insights on the biotechnological aspects of biodiversity would also be welcome. Should there be additional and differing viewpoints emanating from this special issue of the National Round Table Review, these will be published in subsequent issues of the newsletter.

We are in changing times. Our ability to respond as a nation to what has become a global ecological crisis, humanity's abuse of the land, the air and the water the Earth so critically depends upon, is being tested. Just as Canada was able to respond in Rio, so must we now take the challenge to arrive at common principles and common beliefs that will energize a process toward a truly National Biodiversity Strategy. Similarly, so must we believe in the need to invest in our ecological and economic futures; one cannot evolve or continue to exist without the integrity of the other.

Anne Fouillard is the guest editor of this Biodiversity newsletter. Currently, she is Policy Advisor to the Foreign Policy Committee of the National Round Table.



Conserving Global Biodiversity

by Kenton R. Miller

Life's variety is crucial to human well-being, not only for the foods, medicines, and building materials that nature supplies, but for spiritual, aesthetic, and ethical reasons as well. Indeed, biodiversity -- the sum of genes, species, and habitats on Earth -- is essential to survival since its many components maintain the soil, water, and atmosphere that support life.

Yet, around the world, the number of species, the genetic variations within them, and the range of habitats are being decimated by such proximate forces as conversion of habitats for human-oriented use, over-harvesting of forests and wildlife, fashion crazes for particular species, and the pollution that pervades everything from the groundwater to the atmosphere. Beneath these obvious causes, however, lie root forces that stem from the way people live and make a living, and how they use -- and abuse -- their natural surroundings. Unless urgent steps are taken to reverse these trends, the legacy of the twentieth century will be an impoverished world.



The Global Biodiversity Strategy

In 1989, the World Resources Institute (WRI), the World Conservation Union (IUCN), and the United Nations Environment Programme (UNEP) established an international effort to design a strategy for conserving biodiversity, in consultation with more than 500 colleagues and 45 scientific, community and governmental organizations from all over the world. This dialogue among many constituencies from many cultures yielded the following objectives:

Save biodiversity through networks of protected areas (national parks and forest and wildlife reserves), off-site support facilities (seed banks, botanic gardens, zoos, tissue cultures, aquaria), and provision of buffer zones, corridors, and other landscape-scale mechanisms to weave protection into the fabric of regional economic development.

Study biodiversity through inventorying its components; creating data bases relevant to science, industry, education, and land-use planning; mounting awareness campaigns; and expanding research and monitoring efforts.

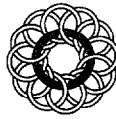
Use of biodiversity in ways that are sustainable (forestry, fisheries, wildlife, agriculture) and equitable (fair share of benefits to local people, indigenous peoples' rights, farmers' rights regarding their contribution to genetic resource identification and selection, and global sharing of costs).

The **Strategy** addresses these objectives through proposing 85 actions, five of which are particularly strategic:

1. Achieve and implement a **Convention on the Conservation of Biological Diversity**. The Convention was signed by 153 nations at UNCED, but implementing it will be the work of years.
2. Call on the United Nations to establish an **International Decade on Biodiversity** to provide a framework for concerted international action. Obviously, biodiversity will not be conserved by the Convention alone nor by current levels of investment.
3. Establish a widely representative **International Panel on Biodiversity Conservation** to craft policy options that address the social, economic, and institutional issues affecting biodiversity. The advisory mechanisms provided for in the Convention and Agenda 21 are valuable and necessary, but they will be limited to government-appointed scientists and an agenda set by parties to the Convention.
4. Establish an **Early Warning System**, a global network linking universities, NGOs, and communities to provide "alerts" on the status of species, genetic resources, and ecosystems. Protocols on criteria and data management can guide objectivity, and the World Conservation Monitoring Centre can serve as one of the network's international hubs.
5. Prepare **National Policies, Plans, and Strategies** to define national and local assets, options for conservation and use, and priorities for action and investment. This provision, which has been included in the Convention and Agenda 21, is key to progress since it will foster dialogue, integration of efforts, and agreement on needs.

The **Strategy** was developed by a team from leading institutions around the world. Since the same people were involved in drafting the biodiversity components of Agenda 21 and in negotiating the Convention, it is not surprising that many of the Strategy's concepts appear in these documents. That said, however, the **Strategy** goes well beyond these documents in calling for action by a whole range of institutions, specifically including NGOs, communities, science and business and industry.

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Biodiversity -- A Search For Common Ground

A Message From The Chair

From its launch point four years ago, the National Round Table has been aware that biodiversity would loom large on its agenda. This was made clear initially by the forceful exposition of the Brundtland Commission, and reinforced by our charter members Diane Griffin and Leone Pippard who have given so much of their own effort to endangered species and ecosystem conservation. The environment ministers, both federal and provincial who have served on the Round Table such as the Hon. Jean Charest and the Hon. Glen Cummings, have made us aware of their own sensitivity and commitment to the issue.

Several of our projects have had direct relevance to biodiversity. Our work with Ducks Unlimited on wetlands, which led to the creation of the Wetlands Conservation Task Force is the foremost example. Our dialogues with the tourism industry and the forest industry have important implications for biodiversity. In this issue of the NRT Review, Jim Patterson has described another issue in the agricultural sector which has captured our attention.

It is probably true that every project which the Round Table undertakes will have some relevance to biodiversity. It is important that we recognize the possible implications, wherever they arise, and address them effectively and responsibly. This proposition has been strongly reinforced by the leadership of the Prime Minister as the first signatory of the Rio Convention.

It is fair to acknowledge, however, that the Round Table, in spite of the many points of engagements cited above, has not as yet defined

a consensual position on the main issue. To several of our members, including myself, it is not always obvious exactly how our interest in biodiversity should be expressed, and how our mandate to bring together environmental and economic issues in the search for sustainable development should be pursued. As the Round Table is broadly representative of regional and sectoral interests across Canada, it may well be that our uncertainty about these issues is representative of the state of mind of Canadians.

We are fortunate to be surrounded by expertise, by strongly held views and by effective advocacy. The collected papers in this issue of the Review draw upon some of the best of that expertise and advocacy. I hope that the Round Table, and indeed, the entire nation will soon be well-positioned to assume a more prominent and constructive role in the national effort. I hope, especially, that we can help to ensure that our national strategy will be exemplary with regard to its grounding in sound scientific principles, its appropriateness in terms of policy and public support, and its efficacy in achieving the desired objectives.

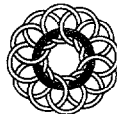
Our first effort in this direction will be a workshop to be held in the month of November. Twenty scientists, philosophers, ethicists, lawyers, public affairs professionals and officers of government have agreed to join some members of the Round Table to reexamine and update some of the premises and principles which are fundamental to our national strategy on biodiversity. The agenda will be built around a series of questions which the participants believe to be the most ba-

sic and important. While many of our leading advocates will long since have answered such questions to their own satisfaction, we believe it is not unreasonable to ask them to restate their convictions for a workshop audience that may be, at least in part, quite skeptical. A consensus among advocates and skeptics may, in fact, provide a very robust foundation for further deliberations and plans of the Round Table.

It is entirely possible that our convictions about biodiversity and ecosystem preservation may be severely tested in the future. If there are, down the road, real or apparent conflicts with traditional values and lifestyles, or economic well-being of Canadians, the long term values of conservation policies would be in jeopardy unless they were securely held in the hearts and minds of members of the public and our political leaders.

What I am proposing may seem to be a low-key approach in contrast to the spirited leadership of other advocacy groups. It is, however, a role which is well-suited to the Round Table, and complementary to the efforts of others. We are grateful that the effectiveness of others makes it possible for us to adopt a more deliberate approach. This will help to ensure that, when more aggressive engagement of issues by the Round Table is needed, we will be ready.

Dr. George Connell is the Chair of the National Round Table on the Environment and the Economy.



Miller: Cont. from pg. 2

Hard Questions Surrounding Biodiversity

Who Owns Biodiversity -- and By What Right? The Convention and Agenda 21 declare that nations are sovereign over their natural resources, including biodiversity -- which spells the end of the free-for-all grab of genetic resources from the "global commons" of the rainforests and other rich environments. But when most of Earth's species have not even been named, much less studied, how can States exercise sovereignty over them? These two documents encourage States to establish procedures that facilitate the systematic exploration of their biotic wealth and its use. The exercise of sovereignty assumes that each country should establish programmes to inventory biotic wealth and to foster research that will provide information by which to make rational decisions for conservation and use of biological resources. With monetary and technological wealth concentrated in the North and biotic wealth in the South, this situation seems ripe for new kinds of international cooperation.

But is it really the State that owns biodiversity? Some argue that biodiversity is a "cultural resource," meaning that nature has always been the human abode and that particular cultures have over millennia bred plant and animal species and shaped the landscape. In most parts of the world, ancient traditions dictated how to manage nature until displaced by more recent ownership patterns, which often exclude traditional inhabitants, alienating peoples from their lands and establishing "commons" on sites that once had "stewards". Parks and reserves have often fallen into this trap, especially in developing countries where whole settlements have been moved to create parks and wildlife reserves. Sites are left without adequate protection by public authorities and a disenchanting community without alternative livelihoods.

The question of rights is further complicated by the issue of intellectual property rights. For example, native communities have invested thousands of years in selecting plants and animals for foods and medicines. Modern technologists take these selected genetic materials and add intensive technological know-how to produce more disease-resistant strains of plants or animals or new medicines -- and then sell them on the world market for considerable profit, without sharing it with the people who contributed so importantly to the enterprise. How can the returns from intellectual property be shared equitably? FAO argues in favor of "farmers' rights" whereby rural communities that identified and selected genetic materials should share in the profits made from subsequent applications of biotechnologies. Others argue that patents protect profits as a

type of reward system to the investment of creativity and entrepreneurship on the part of scientists, engineers, and related industry.

How Can Costs and Benefits Be Shared?

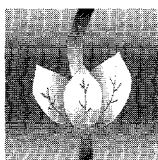
Here, the proverbial chicken-or-egg dilemma arises: must a country achieve a certain level of development before it can afford to conserve its biodiversity, or is conserving biodiversity necessary to make development possible? Environmentalists, most governments of the North, and ecological economists will argue the latter: that there is little chance of achieving a sustainable society without retaining nature's variety and keeping all natural systems in good running order. But the South questions whether public funds should be diverted from poverty eradication efforts and from health and education to save species and genetic materials that are unlikely to confer any great benefits on its citizenry. The answer, of course, is to both save diversity and distribute its benefits more fairly. The example of Costa Rica was ever-present in Rio and during the negotiations for the Convention. There, investments in biodiversity have already created jobs, contributed to the intellectual and cultural development of the country, and set the stage for new economies in the longer term.

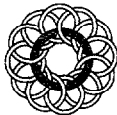
How Nations Can Foster Biodiversity Conservation

Five key principles should guide all nations' actions and investments:

1. **Local Benefits and Participation.** Ecotourism, jobs in parks and reserves, and negotiated shares in revenues from local natural resources can deliver benefits from conservation to local residents. Enabling residents to participate in program design and implementation imbues the program with their wisdom and experience and fosters stewardship.
2. **Business and Industry, The Biodiversity Economy.** In many countries, people's livelihoods depend on the direct or indirect use of biological resources. Careful planning and management, with broad-based participation and solid analysis, can make it possible to generate or enhance local economies based on biological resources while retaining significant portions of wildland in reserves, holding and developing genetic materials in off-site facilities, and protecting ecological processes on the landscape (watershed management, wetland protection, coastal zone management, etc.).
3. **Regional Management.** Traditional conservation practices such as setting aside protected areas are

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Biodiversity And Toxicology *by Dr. Pierre Béland*

Biodiversity is generally understood in terms of the number and variety of living species on the planet. Preserving biodiversity is therefore simply equated to preventing the disappearance of species. There are, however, two other levels of biodiversity: genetic diversity within populations and species, and community or ecosystem diversity. Toxicologists seldom witness the loss of a species, which would only occur when acute chemical pollution overwhelmed the single habitat of a rare species. They are however faced daily with the subtle effects of toxic chemicals which are major threats to biodiversity.

Darwin's grand insight -- *survival of the fittest* -- is the key to understanding how toxic chemicals can influence biodiversity. The struggle for life leads to the selection within a species of those individuals who will contribute the most to future generations. Toxic chemicals can interfere with evolution in three ways. They can cause structural damage to genes, they can modify the development of individuals before they reach adulthood, and they can influence the natural selection process within populations.

Genetic damage occurs when a chemical destroys the integrity of the message carried within the genes, by removing, replacing or adding elements to their DNA structure. For example, cigarette smoke contains the hydrocarbon benzo(a)pyrene which, after entering the blood stream through the lungs, will end up being metabolized into smaller pieces within the liver. These metabolites then bond to the DNA of various tissues, resulting in erroneous messages, eventually leading to a disruption of normal physiological processes. When chemical damage occurs in reproductive tissues, it can either prevent successful reproduction, or be passed on to the next generation.

Developmental effects range from gross malformations -- which although spectacular, are rare occurrences -- to a wide array of more subtle disruptions. These occur during embryonic development and early growth, and may become evident only in later life when affected individuals exhibit an overall lower competitive success. Thus, toxic chemicals can have an impact on reproductive potential; on survival and hatching of eggs; on survival, growth and settlement of larvae; on rate of growth; on immune system competency; and on behaviour (such as required for mating, control of territory, defence against competitors and predators, and other functions).

Selection effects occur when individuals are removed from a population on account of their lower resistance to a chemical. The long-term effect of such a process is well known to farmers who, by repeatedly spraying pesticides on their crops, have eliminated weaker morphs, thus selecting for resistant insects which are now eagerly devouring their crops. Basically, whenever an organism dies, a specific set of genes is lost. If that organism has not had the chance to reproduce, this particular combination may not occur again for a long time, if ever.

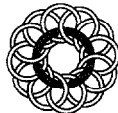
The cumulative effects of these processes may in turn have an impact on the community as a whole. Reduced recruitment and survival within a population lowers its competitive edge relative to other populations and species. The loss of this population is a first step towards changes in community composition and in ecosystem equilibrium. Communities in contaminated ecosystems generally have reduced species diversity. As pollution resistant species are favored and, relieved of competition, they can proliferate.

Eventually, complex changes in community and ecosystem organization and integrity may pave the way for the loss of a species--the more

visible unit of biodiversity. More often than not, species at the top of the food chain may suffer most, for the following reasons. **First**, any process that weakens a lower link, such as the loss through chemical pollution of a benthic invertebrate on which many species feed, must have an impact on organisms above it. **Secondly**, nondegradable toxic chemicals progressively accumulate at higher levels of the food pyramid, resulting in progressively higher exposure, and therefore, potentially stronger effects. **Thirdly**, higher organisms are less likely to evolve resistance to chemicals. Contrary to primitive organisms like insects, their populations have fewer individuals, and their generation times are longer. This means that fewer individuals, therefore fewer combinations of genes, are exposed to toxic chemicals. Consequently, the likelihood of a resistant -- or winning -- combination of genes being selected is lower. Sadly, species at the top of the food chain are often birds and mammals, and their loss is even more dramatic.

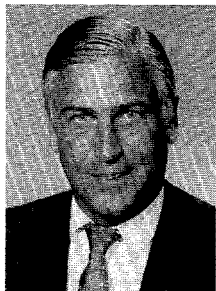
Diversity begets opportunity. Diverse populations, diverse species and diverse communities are better prepared to meet challenges. They are more likely to survive a wide array of unpredictable events, and to spring back when storms have abated. Toxic chemicals impact on community integrity by modifying genetic integrity within individuals, and by reducing genetic diversity within populations. This destabilizing regime makes ecosystems even less able to cope with other disturbances, whether natural or man-made.

Dr. Pierre Béland is Director of the St. Lawrence National Institute of Ecotoxicology. He is internationally respected for his work in Canada and abroad in the areas of population mathematics, paleobiology, marine ecology and ecotoxicology of marine mammals.



Biodiversity - The Web Of Life

by Arthur H. Campeau



When historians look back on the state of the environmental movement during the closing decade of this century, we can be certain that "biodiversity" will figure largely in the many publications that are sure to emerge. Indeed, it is likely that the inseparable twin issues of biodiversity conservation and sustainable development will be viewed as the most pressing and influential in the ongoing global debate over the fate of our planet. At the Earth Summit in Rio de Janeiro, biodiversity gained a prominence that no one could have anticipated but which all who are concerned with "the environment", will welcome. Known previously to a relatively narrow spectrum of the population, the term is now rapidly becoming entrenched in the lexicon of politicians, bureaucrats, the media, the general public and anyone else who followed events in Rio.

The origins of biodiversity actually extend back many years. In 1864, George Perkins Marsh wrote of the close links between man and nature and lamented the destruction of wildlife and its habitat stemming from human activities associated with the westward advance of the American frontier. Marsh argued that countermeasures were needed to replenish the earth because the "welfare" of future generations matters more than immediate considerations. Later, naturalists such as Aldo Leopold expressed it in their writings. The present concern with saving our wildlife is an outgrowth of the thoughtful and perceptive observations of these early conservationists.

With so many environmental issues to contend with - climate change, global warming, pollution, deforestation, desertification etc. - why has biodiversity conservation evolved to become perhaps the most important and compelling environmental issue of the decade?

Firstly, the myriad of plants, animals and microorganisms that inhabit the earth collectively form the total basis for our existence. Without a healthy and varied stock of genetic resources, life on earth as we know it cannot continue. When we talk about biodiversity, we are talking about life itself. What could be more important than that?

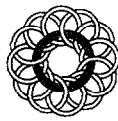
It is well known that we derive our food, many medicines and a host of industrial products from plants and animals. Biological resources also provide essential and often less obvious "ecological services" such as maintaining hydrological functions, photosynthesis, regulation of climate, soil production, storage and cycling of essential nutrients, absorption and breakdown of pollutants and reproductive functions including pollination, gene flow and cross-fertilization. These contributions have been well documented elsewhere, and some of the statistics are truly astounding. Wild species and the genetic variation within them literally contribute billions of dollars annually to the global economy.

Beyond the utilitarian value of biological resources are its less tangible but no less important attributes, including their role as a source of outdoor recreational opportunities and of artistic and spiritual inspiration. Nature, viewed as both enchanting and fearsome, forms the basis for many of the world's religions and works of art, of music and of literature. Even in industrial na-

tions, there exists an intense and almost mystical attachment to the natural environment and an inherent sense of moral responsibility towards the other forms of life with whom we share this planet. Many people find satisfaction in knowing that a species or habitat exists, even if they are never seen or used or there is little likelihood they will ever get a chance to observe or visit the species or habitat. And, there is a need to respect other forms of life for the simple fact that they are also alive, a recognition of the important role that "reverence" for other species plays in the spiritual and material lives of indigenous people who seek to live in harmony with their environment.

The renowned environmentalist, René Dubos, has long held that our salvation depends on our ability to create a religion of nature. G.K. Chesterton observed long ago *"...it is exactly where biology leaves off that religion begins"*. And Thomas Berry wrote: *"Both education and religion need to ground themselves within the story of the universe as we now understand this story through empirical knowledge. Within this functional cosmology, we can overcome our alienation and begin the renewal of life on a sustainable basis. This story is a luminous, revelatory concept that could evoke the vision and energy required to bring not only ourselves but the entire planet into a new order of magnificence"*.

The second reason for the current concern about biodiversity is the knowledge that there is an ominous and accelerating decline in the global assemblage of species, genes and ecosystems. An endless stream of disturbing and startling figures detailing biodiversity loss and rates of extinction abound and no one knows for sure the rate and



extent of this decline, let alone how many plants, animals and microorganisms exist in the first place. It is also difficult to gauge the seriousness of the damage or loss to individual species. Those thought to be useless or even harmful, or perhaps not even known to us, may in fact, be a crucial part of the overall picture.

As Leopold wrote: *"Living systems are so complex, so conditioned by interwoven cooperations and competitions, that no man can say where utility begins or ends."*

I like to compare biodiversity to a spider's web. All the component parts are linked in one interdependent system. Damage to one part has a detrimental effect on other parts. The crucial and unanswered question is: At what point has sufficient damage occurred that the entire structure collapses? That "built-in" redundant response or failsafe defense mechanisms within the ecosystem can no longer maintain its fundamental integrity. The harsh reality is that we do not know how close we are to this breaking point. What we do know is this -- humans are using biological resources faster than they can be replenished. And, we are destroying habitats without apparent concern and frequently in ignorance of what the consequences may be to the individual species that cohabit within or the interrelationship between that ecosystem and another. If current rates of use and destruction continue, our very survival is threatened. We must now realize and accept that we are but one strand in the web and that time is truly running out.

Thomas E. Lovejoy, a knowledgeable tropical and conservation biologist, with the Smithsonian Institute, has observed that each and every life-form has something to tell us about the possibilities of living systems. Each species represents a set of solutions to an individual set of biological prob-

lems. Since we have only begun to learn about the diversity of other species on earth, it would be arrogant to reduce our ability to learn by condoning the current unnaturally high rate of extinctions. Lovejoy equates this with the "biggest book burning in which the world has ever engaged."

Twenty years ago, British chemist, James Lovelock, proposed the startling hypothesis that "The Earth is a living organism". That hypothesis is rapidly moving to the centre of public awareness. The concept, known as Gaia - named after the Greek earth goddess, has already provoked an extraordinary amount of startling innovative and cross-disciplinary research. Gaia may well be on its way to being one of the great, original scientific ideas of our time. The Gaia hypothesis argues that for 3.5 billion years microbes, plants, and animals have co-evolved with their environment as one globally integrated superorganism; a superorganism in which living things interact with geophysical and chemical processes to maintain conditions suitable for life. At the very least, the Gaia theory has provided an organizing focus for research as scientists step up their efforts to learn more about how the enormously complex global environment functions, what maintains it and what disrupts it. For those whose major preoccupation is climate change, it has stimulated a spirited debate over the role of life in governing the Earth's climate.

But, there is a spiritual dimension to this as well. Many religions enjoin their adherents to "love thy neighbour as thyself". We are rapidly coming to understand that this must also include our non-human neighbours, and that in this expanded notion of "neighbour", failure to obey is not only damnation in the next life, but catastrophe here and now.

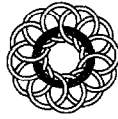
What can be done to preserve our precious heritage of biodiversity, the individual and collective result of millions of years of co-evolution, to ensure that structure, functions and diversity of the human life support systems are maintained for this and future generations? How can this be accomplished in a manner that also ensures an adequate supply of biological resources for essential economic development? The answers are multiple and lay at many levels - local, national and international. I have been privileged to lead Canada's involvement in one international initiative, the negotiation of the International Convention on Biological Diversity.

The Biodiversity Convention

It was with pride and a feeling of accomplishment that the Prime Minister of Canada led over 150 other nations in signing the Convention on June 11, 1992 in Rio. Our country was an important player in guiding negotiations to a satisfactory conclusion, against an almost impossibly tight deadline and in the face of widely divergent views between (and within) developed and developing nations. Canadian objectives, the result of extensive federal-provincial-territorial-NGO consultations, were largely accomplished in the end. The Convention covers a very broad range of issues. It would be a mistake to consider it a "spaces and species" convention although that aspect is very important. In many respects, **Convention application to fisheries, forestry, agriculture, education and trade can be considered more important than to parks and wildlife. The Convention is as much about sustainable use as it is about conservation.**

At the heart of the Convention is the recognition of the

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continued necessity of developing national biodiversity action plans. This "bottom-up" approach ensures that each country takes responsibility for conserving its own biodiversity, within a policy and planning framework geared to its particular circumstances and aspirations. Canada and other developed countries will provide funds, to be distributed according to criteria set by the Parties to the Convention, to enable developing countries to each formulate its own plan. It is primarily in these countries that biological resources are the most significant but where governments are the least able to afford to conserve them or to use them in a sustainable way. **The Convention recognizes the need to encourage fair and equitable sharing of benefits derived from the use of genetic resources with those who provide these resources.** As I view it, a fair deal between those who hold the patents and those who own the copyrights to the genetic codes.

Complementing these provisions are obligations relating to education and training, research, information exchange and transfer of technology. A range of conservation measures are called for, covering both in-situ and ex-situ protection of biodiversity, environmental assessment and species and ecosystem restoration.

Industry can be comfortable with this Convention, for, as observed earlier, it is as much about sustainable development as it is about conservation. It acknowledges that biological resources must be used for the benefit of mankind, providing that natural systems are not destroyed in the process. **The Convention also stipulates that sharing of benefits and technology transfer will be carried out within existing intellectual property rights legislation, while recognizing the need for the "fair deal".** It calls for

partnerships between governments and the independent sectors.

The Convention mirrors Brundtland's thesis that for environmental initiatives to succeed, the grinding poverty that underlines so much of the current problem must be eliminated and the domestic capacities of developing countries to solve their environmental problems must be strengthened. Developing countries will hopefully now have access to the funds, technologies and information they need to conserve their biological resources. Social and economic incentives for conservation will be provided, so that the support, understanding and participation of the local people who own and manage biological resources is secured.

The Convention also recognizes the close and traditional dependence of many indigenous and local communities on biological resources and the desirability of sharing equitably the benefits arising from the use of traditional knowledge relevant to its conservation and the sustainable use of its components. Of very great importance also is the recognition of the vital role that women play in the conservation and sustainable use of biological diversity and the affirmation of the need for the full participation of women at all levels of policy, decision making and implementation.

How will history judge this Convention? Will it have any real impact on guiding global efforts to protect biodiversity and encourage the sustainable use of biological resources? The text is imperfect, the inevitable result of the need to reach compromise across a wide spectrum of issues in a very short time frame. There is criticism that the language is heavily qualified, or that conservation measures are seemingly weak, or that some of the articles appear to be vague and

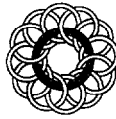
sometimes contradictory. The refusal of the U.S.A. to sign, at this time - based on apprehensions that Canada does not share - may raise doubts among some as to its actual value.

I am convinced, however, that the document will prove to be a landmark in international law, an important building block in the search for solutions to global environmental problems. This is because it provides for the first time a framework for nations of the world and importantly, the non-governmental communities to address, in a cooperative way, the destruction of our biodiversity, a problem that unites us all, that cuts across national jurisdictions and generations. Within the Convention are many of the tools that we require for effective action. What is now required is to develop and implement effective follow-up programs.

Canada will continue to work actively on the international scene to ensure that the momentum is maintained during the interim period between signature and ratification. Many of the actions required in a national biodiversity strategy are already in place, within federal, provincial and territorial policies and programs. By working collectively, governments, indigenous people, interest groups and business can ensure an effective Canadian response. The provinces and territories as well as indigenous government structures will have to assume substantial responsibility for implementation requiring catalyses, consistency and coordination, in a context of transparency and in a spirit of inclusiveness. This is a global Convention in which we "think globally and act nationally". It is in our medium and long term interest that this Convention is effective globally. Developing countries can undertake conservation initiatives if we

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Biodiversity Issues In New Brunswick

by Jean Arnold and George Peabody

When chickens were a normal part of farming ecology rather than the specialized industry they are today, folk wisdom coined the admonition: "Don't put all your eggs in one basket". Like many folk sayings, this encapsulates a depth of understanding and applicability that leads a long way from the barnyard where it began. It is, in fact, an explicit warning of the dangers of overspecialization. As such, it is also an implicit appreciation of the value of biodiversity.

A society which has sprung so far from its roots that it sees only the quaintness of folk sayings and ignores their messages, is an endangered society. As we place the emphasis of our lives on ever fewer species, we narrow the range of our biological options, putting more eggs in fewer baskets and so courting disaster when they drop or the handles break.

In New Brunswick, as elsewhere, we follow this risky practice throughout our relationship with the biological world. Industrial forestry has evolved a cycle intended to produce low cost raw wood, principally for paper making, secondarily for lumber. Its focus, therefore, is on softwoods, primarily spruce. Clearcut land is planted to spruce plantations, regardless of what grew there before clearcutting, and other species are suppressed by chemical or mechanical methods. Chemical pesticides also control the insect epidemics attracted by the monocultural plantations.

By concentrating on the few species of trees it wishes to grow, industrial forestry is unable to see the biologically

diverse forest it is preventing. Ecologically, the consequences are alarming: a black spruce plantation, for example, can support only the very few bird, insect and animal species capable of adapting to life there. Even these few are frequently damaged by the chemical controls used. Economically, putting all our forests into spruce is even more dangerous. New Brunswick is a transitional forest area, where the softwood, boreal northern forest meets the hardwood, deciduous, southern forest. The global warming predicted in the next forty years will improve conditions for hardwoods and imperil softwoods in New Brunswick. Already the spruce plantations intended "for harvest in 2025" are growing more slowly than anticipated.

The economic and environmental consequences of this biological narrowing are widespread. Ignoring the value of local native hardwoods -- beech and yellow birch, maple, ash basswood and butternut -- helps to create the market for tropical hardwoods, leading to overcutting of rainforests, further biological narrowing, and increased global warming which makes the spruce plantations of New Brunswick even less viable.

As in forestry, so also in farming. Most commercial farms focus on a single product; biological diversity diminishes here as well: the forty-odd commercial potato varieties of a generation or two ago are now reduced to a dozen; dairy farms raise only Holsteins; piggeries and chicken and egg operations tend likewise to one or two breeds. The dangers of this are less obvious

perhaps, but the tremendous loss of human farming wisdom which produced those diverse varieties to fill specific niches and to provide products with particular qualities is incalculable. At worst, it represents a permanent depletion of the genetic pool.

The commercial fishery follows a similar pattern. Single species are over-exploited to the point of economic or environmental collapse: Atlantic salmon, Queen crab, haddock, northern cod...as human activities narrow the biological diversity of the oceans, the human communities which economically depend on that diversity suffer and decline.

The diminution of biological diversity is as dangerous as our focus on single species. Who knows what new rosy periwinkles or Pacific yews, presently ignored, or worse, killed to protect commercially valuable species, exist in the world? Our tragedy is that we may never know what we have lost if we continue to ignore the dangers our ancestors understood and put all our biological eggs in a single basket.

Jean Arnold is the Director of the Falls Brook Centre, a sustainable community development demonstration and training centre where theory and practice, global and local come together working to build a sustainable future.

George Peabody is a writer and editor living and working in rural New Brunswick.

Campeau: Cont. from pg. 8.

demonstrate that we are taking them ourselves. Many developing countries believe that we have achieved our wealth at the expense of our natural resources. They want that opportunity or compensation for not taking it.

The first priority is to ratify the Convention. I am hopeful that this

can be achieved shortly, both in Canada and other countries, so that the Convention can take its proper place on the world's stage and so that its much needed global influence can prevent too many more strands of our web from being broken before its too late.

Ambassador Arthur H. Campeau, Q.C., Personal Representative (Sherpa) of the Prime Minister to the United Nations Conference on Environment and Development led the Canadian delegation during the negotiations of the Convention on Conservation of Biological Diversity.



A National Biodiversity Strategy For Australia: What Will Be The Outcome?

by Ralf Buckley



As Canada moves toward its own national strategy for Biodiversity, the parallel experience of Australia may be of interest. Like Canada, the Australian economy is

heavily dependent on primary industries. The manufacturing sector is small and protected. Tourism is large and growing and while the primary industries are powerful lobbyists, tourism is not. Information on the taxonomy, biogeography and ecology of potentially endangered species is scanty. And, funding for relevant research organizations has declined steadily in real terms for the last two decades, a situation that mirrors that of Canada. Australia's federal system of government has most legal power over primary industries within the jurisdiction of state governments. There is no specific federal power over the environment and federal environmental laws rely on other constitutional powers, such as those over exports, foreign investment, and foreign relations. Federal powers over corporations and finance have not been used, for political reasons.

Each State has different environmental laws. Most States regulate the taking of particular species in conservation reserves, and sometimes in other state lands, but rarely on private property. The schedules of species differ between States. A few years ago, the State of Victoria passed its *Flora and Fauna Guarantee Act*, which is intended to prevent State government agencies from approving developments which would threaten species or their critical habitats. For the country as a whole, there is no federal Endangered Species Act in Australia. Although a signatory to

CITES, Australian enforcements are principally at Customs checkpoints.

The Australian government took the responsibility for developing a national biodiversity strategy (NBS), a process which started in 1990. The Commonwealth Department of Arts, Sport, Environment and Territories (DASET) was designated as the lead agency to evaluate and apply the UNEP guidelines for a country study on the economics of conserving biodiversity. A firm of consulting economists conducted the Australian country study; a report was due in September 1992. Australian involvement in developing the international biodiversity convention for Rio led by the Commonwealth Department of Foreign Affairs and Trade (DFAT), also included personnel from DASET.

Besides the State and Commonwealth government agencies concerned specifically with taxonomic research, several recently formed Commonwealth agencies collect, collate and analyze information on biodiversity: the Environmental Resource Information Network (ERIN) in DASET; the National Resource Information Centre (NRIC) in the Department of Primary Industries and Energy (DPIE); and the Resource Assessment Commission (RAC) reporting to the Prime Minister.

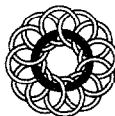
Australia's federal two-house parliament, the House of Representatives and the Senate, both have Standing Committees on Environment, Recreation and the Arts (SCERA). The House of Representatives SCERA conducted an inquiry, (due in June 1992) into the effectiveness of existing Commonwealth funding programmes to help conserve biodiversity. These focused on: retention of native vegetation on private land; tree plantation; conservation in the catchment of the country's largest river system; and soil focus. (Commonwealth policies

on lumber and woodchip exports, pulp and paper operations, fisheries, and mineral development in conservation reserves are outside its terms of reference although these have far greater impacts on biodiversity than the four programmes mentioned).

In late 1990, the former Prime Minister established nine sectoral Working Groups on Ecologically Sustainable Development (ESDWG), plus an intersectoral group, with a Secretariat attached to the Prime Minister and the Cabinet. Analogous to and with some similarity to the Round Tables on the Environment and the Economy in Canada, these working groups are structured by sector rather than by level of government and include representatives from federal and State government agencies, local government, industry associations, individual corporations, labour unions, and NGOs. Well-funded, and authorized to conduct short-term research through consultants, some Working Groups reached consensus quite easily and rapidly while others were unable to reach consensus on all points. Final reports in October 1991 identified a number of issues where views still conflicted and biodiversity was an important consideration for many of these Working Groups. Increased risks to rare or endangered species were also major concerns within many of the case studies. (The current Prime Minister appears keen to continue the process started by the ESDWG, and although this interest has been recently submerged by political events, both industry and conservation representatives have also called for the ESDWG to be extended into permanent round tables).

Last year, the Minister of the Environment appointed an expert group, the Biodiversity Advisory Committee (BDAC), to draft a National Biodiversity Strategy (NBS).

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Biodiversity - In The Context Of the Newfoundland And Labrador Fishery

by David Vardy

Given that biodiversity, or its indices, constitute indicators of ecosystem health, and a guarantee of ecosystem resiliency, it is of prime concern to fishery planners in Newfoundland and Labrador. The interrelations and interactions between species in an area such as the Grand Banks, as well as areas of rapid change or transition such as near-coastal zones, must ensure stability and act as a buffer against catastrophic change. Similarly, genetic diversity within a species enables it to be more tolerant to environmental change, and to take advantage of a greater geographic area.

Species diversity in an ecosystem or ecotone (zone of change between relatively homogeneous ecosystems) ensures that the available niches within an ecosystem will be filled, even if certain species decline drastically. As well, the predator-prey relationship, implicit in any estimate of biodiversity, keeps the number of predator and prey species stable as a result of species interdependence.

The present shift in weather and oceanographic conditions in the Northwest Atlantic is an example of ecosystem perturbation. In an ecosystem which is fully diversified, and with all its species niches occupied, the result would be a shift in the species spectrum. However, as the oceanographic conditions return to their original state, so too will the species spectrum.

The history of commercial biological resources in Newfoundland and Labrador waters has been one of increasingly severe disruption of fish stocks. This has been the result of the targetting of only a few species, as well as the removal of such a high proportion of overall resource biomass. Even if a balanced

cropping of all trophic levels were to be carried out, the ecosystem would not be capable of sustaining this level of biomass removal on a continuing basis.

Recent declines in fish stocks in Eastern Canada have raised concerns about the impact of fishing methods on balanced benthic communities, which constitute the major food supply for demersal (near-bottom living) fish. These benthic communities play a critical role in the conversion of energy from the plankton to commercially exploited fish and shellfish species. Harrison (1991) states: "One effect of increased predation pressure [e.g., fishing] on damaged species is the temporary shift in community structure and size frequency distribution [e.g., biodiversity] caused by increases in local predator abundance. Studies such as these suggest that an area constantly disturbed by fishing activity, with a concomitant increase in dead or damaged animals, may lead either to a redistribution of fish populations within a fishing zone or a permanent division elevation in the number of scavengers causing local increases and depletions of stock. While not documented directly, the Grand Banks of Newfoundland cannot be excluded from these findings.

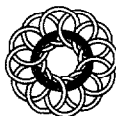
A major concern in Newfoundland and Labrador is, as many are aware, the high level of foreign fishing effort concentrated on the margins of major ecological zones, that is, the "Nose" and "Tail" of the Grand Banks. There is clear evidence that the European Community, particularly Spain and Portugal, fishing outside the Canadian 200 mile limit, are misreporting catches, fishing well above the levels recommended by the Northwest Atlantic Fisheries Organiza-

tion (NAFO), and fishing for juvenile flatfish and cod. To compound this problem, countries which are not members of NAFO are fishing in the regulatory area without any NAFO assigned quotas; these countries include: Panama, Korea, the United States, and the Cayman Islands. The impact of these actions on fish stocks is intensified by the fact that the Nose and Tail of the Grand Banks contain important spawning and nursery grounds for a variety of commercial fish species.

The effect of foreign overfishing on local species diversity has not been adequately addressed and is a matter of great concern. As the Nose and Tail are transition zones between the plateau of the Grand Banks and the Atlantic abyssal plain, these regions tend to conform to the general ecological rule that transition zones are areas of elevated productivity and exceptional biological diversity. Although they seem, in commercial fishing terms, to be choice areas to target, their role as natural biological reserves capable of maintaining stocks in adjacent areas -- if left undisturbed -- should not be underestimated. Certainly, the presence of 70 foreign vessels fishing a 20 square mile area on the "Nose" of the Banks, as was the case this spring, must have major implications for the ability of the local ecosystem, as well as the neighbouring shelf areas, to support any reasonable level of productivity or to withstand simultaneous environmental stress.


The establishment of formal marine reserves as nursery zones in foreign continental shelf areas (notably in the United States) may prove to be the best guarantee of

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Indigenous Peoples And Biodiversity: An Algonquin Conservation Strategy

by Russell Diabo



In 1987, when the World Commission on Environment and Development released its report, there was one small Indian community in Canada, the Algonquins of Barriere Lake, that took to heart the Brundtland Report's recommendations. With a population of approximately 450 people, Barriere Lake is located in the centre of the La Verendrye Wildlife Reserve in Western Quebec, about a 3-1/2 hour drive northwest of Ottawa-Hull. This First Nation continues to live in a traditional way of life despite the many problems that confront them: the flooding of their traditional territory by storage reservoirs; extensive clear-cutting by logging; as well as the depletion of fish and game by sports users.

The Brundtland Report states: *"These communities are the repositories of vast accumulations of traditional knowledge and experience that links humanity with its ancient origins. Their disappearance is a loss for the larger society, which could learn a great deal from their traditional skills in sustainably managing very complex ecological systems. The starting point for a just and humane policy for such groups is the recognition and protection of their traditional rights to land and the other resources that sustain their way of life...And this recognition must also give [Indigenous] communities a decisive voice in the decisions about resource use in their area."*

Canada's 1987 Report of the National Task Force on Environment and Economy agreed with the recommendation that a nation should establish national, regional and local conservation strategies.

In 1988, the Barriere Lake Chief, Jean Maurice Matchewan, obtained a commitment from the Minister of State for Indian Affairs,

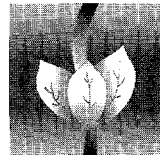
Bernard Valcourt, for the development of a conservation strategy in the territory of the Barriere Lake Algonquins. Mr. Valcourt's agreement was contingent on an agreement with the Government of Quebec. It took many years of struggle and hard work by the Algonquins to reach the Trilateral Agreement (Canada-Algonquin-Quebec) which was formally signed on August 22, 1991, in Quebec City. It provided for the development of an Integrated Resource Management Plan (IRMP) for forests and wildlife over a 10,000 sq. km. territory.

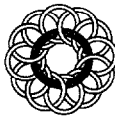
The Trilateral process, managed by a Task Force committee of Special Representatives, one for each party, is working to ensure the development of the IRMP by 1995. Over the longer-term, a three to five year study to complete an Integrated Resource Management Plan is based on the following principles: 1) the importance of a particular area/condition/zone/factor on the whole ecosystem; 2) **the interrelationships and interdependence** among the elements of the system; 3) recognition that **humans are part of nature**, and not separate from it; 4) recognition of the **dynamic nature of the ecosystem**; 5) the essential need to evaluate the concepts of **carrying capacity, resiliency and sustainability**, and the **limits to human activity**; 6) **the recognition that the environment encompasses natural, physical, economic, social and cultural elements**; 7) the importance of traditional as well as scientific knowledge; 8) recognition of the importance of **living species** other than humans, and of **generations** other than our own; and 9) recognition of the importance of diver-

sity within the ecosystem and interest in maintaining and enhancing ecosystem diversity.

So far, a Consensus Report to the three Special Representatives has not been possible as there was no consensus between the Algonquin and the Quebec Task Force Members. During the spring of 1992, differing interpretations of the Trilateral Agreement, even among the Special Representatives, forced a negotiation-mediation process as recommended by the Special Representatives to the Chief and the Ministers. In August 1992, Quebec Superior Court Judge Rejean Paul was appointed as a mediator through a Quebec Decree. Judge Paul determined that *"This pilot project is of a capital importance for the future harmonious development of the forest industry in La Verendrye Park, and elsewhere in Quebec"*. To date, the Government of Canada and Quebec have not yet responded to Judge Paul's Mediation Report, an illustration of the difficulties that Indigenous peoples face when they try to obtain recognition from the provinces for their land use activities.

The Algonquins of Barriere Lake were concerned about the ongoing impact of natural resource development activities in their traditional lands and waters and proposed a conservation strategy, rather than a land claim. Their interest in biodiversity stems from their continued reliance on many plants and animals species which they have used for hundreds, if not thousands of years. By identifying sensitive zones and measures to harmonize forestry activities with traditional Algonquin activities, the Barriere Lake community is developing the experience to com-





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bine their traditional knowledge with contemporary scientific techniques for the development of an IRMP which will ideally take into account the future of biodiversity in the territory, including the Algonquins' future needs.

The Algonquins continue to collect data through site visits for the IRMP. A series of maps are being prepared indicating important information including the following: old settlement sites, occupancy sites, burial sites, sacred sites, historic sites (e.g., battle grounds), main travel routes, medicine sites, sugar bushes, specialty wood sites, tobacco sites, bear dens, eagle nests, moose yards, heronies, and spawning sites.

In addition, there is a Forestry Education and Harmonization Project to determine the effects of current forest management practices on the traditional activities of the Algonquins of Barriere Lake. It will review current forest management practices in light of these effects. It will educate and inform the members of the Algonquin Community with regards to Quebec Forestry Policy and silvicultural techniques/strategies. It will propose general forest management prescriptions which harmonize forestry operations and traditional Algonquin activities.

Prior to the submission of the final report, a Community meeting will be held to review the findings of the site visits and consolidate

opinion as to the impacts of forestry on the land base. This will assist the Barriere Lake Algonquins as they seek consensus and ways to harmonize forestry operations with land uses in their community.

Russell Diabo is a Quebec Mohawk working on his Masters Thesis while also advising the Algonquins of Barriere Lake.

For more information, contact Russell Diabo (613) 729-9491. A National Film Board production entitled: "Blockade: The Algonquins Defend the Forest", can also be obtained from any NFB office.

Biodiversity Conservation And Local Communities

by Wendy Parkes

Biodiversity is as much about people as it is about wildlife. To be effective, the intimate interdependencies between biophysical and cultural systems must be reflected in conservation strategies. And, human influences and activities need to be incorporated into the traditional wildlife-centred approach to biodiversity, as humanity is viewed as part of nature, subject to the same natural forces as other species. Biodiversity is also viewed not just as a precondition for human activities but also as the outcome of thousands of years of human use and transformation of the Earth. Much of the world's biodiversity is the result of the land use practices of generations of people, who cleared land, planted fields and woodlands, and harvested wildlife, creating new ecosystems that sustained life and were maintained over time.

The relentless destruction of biodiversity today represents a distortion of the harmony that existed for so long between human beings and na-

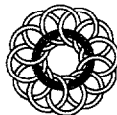
ture. Controlling these trends and protecting biodiversity involves reestablishing the balance between human and natural communities and must be undertaken with the local people who use and depend upon the biological resources. Efforts will falter if not based on an understanding of human values and customs, past and present activities, technologies and legal and institutional arrangements.

To date protected areas such as national parks and wildlife reserves, in which development is excluded or severely restricted, have traditionally been viewed as the best way to protect biodiversity. These areas will continue to have an important role to play, although relatively few of these are sufficiently large or remote that entire biotic communities can be saved. In most countries, it is not economically or politically feasible to set aside large areas from human use. In any case, most of the world's ecosystems have been or are destined to be modified for human uses. Thus,

biodiversity conservation needs to be based increasingly in inhabited as well as wilderness areas. And, while purists may object, protected areas need to be managed in concert with surrounding areas, through buffer zones and ecological corridors, and some may need to accommodate multiple uses.

Biosphere reserves provide an excellent example of how conservation and development of biological resources can co-exist. For example, the national parks of England and Wales, settled areas with a long history of economic development have had considerable success in protecting species and ecosystem diversity while also ensuring appropriate development in the local and national interest. In Canada, the Northern Yukon National park co-management regime provides a model for integrating conservation and sustainable use of biological resources where indigenous populations are located. In these and other examples, local

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communities are regarded as partners not opponents of conservation programs. While it is not always easy to balance conservation and development objectives, particularly within protected areas, this integrative approach offers real opportunities for saving threatened areas and their biodiversity.

How Can Local Involvement in Biodiversity Conservation be Encouraged?

(i) Using and Rewarding Traditional Ecological Knowledge

The knowledge, innovations and practices of indigenous and local people, accumulated over time, can play a vital role in biodiversity conservation, in both protected areas and diversity-sustaining production systems. While abuses do occur, many of the world's remaining areas of high biodiversity are inhabited by indigenous people, whose land-use practices support sustained diversity and who have the deepest understanding of ecosystems. For example, fishermen in Newfoundland fishing communities can predict with statistical accuracy, the volume and pattern of iceberg flows and other natural phenomena. Unfortunately, the wealth of disappearing knowledge in indigenous and local communities is not being fully utilized in conservation policies and programs. Creating a mechanism for rewarding the application of traditional knowledge, within the context of existing intellectual property rights regimes is a major challenge for biodiversity conservation.

(ii) Demonstrating and Promoting the Economic Benefits of Conservation and Sustainable Use of Biological Resources

Biodiversity conservation strategies which demonstrate and maximize the economic value of biological resources used wisely are powerful tools for engaging local involvement and support. These can

build the capacity of local communities to conserve and use biological resources in a sustainable way while directing benefits of resource development to the pockets of local people. There are incentives such as:

- subsidies and loans to support resources use activities consistent with sound management;
- grants to encourage appropriate settlement patterns;
- special taxes or concession rights for land kept for conservation or for appropriate extractive uses;
- elimination of policies that encourage harmful agricultural and forestry practices;
- redirection of benefits and encouragement of local employment in large-scale development projects and protected areas;
- changes in land tenure arrangements to recognize the rights of local people to land and resources used for generations;
- and support for education and training programs.

Several types of local economic activities can co-exist with biodiversity conservation. These are the harvesting of wild species or commercially viable breeding or restoration projects; and productive uses of non-timber forest and other biological resources for food, fuel, medicines, cosmetics, industrial products and crafts, providing species and ecosystems are carefully selected. So can sport hunting and ecotourism. As well, local knowledge and capabilities can be utilized and rewarded in research and monitoring studies and environmental impact assessments.

(iii) Creating Partnerships with Local Communities

In Northern Canada, for example, various co-management arrangements have been created whereby local communities are given substantive roles in controlling resources uses and undertaking research and management projects. The federal government's Environmental Citizenship Initiative provides seed money to local groups for commu-

nity-based environmental initiatives. In developing countries, many examples exist of collaboration between local communities and government to protect and use biological resources in a sustainable way.

No one community or level of government can manage alone. A respect for the knowledge and skills, rights and needs of local people allows the tapping the wealth of expertise and enthusiasm of local communities and provides a vehicle for constructive dialogue and strategic arrangements amongst many and diverse constituencies.

(iv) Promoting Education, Training and Research

If people understand biodiversity and its importance to them, and know how to manage it, they can assume a measure of responsibility and control for protecting their environment thus lessening the burden on governments. Polls show that few Canadians understand the meaning and importance of biodiversity. There are insufficient resource managers trained in biodiversity-related specialities such as taxonomy to meet growing needs. Therefore, efforts to build capacity are needed on several fronts - within the general public, in the formal education system, from elementary to university, within local communities, at the political level. Also needed is research on the social, historical, legal, institutional, economic and political framework within which local people manage biological resources. Conservation policies and programs are most likely to succeed in programs based on an understanding of how the perceptions, customs, values and behaviour of local people influence resources use. This type of information can complement the natural sciences research that is also essential.

Wendy Parkes is Manager of Operations, Biodiversity Convention Office, International Affairs Directorate, Environment Canada in Ottawa.



Saving Bio - What?

by Monte Hummel



One of the more heartening outputs of the Earth Summit in Rio was to hear the word "biodiversity" on the lips of our Prime Minister, especially since he was pledging to conserve it in Canada.

Simply put, biodiversity is the "full variety of life". It is our God-given natural wealth, including eco-systems, species and the range of different genes which they represent. Maintaining biodiversity is important as a complex and beautiful system of life in its own right, but also because it constitutes a biological life-support system for all species, including humans. Furthermore, our economy is dependent on maintaining biological diversity in the form of natural resources such as forests, fisheries, and wildlife, and as a source of wild genes for plant breeding, medicines, agricultural crops, and other uses.

A challenge, for decision-makers and for people designing specific programs, is that almost anything we do which helps the environment counts as conserving biodiversity. Therefore, accomplishing this task tends to be a somewhat squishy concept, with no clear beginning and end to measure points in between. To simplify this problem, and to give it some scope, it may be useful to think of a two-pronged approach.

First, there is the **preservation or protection** approach. This involves establishing protected areas such as parks or wilderness reserves, as well as protecting endangered species. This approach

maintains biodiversity by making sure some things are not used by people, but instead are left to change at the hands of nature. This at least gives us benchmarks against which to measure the changes we humans are making on the rest of the landscape.

Second, there is the **sustainable use** approach. This involves making sure that those areas and those resources which we **do** use are used in a way which doesn't exceed their biological integrity or capability to reproduce. Examples, of course, are fisheries, hunting, forestry, agriculture and even tourism.

The important thing here is to accept that **both** approaches -- protection and sustainable use -- are necessary to maintain biodiversity. Too often, environmentalists have engaged in a titanic struggle as one faction insists that either one perspective or the other must totally dominate. The protectionists sneer at those crass users (loggers, hunters, miners, etc.), and the users can't stand those airy-fairy protectionists (wilderness proponents, animal rights advocates, and environmentalists).

But this is really a futile debate, akin to fiddling while Rome burns, because we are not conserving biodiversity unless we have both a protectionist and a sustainable use element to how we relate to our environment. And, if we are not conserving biodiversity, we are not practising sustainable development.

Therefore, organizations such as the National Round Table must have the mission of maintaining Canada's biodiversity at the heart of its mission. This group can play a key role in helping the Prime Minister deliver on his promises in Rio.

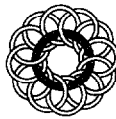
Monte Hummel is the President and CEO of the World Wildlife Fund (WWF) Canada. Founding member of Pollution Probe and Founding Director of the Coalition on Acid Rain, Monte is also a member of the World Conservation Union (IUCN) Species Survival Commission and WWF International Program Committee. His most recent publication was co-authored with Sherry Pettigrew - "Wild Hunters: Predators in Peril".



WWF World Wildlife Fund
Fonds Mondial pour la Nature

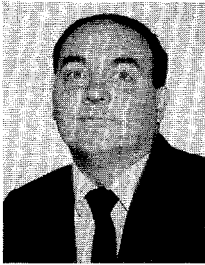
Post - Rio Follow-up

Representatives of the Core Delegation to UNCED and the major sustainable development institutions in Canada - the Canadian Council of Ministers on the Environment (CCME), the International Institute on Sustainable Development (IISD), the International Development Research Council (IDRC), and the National Round Table on the Environment and the Economy (NRTEE), - are meeting at Ottawa, Nov. 5 and 6, 1992 to consider how Canada can sustain the momentum UNCED has created. In a letter to the National Round Table, Environment Minister Jean Charest indicated that "in my view, these groups are key to responding to Rio and together with the Official Canadian Delegation to UNCED are uniquely placed to make recommendations on Canada's post-Rio Priorities". NRTEE Chair George Connell has been asked to chair the meeting.



Assessing Biodiversity Risk In Canada

by Clayton Rubec



A national modelling project has recently concluded that Canada's working landscapes, are the areas of greatest biodiversity risk. Canadians are the custodians of a substantial proportion of the earth's northern latitude ecosystems, and since the advent of Europeans to the North American continent, the diversity and richness of these ecosystems have collectively been tied to the prosperity and well being of Canadians. However, many of Canada's natural landscapes have been altered, as can be seen in urban areas, agricultural farms through to managed forests. Currently, the establishment of national, systematic plans for the protection of representative examples of the biological diversity of these landscapes is the cause of a major debate.

To promote conservation of natural ecological systems, and hence, biodiversity, various organizations have promoted conservation targets as international and/or national objectives. It is now accepted that the conservation of biodiversity must include the physical habitat as well as representative examples of species and ecosystems, examples which must be viewed in a systematic way.

This new integrated scientific study of landscape and biological resources at risk involving the expertise of modellers at Environment Canada and a range of federal and non-government agencies was recently completed. The data on biological resources focused only on wildlife to provide a preliminary view of the issue. The overall objective of the study was to simplify a complex issue and present an as-

essment of "biodiversity risk" in Canada's landscapes by linking national data bases on protected areas, land use, and wildlife resources within the framework of landscape "ecoregions". Geographic information system technology provided the means to integrate the data. Information on all parks, ecological reserves, wildlife areas and other categories of protected space managed by government were also compiled. Sites managed for conservation by non-government interests provided additional data. Overall the study represents the most comprehensive data set on conserved areas in the country.

An index of landscape fragmentation was also developed which defines landscapes under stress as a result of the fragmentation caused by human activities in each ecoregion. A national data base on the distribution of all terrestrial mammal and bird species across Canada, with specific notation of rare and endangered species, was also included. The development of a biodiversity risk assessment focusing on these wildlife resources was subsequently generated from the integration of the data for protected areas, land use fragmentation, and wildlife data.

The analysis indicates that 14 of Canada's 177 landscape ecoregions are concentrated in Canada's central Prairies, southern Ontario, southeast Quebec, and small interior and coastal areas of British Columbia and Newfoundland, and are at greatest risk. High risk areas generally have Canada's highest number of rare and endangered species relative to the total number of species present. They also have a highly fragmented landscape due to agricultural and urban development, and have the lowest overall

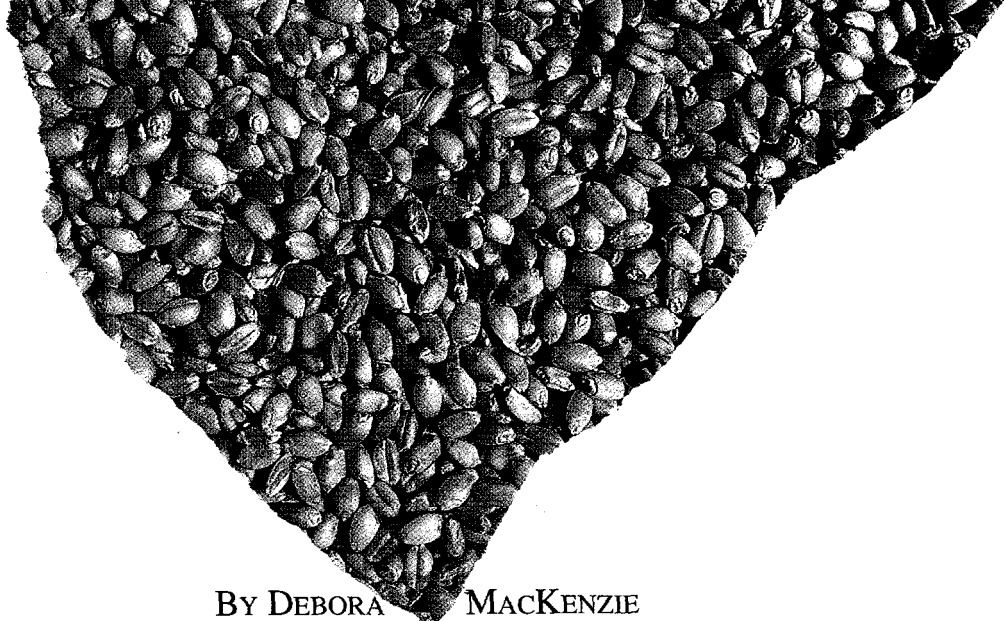
amount of protected habitat area. Most high risk areas coincide with the rural agricultural landscapes of Canada. Another 120 ecoregions have moderate risk ratings and 43 ecoregions are identified as having low overall biodiversity risk to wildlife resources. These low risk areas coincide with landscapes with relatively few rare or endangered species, dominated by wilderness environments, and with a large amount of protected habitats.

Focusing national attention and programs on securement of species and habitats in high risk landscapes offers the potential for significant progress towards conserving Canadian biodiversity. These high risk areas are concentrated in our nation's "working landscape"; areas of high private land ownership which offer little opportunity to introduce new fully protected spaces, or new parks.

Conservation efforts involving, rather than excluding, the landowner offer a real opportunity. Private stewardship and the development of economic incentives for landowners which promote ecosystem conservation are the means for securing biodiversity in these working landscapes. Working hand-in-hand to complement national and regional efforts to achieve protected areas, the 12% target articulated by the Canadian Wilderness Charter and the Federal Green Plan could be achieved.

This scientific study supports the view that conservation efforts need to be focused among a broader range of participants to achieve rural renewal goals. Other agencies, particularly wildlife agencies, who are actively involved in ecosystem conservation must be recognized to a greater degree. Non-governmental organization initiatives are important and have not been properly

Continued



BY DEBORA MACKENZIE

SEEDS OF HOPE

With an approach more akin to group therapy than tough negotiation, the Keystone Dialogue has helped old adversaries reach a breakthrough agreement on protecting genetic diversity in food crops. Perhaps just as important as saving seeds, however, is Keystone's demonstration that business, environmentalists and government can find new techniques to cultivate common interests.

A fierce international debate about a seemingly unlikely topic—the preservation of seeds—had reached a fever pitch. Activists, industry leaders and government officials were locking horns over their separate agendas. Meanwhile, precious varieties of seeds, the sort that might one day be essential to feed the world, were disappearing. But now, thanks to a unique mediating effort, the opposing forces will go the “Earth Summit” in Rio de Janeiro with a single set of proposals for saving the world’s crops from genetic disaster.

The Keystone Dialogue, as the process has come to be known, has hammered out an agreement that could safeguard the vital seed varieties used to develop new food crops. The Keystone proposals would balance the needs of the Third World farmers who in effect operate a vast seed bank with the interests of the huge corporations that dominate the \$50 billion world seed business. If the recommendations of the traditional adversaries are adopted as a formal international treaty this June in Rio, then a redoubled effort to save the world’s crops can get under way.

For decades plant breeders from industrialized countries have collected crops from the developing world and used



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them to create new, often highly profitable varieties. Third World farmers, who have studied and selected superior crops over centuries, get nothing for providing the raw materials. Meanwhile, modernization has wreaked havoc on the world's huge variety of plant genetic resources. As industrially produced seed varieties became available, Third World farmers have stopped growing the old varieties. With more species disappearing every year, discussions between agribusiness, environmentalists and politicians had reached a stalemate.

Traditionally, industry has defended its right to make a profit, no matter what. Governments have attempted to avoid any commitments with price tags. Activists howled that both would destroy the world and scientists moaned about how little they know, and how much more funding they needed. The United Nations Food and Agriculture Organization, charged with resolving the conflicts, compiled documents and called more meetings.

Frustrated by inaction at the UN, representatives of several interest groups involved in the debate decided to take matters into their own hands. Dr. M.S. Swanimathan, a distinguished Indian scientist, Melaku Worede, who headed crop-saving efforts in Ethiopia, and scientists and activists from Europe, the U.S. and Asia, approached the Keystone Center, a mediatory organization in Colorado, USA. With 40 people present at its first meeting, the Keystone Dialogue was born.

After a second meeting in Madras, India, the group got together last summer in Oslo with high hopes for a breakthrough. Just five years ago such an amicable gathering was scarcely thinkable. There was Pat Mooney, a Canadian activist who accuses agribusiness of causing a crisis in world agriculture. Across the table sat John Duesing from Ciba-Geigy and Tim Roberts from ICI, two of the world's biggest agribusiness companies.

Also participating were Jose Lopez Portillo, son of the former president of Mexico and a champion of fairer deals for Third World farmers, and Henry Shands of the U.S. government. The Americans had until recently refused to even discuss the issue with the developing world. Michel Petit, head of agriculture for the World Bank and Camila Montecinos, a farm activist from Chile, brought their perspectives to the meeting.

Discovering their common causes allowed the group to tackle the political problems that had been blocking compromise at the UN. One challenge results from the geographic distribution of crops. Most of the original varieties of the plants we eat are still found in or near the place they evolved. That means most varieties now exist in the Third World. The genes to breed better potatoes and tomatoes

come mainly from Peru. Better barley and coffee come from Ethiopia. Better rice comes from Southeast Asia, better wheat from Asia Minor.

At the UN, people like Lopez Portillo and Mooney argued that the farmers have a right to be compensated for their discoveries, and for laboring to maintain the genetic resources that are turned into profit by Northern scientists. Britain, Canada and other industrialized countries argued that the plants were a "common heritage of mankind," and no one needed to pay for them.

Industry agreed.

What brought them together in the Keystone Dialogue was the realization that paying Third World farmers to conserve crops is not just a matter of fairness. It is also the best way to protect the varieties themselves.

So the Keystone participants decided that by the end of the decade, \$300 million a year should be spent to save crops. A lot of that money, they said, should be given to Third World farmers and agricultural scientists to help them conserve varieties on the farm, the very place where they are now dying out.

Confronted by a maze of conflicting demands, the atmosphere was tense at the first Keystone meetings. Ciba-Geigy's Duesing says the people from industry "tended to take what the activists said personally. They attacked us, and we got defensive." But after a while, says Duesing, people started relaxing as they realized the attacks were aimed not at people but at policies, and that policies can be discussed.

A key to the relaxation was that no one formally represented the authorities and companies that made those policies. People represented themselves, not the views of their institutions. All were free to say what they felt.

This could not have been more different from the UN meetings on preserving crop diversity that have taken place since 1980. On the floor of the UN chamber, everyone is careful about what they say in public. "But what we learned through Keystone," says Duesing, "is that when you can get people into a condition where public posturing doesn't mean so much, we can cross-educate each other."

As they did, they made some discoveries. "What was surprising," says activist Pat Mooney, "was that there was often more agreement between us and industry than between either of us and the government people." Each side was astonished to find that, behind the superficial opposition, they all were worried about much the same things, and realized that action was needed.

The group was also drawn together by the fascination of learning new things from people they would ordinarily never meet. "I felt the activists understood our position





If the Keystone suggestions become part of an international treaty at the Earth Summit this June, farmers in developing countries may get a share of the \$50 billion world seed industry.

better after a while," says Duesing, "but I also started understanding theirs." Duesing says he learned most from Camila Montecinos of Chile and Renato Salazar from the Philippines—the kind of people rarely met in corporate corridors.

Jaap Hardon, a Dutch scientist, explains why political divisions faded once the Keystone Dialogue got underway. "Our Dutch seed potato industry depends on varieties of potatoes from Peru. We can spend money on conserving Peruvian potatoes and say we are paying them for their contribution. Or we can say we are protecting our own industry. It amounts to the same thing. What is important for all of us is making sure the potatoes don't die out."

The realization that they had common interests opened the way for discussion of another problem that had been unresolvable at the UN: how to practically go about

conserving the threatened varieties. One battle concerned the future of the world's "seed banks."

These are mostly large refrigerated warehouses where different varieties of seeds are kept. Ten years ago, it was thought that such banks were the answer to conserving genes. It is now clear that not all seeds are still viable after years in cold storage. Even those that do survive need to be planted and grown, and the seeds re-collected every few years. Seed banks, even in the North, have simply not had enough money to do all that work. Jaap Hardon says "as many genes are dying in the banks as outside them."

The Keystone Dialogue heard Melaku Worede describe how he had paid Ethiopian farmers to grow plots of the old varieties, giving them the difference between the money they would make if they grew new, improved ones. "It costs me less to do that than it does to buy electricity to run



the seed bank," says Worede. The result is better conservation.

Third World insistence in UN debates that farmers be given the funds to conserve plants had been regarded with suspicion by the wealthy countries and industry. Control of genetic resources will be commercially important in the next century with the growth of new bio-technological industries.

The North feared it would be denied access if the Third World took over more control of genetic material. The Third World complained that the North's seed banks already monopolized genes that had come from the South. But the Keystone Dialogue made it clear that the issue was not political control. All possible efforts—the North's seed banks, the South's farmers and the South's seed banks (with more funding)—are necessary or everyone will lose.

In Oslo, the group prepared a final consensus document. "We had been aiming for something we could all live with," says Mooney. "In the end we were describing it as something we could die for."

The consensus dropped some of the things industry opposed—a tax on seed companies, for instance, to pay for conservation in the Third World, which had been a major bone of contention at the UN. Industry also gave up some things it had insisted on, such as universal recognition of patents and other forms of ownership of varieties.

Patents and other such "intellectual property" let industry earn a return on research investments by keeping products from being copied and sold by others—a relatively easy matter with seeds. But the activists insisted that the trend to protect varieties this way made laboratories reluctant to exchange samples, and kept genetic material away from Third World conservation programs.

In the end the Oslo report asked GATT, the General Agreement on Tariffs and Trade, to assess the potential impact of intellectual property rights on plant genetic resources. "Industry recognizes that there are places where government systems, such as plant variety protection, can have a negative impact on plant genetic diversity," says Duesing, a startling admission no industry representative would have made at the UN.

The Keystone document makes some other unexpected recommendations. Between now and the year 2000, efforts to conserve crop varieties should get \$1.5 billion in additional funding. That would be twice what is currently spent on crop conservation.

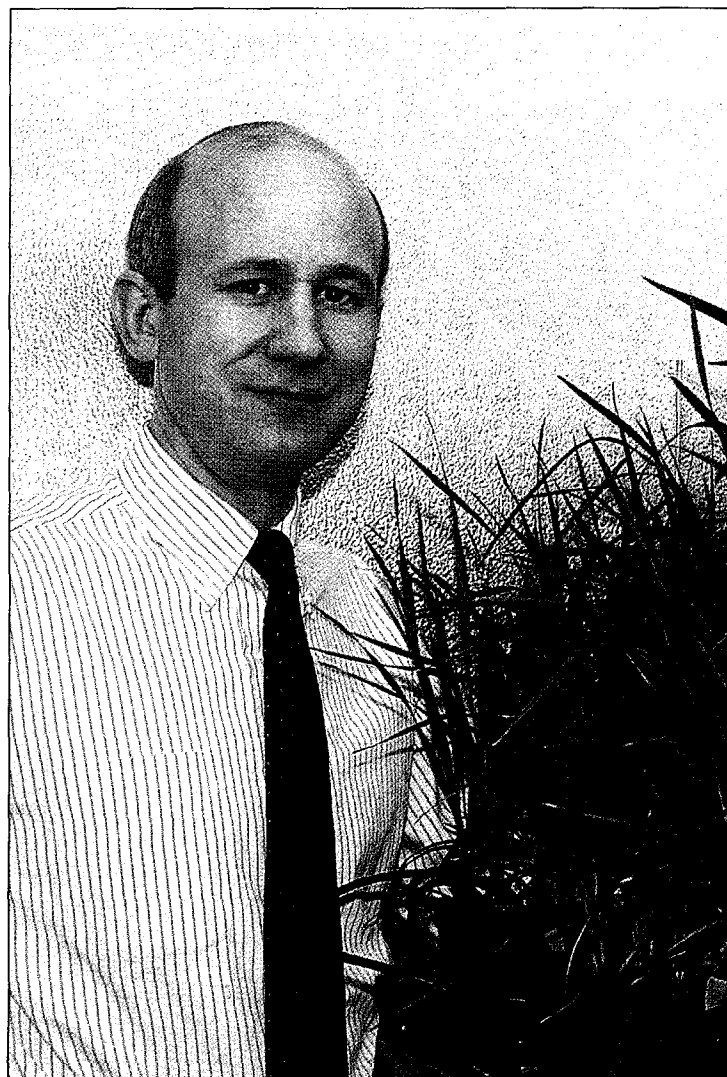
But the group points out that the money represents 0.6 percent of the yearly value of the world market in seeds. Even more starkly, it amounts to only 0.002 percent of global agricultural output—the very output threatened if the

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investment is not made.

The recommendations will be put to the UN Conference on Environment and Development, the "Earth Summit," in Rio de Janeiro, Brazil next June. As the document represents an agreement between all the main players in the debate, Keystone members are confident that their proposals will be approved, and perhaps enshrined as a formal international agreement in Rio.

"All the negotiating work has already been done for governments," says Mooney. "They'd be crazy not to take it." And Duesing agrees. "When you put this on the table, and say industry people back it, as well as the environmental groups and government experts, it will carry





weight with governments.”

Whatever happens in Rio, the exercise in negotiation may be as important as the renewed effort to save crops. Many similar issues now face the world, all pitting governments, industry, and environmentalists against each other: climate change, clean technology, deforestation, pollution. International negotiations are stalled in most of those areas. Duesing says the Keystone process “is an excellent model for future collaboration” between opposed factions. ●

Deborah MacKenzie, who is based in Brussels, writes for New Scientist magazine.

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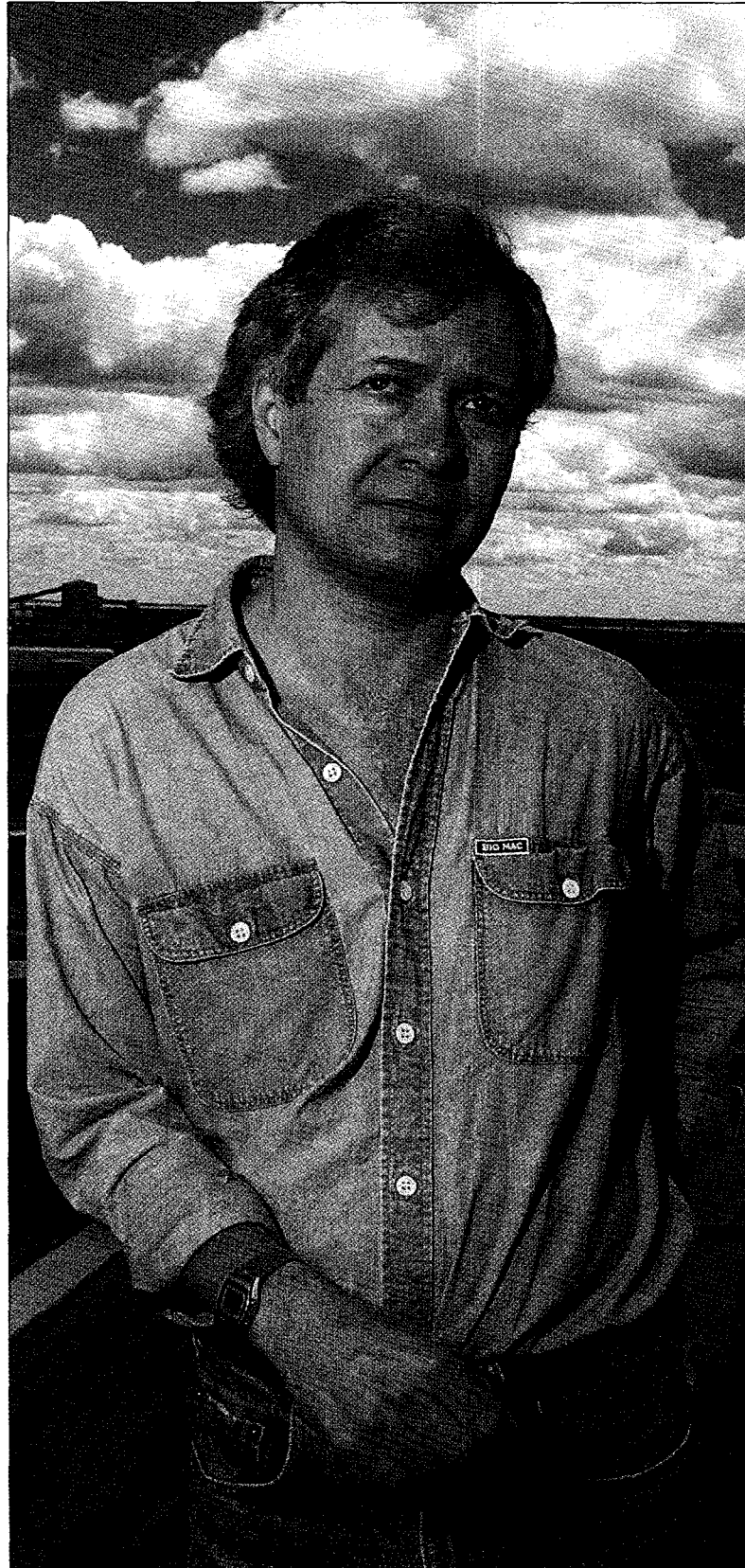
Right: Pat Mooney of the Rural Advancement Foundation in Manitoba, Canada, a long-time foe of agribusiness, found new ways to work with industry on protecting plant genes.

Left: John Duesing, Manager of Research Services at the Swiss chemical giant Ciba-Geigy, says the Keystone Dialogue allowed him to speak more openly than he would have in formal negotiations.

Below: A former government official in Ethiopia, Melaku Worede advocates paying Third World farmers to continue cultivating original varieties of food crops.



Per Frisk



Eva Leihof



The Medicinal Value of Biological Diversity

By Danna Leaman

For the past few years, I've lived and worked with the Kenyah Dayak people of Borneo, in remote highland villages surrounded by vast expanses of tropical rain forest. These forests rival the Amazon in diversity and novelty of the plants, animals, and indigenous tribal peoples found there. The Kenyah themselves use more than 300 species of plants from the surrounding forests to prepare herbal remedies for all sorts of ailments, ranging from simple disinfectants for wounds, and mouthwashes to prevent tooth decay, to complex ritual cures for malaria and migraine. As an ethnobotanist, my work has been to collect and identify the plants used by the Kenyah, and to examine the diverse chemical properties that make these plants useful as medicines.

The World Health Organization has compiled a list of 20,000 species of plants that are used in traditional medicine or as sources of commercial drugs somewhere in the world. Only 5,000 of these species have been studied exhaustively as sources of medicines, and most of these are temperate species. More than half of the 250,000 known species of higher plants are found in tropical forests, however, and new species are still being discovered at a very high rate. The potential value of tropical forests as a source of plant-based medicines relies not only on the great number and variety of plant species found

there, but also on the variety of complex and unusual chemicals these plants produce.

Tropical rainforests, the biological diversity they contain, and the indigenous peoples they shelter and support, are the least explored and the most threatened with extermination of the world's resources. The possibility that a valuable treatment for cancer, AIDS, or some other globally important disease might be lost even before it is found has recently revived efforts of health research agencies and pharmaceutical companies to screen plants for useful compounds.

In the laboratory at the University of Ottawa, we are hoping that the knowledge of healing properties of plants acquired by Kenyah healers over thousands of years will provide short-cuts to the development of new, effective treatments for serious health problems such as malaria. The benefits to modern medicine of such "discoveries" are undisputed but how will the commercial development of their own novel treatment for malaria benefit an indigenous tribe living deep in the rainforests of Borneo? How will it benefit Indonesia, the nation to whom these particular Borneo forests belong?

Who should benefit from the development of resources from tropical rainforests was among the most important and divisive issues arising from the United Nations Conference on Environment and Development

(UNCED) in Rio de Janeiro in June. A key element of the Convention on Biological Diversity signed in Rio by 154 countries, is the notion that the wealthy industrialized nations of the world no longer shall have free access to useful plants and animals - the "biological resources" - of the poorer developing nations, but should be obliged to pay for them by providing training, technology, and funding for conservation, and to share any profits or benefits derived from them through joint ventures. Among the few nations that did not sign this convention, most notable was the United States, whose large pharmaceutical industry objected to sharing their exclusive right to profit from the commercial development of plant-based drugs and other natural products, currently protected by patents.

Some degree of the protection afforded by patents is justified by the high risk, cost, and length of time associated with the development of commercial drugs from natural sources. In North America, one in 10,000 chemicals investigated will emerge as a new drug, the process will take at least 10 years, and the cost of research and development for a single drug will likely exceed \$125 million. But tropical rainforests, and the rich diversity of species they contain, are concentrated in developing nations, and are therefore primarily a Third World resource. The challenge

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Rubec: Cont. from pg. 16

recognized, and could significantly raise the total area of land and water in Canada secured for conservation purposes.

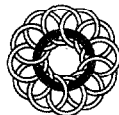
In working landscapes, biodiversity conservation is already being pursued through private stewardship programs, privately held ecological reserves, and land-

owner agreements such as the Canada-United States North American Waterfowl Management Plan (NAWMP) and the Permanent Cover Program of the Prairie Farm Rehabilitation Administration (PFRA). Since 1988, over 130,000 hectares of wetland and associated upland habitats have been secured in initial efforts by the NAWMP in

Canada. These programs are well targeted and exemplify the directions required in our national efforts.

Clayton Rubec is Head of the Secretariat of the North American Wetlands Conservation Council (Canada), has published extensively in the field and is author of the internationally recognized book: "Wetlands of Canada" (1988).





Leaman: Cont. from pg. 17

ing question is not whether the benefits derived from these resources should be shared, but rather how they can best be developed to meet the needs of the countries and peoples to whom they belong.

In 1989, the government of Costa Rica established a National Institute of Biodiversity (INBio), and struck a deal with Merck, the largest pharmaceutical company in the world. INBio would provide Merck with plants to screen for useful chemicals, in exchange for \$1 million and a small percentage of the profits derived from commercial development of Costa Rican plant products. While there is some feeling within Costa Rica that its valuable resources have been undersold in this deal, many other countries are watching the progress of this association with great interest as a model for collaboration with the pharmaceutical industry.

The World Health Organization estimates that 80% of the world's human population relies exclusively on

traditional medicines for health care. While the process of developing a commercial drug from a traditional remedy frequently results in a safer, more effective treatment, most commercial drugs are either too costly or unavailable to the majority of people in the world. One example of an effort to redirect research funds toward more widely accessible products is a large project known by the acronym TRAMIL, currently underway in the Caribbean to study the scientific basis for traditional medicine. This project is identifying safe and effective traditional treatments and encouraging their wide distribution as inexpensive alternatives to modern drugs.

Across the mountains from the Kenyah villages where I work, among some villages of Iban people in Sarawak, almost no one remembers the traditional medicines their elders once extracted from the surrounding rain forests. The sick are taken downriver to a Dr. Lee, who administers "the mixture" - a blue fluid given for ailments ranging from

the flu to gonorrhea. The replacement of a rich indigenous system of medicine, evolved over thousands of years, with some local form of "the mixture" - a syringe cult that is inferior to both traditional and modern medicine - is the fate of many remote tribal peoples. This may be the fate of the Kenyah, too, when the current generation of healers is gone. The activities of non-profit organizations such as the Rainforest Alliance and Conservation International, and of a new culturally-responsible breed of pharmaceutical company (for example, Shaman Pharmaceuticals) are aiming to encourage, rather than impoverish, traditional knowledge by creating opportunities for young people to learn their own traditional systems of medicine, and to derive commercial benefits for their people from this knowledge.

Danna Leaman is an ethnobotanist currently working on a doctoral degree at the University of Ottawa. She has collaborated with the Indonesian National Institute of Sciences and the World Wide Fund for Nature.

Miller: Cont. from pg. 4

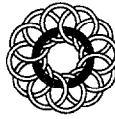
necessary but not sufficient. Biodiversity conservation must be exercised across whole landscapes to cover animal migratory routes, plant dispersment, habitats found in farms and harvested forests, and the varied habitat required by the species and genetic variations found in any particular region. This calls for innovative institutional arrangements among public sectors -- and cooperation with private industry, villages, local farm, forest and fisherman associations, and universities.

4. **International Cooperation.** Biodiversity knows no political boundaries. Animals migrate across borders, and so does pollution, marine currents, and climatic patterns. While some countries possess knowledge, skills, and technologies that are elsewhere in short supply, biodiversity -- like the atmosphere and the high seas -- is of common interest to all humankind. Thus, international cooperation to conserve biodiversity is in the interest of all countries.

5. **National Policies and Plans.** Formulating national policies on biodiversity legitimizes action and investment in reserves, germplasm facilities, inventory, and experimentation in sustainability. Plans can be drawn that will integrate biodiversity objectives and activities into the development process. Assets can be identified, needs determined, and requirements for international cooperation detailed. Only in this way can local, regional, provincial, federal organizations and agencies articulate proposals that are open to debate and consultation, and negotiated with potential partners.

Kenton Miller is the Director, Program in Biological Resources and Institutions, World Resources Institute, Washington D.C.; International Coordinator for the Joint WRI, IUCN, UNEP Biodiversity Programme.





Potential Impacts Of Climate On Biodiversity And Food Production

by Sid Embree and Roger Street

The Intergovernmental Panel on Climate Change (IPCC), established by the United Nations Environment Programme and the World Meteorological Organization (WMO), stated in its most recent assessment, that natural ecosystems and their component species could face significant consequences as a result of the global increases in the atmospheric concentrations of greenhouse gases and associated climactic changes. Biological diversity is therefore expected to be affected by changes in climate. Uncertainties exist however, as to quantitative impacts, particularly at the regional level, due to uncertainties in timing, magnitude, regional patterns of climate change, the response of natural systems as well as individual species to such change.

In its "business-as-usual" scenario, the IPCC has estimated that emissions resulting from human activities are increasing substantially the atmospheric concentrations of "greenhouse gases" (e.g., carbon dioxide, methane, CFCs, nitrous oxide and ground-level ozone), enhancing the natural greenhouse effect. Studies indicate that if no response measures are taken, global mean temperature will increase at a rate of approximately 0.3°C. per decade. This will result in an increase of global mean temperature above present values of about 1°C. by 2025 and 3° C. before the end of the next century. These temperature changes are expected to be accompanied by a rise in global mean sea level of approximately 6 cm. per decade over the next century. Both projected temperature changes and changes in sea level will have an impact on regional vitality, especially low-lying islands and coastal

areas that are particularly vulnerable to changes in sea level.

In examining the impacts of climate changes on natural ecosystems and their component species, and thus biological diversity, it is evident that the severity of these impacts will depend to a large degree on the rate of climate change. Concern for the survival of ecosystems is further compounded by the likelihood that changes in climate will not be steady. Therefore surprises should not also be ruled out.

Over the next fifty years, projected changes in temperature and precipitation suggest that climatic zones, which are currently associated with vegetation and habitat distribution, could shift several hundred kilometres polewards, and several hundred meters in altitude in mountainous regions. Ecosystems are not expected to move as single units in response to these climatic shifts. Flora and fauna which comprise these ecosystems may respond differently and are likely to lag behind the climatic shifts. Species surviving in their present location could possibly find themselves in a more or less hospitable climatic regime. The implications are that their ability to survive will depend on their ability to adapt to the altered environment, habitat and species relationships.

A reduction in biological diversity could result in a negative impact on species and ecosystems adaptability to climate change. This negative impact would be most apparent for those species and ecosystems for which the options available for adaptation are already low (e.g., restricted or isolated species and ecosystems), and where further loss of biological diversity could adversely affect ecosystem stability and/or resilience.

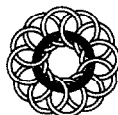
Even minimal climate change could have major consequences for natural land and water-based ecosystems. The greatest effect will be on plants since they are directly affected by temperature and rainfall and cannot move if conditions become hostile or counterproductive. Changes in temperature, rainfall patterns, humidity and sea level can affect predation, competition, reproduction, developmental rates, speed and the distance of travel of insects and fungi.

Natural systems may be unable to adapt to rapidly changing climatic zones. Extinction of species could increase from current rates caused by human intervention (e.g. land-use changes including deforestation) and natural factors. Migratory pathways that are blocked by water, agricultural lands, roads, urban areas or other obstacles could inhibit prospects for survival for some species. Nevertheless, some species may benefit from climate change, resulting in increased habitat size or a reduction in the population of competitors or predators.

The impacts on fisheries would vary, and would depend on factors such as sensitivity to temperature, prospects for migration, increased growth of plankton, and changes in aquatic habitat characteristics. There could be reductions in populations, although not necessarily species loss, of shellfish, fish and waterfowl from saltwater intrusion into wetlands as sea level rises.

Estuaries may enlarge, by submerging low-lying areas, and become more saline. While increased salinity in estuaries could reduce the abundance of freshwater species, marine species could increase. Some coral reef species may not survive warmer waters, thereby

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Embree & Street: Cont. from pg. 19

threatening the integrity of reef systems and weakening their capability to protect coastal ecosystems from the effects of continuous wave action. Similarly, coastal marshes and swamps may not be able to keep pace with sea level rise. Some wetlands may migrate inland. Effects on migratory birds would depend on the impacts on their habitats. Some winter habitats could become more productive, while sea level rise and changing climate could result in a loss of wintering grounds and inland wetlands.

On land, tree migration would lag behind shifts in climatic zones resulting in a potentially smaller geographical range for some species. Changes in forest composition are also likely, depending on species, soil, moisture and other factors. Such changes may be visible within 30 to 80 years.

Agriculture is probably more sensitive to climate than any other sector of the economy. Although impacts would vary depending on

the species, general impacts of climate change on agriculture may include: increased or reduced yields; northward and altitudinal shifts in productivity; expanded habitats for agricultural pests; changing precipitation patterns, including increased aridity and higher rates of evapotranspiration; thermal stress on plants; changes to production and export patterns; and longer growing seasons. Increasing concentrations of carbon dioxide in the atmosphere could have a fertilizing effect on some crops by stimulating growth and improving water use efficiency.

Genetic diversity provides a source of genes for adaptation not only in natural systems but also for crops and animals to new climates. It is likely that farmers will adapt, on their own, to most effects of climate change. How they adapt will depend on the nature and severity of impacts and the technical and managerial options open to them. The success of adaptation will depend on the costs. One of the most important considerations will be additional demands from multiple uses on water resources,

which would also be affected by climate change. Flexibility in the world trading system could also promote successful adaptation.

On the other side of the coin, the inclusion of biomass in the agriculture and forestry sectors, provides various opportunities for responding to climate change, through storage of carbon in soil and trees. Irrespective of these opportunities, biomass-based strategies for responding to climate change must accommodate the need to maintain maximum diversity, as opposed to maximum use of afforestation of plantation crops to absorb carbon dioxide.

Sid Embree works within the Atmospheric Environment Service, Environment Canada. She works on international policy issues and with developing countries in the area of capacity building for the implementation of the Climate Change Convention

Roger Street is currently heading up a group of specialists within the Atmospheric Environment Service, Environment Canada, examining Canada's climate to identify temporal and spatial trends and patterns.

Buckley: Cont. from pg. 10

Largely composed of scientists with expertise in taxonomy and biogeography, plus government, industry and NGO representatives, two draft reports were submitted. The last report released for public discussion in February 1992, was debated at a large public conference in mid-March. The Conference which concentrated primarily on the Australian NBS was open; several hundred people attended. Dr. Kenton Miller of the World Resources Institute provided the keynote speech. Not surprisingly, economic issues proved particularly contentious, and industry and ENGO representatives most vocal. Of greatest concern were the effects of measures to conserve biodiversity on the international competitiveness of industry. The

other issue was: What compensation would be paid to landholders and other land users for any reduction in rights of land use or land access?

Before Rio, stakeholders from industry called for further discussion before the NBS was to be finalized. They complained that their representation on BDAC was inadequate, and argued that the NBS should not be allowed to preempt the recommendations of the ESDWG. Industry representatives also proposed that the Australian government should accept only those components of an international biodiversity convention which match existing recommendations from the ESDWG. In response, DASET added representatives from the mining, forestry, fisheries and tourism industries to BDAC. Agri-

culture was already represented. DASET also invited public submissions on the draft NBS until May 1st, 1992. The public responded with 160 submissions and the deadline for the final NBS was extended to September 1992. Rather than the final NBS strategy, a draft document of the Australian NBS was taken to the Earth Summit.

Ralf Buckley was a key player and consultant in the development and design of the Australian National Biodiversity Strategy. Author and Professor in the Division of Science and Technology at Griffith University in Queensland, Australia, Buckley is also adjunct professor in business and Director of the Centre for Environmental Management. He has worked in 40 countries and has more than 15 years of experience in commercial consulting and private industry.



Biodiversity, Biotechnology And UNCED 1992

by Edward Rugumayo

We all depend on the world's biological resources for our survival. Yet it is feared that a million plant and animal species are threatened with extinction over the next 20 to 30 years. Current estimates are that up to 70 percent of the 185,000 tropical plant species could disappear over the next 25 years. Most of the important centres of the world's biodiversity are in developing countries. Tropical forests alone are believed to contain about half of the world's species. A monetary figure on the total value of biological resources to the world's community is difficult to estimate but U.S. agriculture alone benefits to the tune of several billion dollars a year from the use of plant genetic resources originating in developing countries. Plant-based drugs sold in industrialized countries are worth over US \$40 billion a year.

Even so, genetic diversity remains both underutilized and undervalued. Currently only about US \$50 to \$60 million is spent on conserving plant genetic resources *ex situ*. Estimates show that US \$500 million is needed for urgent work in genetic resource conservation of plants alone and even more funds may be required if we are to adequately protect both plant and animal biodiversity. While gene banks and *ex situ* methods of conservation have a role to play in this protection, there is no substitute for in situ conservation; whether it be in the farmer's field or in tropical forests.

Indigenous knowledge is also important because indigenous groups have tended to use a much broader variety of plants and animals to survive and are therefore biodiversity experts of sorts. Unlike most other societies today who use only about 150 plant species for food and rely on just 30 of these

species for 95 percent of food sources, indigenous communities use a far wider range of species than does modern agriculture. Communities such as the Amerindians, for example, use between 500 and 2,000 species for their food. The key to sustainable utilization of these genetic resources is, therefore, in indigenous knowledge. It is also in the technology developed by communities that use them.

Likewise, concern for the conservation of biological diversity recognizes that severe erosion has taken place as a result of the commercialization of agriculture and forestry. This has led to genetic uniformity and the erosion of life forms. A related concern has therefore arisen for the protection of genetic diversity from the potential dangers of commercialized conservation. Commercialized conservation is linked to the emergence of new biotechnologies which have transformed global genetic richness into raw materials for the industrial protection of food, pharmaceuticals, fibres, etc. Commercialized conservation judges conservation in terms of its present or future use for profits. This approach, an attempt to reshape the conservation movement using the logic of market forces, does not take into account that this will more or less erode genetic diversity.

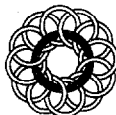
Biotechnology is inextricably linked to biodiversity and it promises to change life at least as profoundly as the Industrial Revolution. It can greatly increase our effectiveness in the areas of crop production, animal husbandry, food processing and health care; cutting costs and improving production and it may provide us with potential solutions for the poor, the hungry and the marginalized in the developing world. Still, the ultimate uses of biotechnology

are solely dependent on the motives of those who set the agenda for research and development and those who decide the nature and priorities of the problems to be solved. Completely in the hands of private industry, outside of any democratic decision-making process, accordingly, trends in biotechnology research and development have been primarily oriented towards Northern interests and the pursuit of profit. This scenario, where technology introduced into a profit-oriented system will only serve to further disadvantage the poor, is one of the major concerns for non-governmental organizations (NGOs), and it was an important part of how biodiversity was discussed at the conference in Rio.

In spite of the immeasurable contribution that Third World biodiversity has made to the wealth of industrialized nations, the North continues to create legal and political frameworks to make the Third World pay for what it originally gave. The North should both acknowledge and pay royalties dating back hundreds of years to Third World peoples who have protected and continue to protect biodiversity despite the ecocidal policies of past colonial governments and (more recently) multinational corporations. The latter, who patent byproducts of biotechnology for huge sums of money should be aware that they would not be able to do so in the absence of this biodiversity. Emerging trends in global trade and technology work inherently against justice and ecological sustainability. These must be thwarted by democratic forces worldwide.

We are entering a crucial stage in the debate over the control of the world's genetic resources. The UN Convention on Biodiversity

Continued



Conserving Canada's Marine Biology

by Leone Pippard



With the demise of the Soviet Union, Canada now has the distinction of having the longest coastline (244,000 km) of any nation in

the world. Yet, despite the reality that eight of 10 provinces and both territories are located adjacent to marine and aquatic environments, Canadians do not perceive that Canada is a maritime nation. The interior of Canada is so vast that land-locked Canadians have traditionally looked inward, not outward, to where land interfaces with the Atlantic, Arctic, and Pacific Oceans. It is a country-view that has in fact retarded the creation of a network of Canadian marine parks and resources. Only two of the Canadian Parks Service's 29 marine regions are represented by federal marine parks--Georgian Bay and West Vancouver Island Shelf. The remaining 27 regions currently have no protection under the federal parks system, although establishment agreements are being negotiated to create two more marine parks in the area of the confluence of the Saguenay and St. Lawrence rivers, and in association with the South Moresby/Gwaii Haanas National Park Reserve. In summary, while seven percent of Canada's envisioned National Marine Park System

is in place, 93 percent of the system remains to be established. The aim of Canada's Green Plan is to have created three new national marine parks by 1996.

Canadians also do not understand how critical our coastal waters are for the support of diverse marine species' communities. We still see the oceans as teeming with life. Yet, the reality is that the average depth of the oceans (1,700 metres) is just a little more than three stacked CN Towers (1,659 metres). Meanwhile, life in the oceans is concentrated in only about four percent of the ocean's total body of water, where roughly 96 percent is just about as poor in life as a desert. Bringing this picture home, Canada's marine life is concentrated primarily in our shallow coastal waters, and above the continental shelves, in closest proximity to Homo Sapiens coastal concentrations. Our human uses and abuses of coastal waters as well as our exploitation of the species have a profound and direct impact on Canada's marine species.

The devastating outcomes of development because of insufficient knowledge or lack of stewardship about our marine species can be seen on Canada's shores. Too many fish and marine mammal populations are now threatened, endangered or lost forever, the victims of habitat loss, degradation, and over-exploitation. The St. Lawrence beluga whale, the Atlantic cod...just their names tell the

tale of environmentally unsustainable development. How can the trend be reversed?

Completing the system of marine park protected areas is part of the solution. While legislated marine parks will not stop air or water pollution from crossing their boundaries, nor will it stop commercial over-exploitation, they can serve to help protect the vital ecosystem hearts, the nutrient-pumps, the critical habitats of Canada's marine species, upon which ours and the species' survival, depends. Further, they can serve as visible indicators from which we can construct regional sustainable development plans to govern human activity along Canada's coasts. To complete the system of Canadian marine parks, in less than the usual time of 15 years it takes to create a park, will require greater efforts towards the education of Canadians to the need for marine parks. Greater innovation is also required to engage the participation of the regional public and experts earlier in the park planning process.

Leone Pippard is President and Executive Director of Canadian Ecology Advocates. A member of the National Round Table, Leone was also Ms. Woman of the Year in 1987, and has been instrumental in the creation of a marine park on the Saguenay River.

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and UNCED 1992 which put biodiversity into a social and geopolitical perspective, must establish a system which will ensure the conservation and sustainable use of biodiversity within an equitable framework. Such a system would recognize the rights of local communities and indigenous peoples

and their past, present and future contributions to conservation and development. If, on the other hand, the world's resources come increasingly under monopolistic control, the conservation of biodiversity and the sustainable utilization of biotechnology will be irretrievably jeopardized.

Edward Rugumayo organized regional consultations on NGO participation for the UNCED process. He is the Senior Programmes Coordinator of the Environment Liaison Centre International (ELCI) in Nairobi, Kenya. This article was first published as a Guest Editorial in "Network '92", March 1991.



Biodiversity And Trade *by Robert Thomson*

While much has been written about the biological impact of the "green revolution", commercial practices such as packaging, advertising and food engineering have contributed as much to the homogenization of agriculture as to the more well known effects of genetic manipulation.

The economic, socio-political and technological components of the modern international trading system reflect the "market" forces which dictate increased homogenization of consumer products, the "cola-ization" of consumption, which in turn is the product of the concentration of capital in the hands of fewer and fewer large corporations.

The development of large scale plantation and monoculture farming of sugar, tobacco, coffee, cocoa, spices and other crops after 1500 A.D. led inexorably to the standardization of crop species in order to exploit economies of scale and agricultural techniques. With the arrival of the "green revolution" in the 1950s, this standardization was extended to the genetic pool. This was achieved through the development of hybrid seed varieties which require standard applications of fertilizer, pesticides and irrigation.

The introduction of disease resistant high yield plants has slowly squeezed out local varieties in many parts of the world. This has caused a loss of genetic diversity which, in the long run, will make it impossible to maintain high productivity. Hybrid seeds, like mules, cannot replicate themselves. They require constant breeding from diverse genetic pools to combine qualities of yield, disease resistance, and the like.

As the basic gene pool becomes depleted through the combination of biological, economic and socio-political competition generated by modern trading conditions, it becomes more difficult to find the genetic material necessary to fight new diseases thrown up by natural selection. Simi-

larly, species must adapt to changing climactic conditions caused by global warming, desertification, and other natural and man-made phenomena. Increased homogeneity of output reduces post-harvest and processing costs. But, it also reduces our ability to draw on natural diversity and selectively adapt to new conditions.

Local communities, unlike transnational corporations, have a vested interest in long-term sustainability versus short-term yields. Their land has to feed its citizens and future generations. Based on hard experience, they cannot assume that outside resources will be able to sustain them. Aside from the fact that small farmers do not have the cash for high chemical and fertilizer inputs, they are also aware that their own long-term survival is linked to biodiversity.

The globalization and homogenization of cash crops and markets makes it more difficult for local communities to feed themselves, and increases their dependence on trading factors well beyond their control.

The alternative trading movement, through the development of more direct and participatory markets, and equitable links between consumers and producers, promotes an awareness of the rich diversity of social, political and cultural life in our world. Through the distribution of organic and less diversely blended coffees, teas and other food products as well as local hand made crafts, alternative trading organizations (ATOs) not only promote the consumption of diverse as opposed to homogeneous products, but they also promote the development of a diverse trading system. This diverse trading system strengthens local communities instead of making them subservient to the homogenizing demands of transnational corporations and "colaized" consumption.

By purchasing products in Third World villages from co-operatives

and other democratically organized producer groups, ATOs help those communities to retain their economic and cultural viability. Local sustainability in turn reduces rural-urban migration and pollution, excessive consumption and distorted consumer demands (as opposed to needs) of "modern" society.

While some may think that alternative trade is limited to an idyllic pastoral romanticism, it is in fact the trade model of the future, a serious option to the current unsustainable model of unequal South/North exchange of commodities for manufactured goods. The ATO precept of "think globally, act locally" can and has been extended to trade and barter in modern industrial products as well as commodities and handicrafts.

Canadian consumers may for the moment feel powerless to change the variety of corn that goes into their breakfast Corn Flakes, but they can already choose an alternatively traded coffee or tea, and send a signal to General Foods and other large corporations through their purchasing power.

As we become increasingly aware of the impact of our consumption on the environment and biodiversity, we must insist that trading companies adhere to codes of conduct and behaviour which respect biological and cultural diversity. As modern communications create the "global village", we must ensure that we don't create a monotonous homogeneous world society which can be wiped out by a single new societal "disease". Fair trade, not free trade, is the motif of the alternative trade movement, and respect for cultural and socio-economic diversity is as important as, and closely linked with, biodiversity.

Robert Thomson is the Chairperson of the Bridgehead Board of Directors. Bridgehead, an Alternative Trading Organization (ATO) owned by Oxfam-Canada, is a founding member of the International Federation for Alternative Trade (IFAT).



Agricultural Trade And Biodiversity:

Win-win Opportunity For Environment And Economy by J.H. Patterson



Since publication of *Our Common Future* by the Brundtland Commission in 1986, the notion of sustainable development has

gained conceptual acceptance by most sectors in Canada. Sustainable development is seen to be a product of linking environmental and economic factors into day to day decision-making. More recently, biodiversity conservation has also emerged as a globally significant environmental issue. Because the concept is not well understood, in many quarters there is a high degree of uncertainty and apprehension over its implications. To some, the environmental component of sustainable development has been overtaken by biodiversity. At one extreme, biodiversity objectives are thought to be achieved only through wilderness protection. At the other extreme, it is seen to adversely affect sustainable economic development of natural resources. Both extremes imply significant economic and perhaps social costs.

In the context of this article, biodiversity conservation means the maintenance and restoration of viable plant and animal populations and the physical environment at levels that sustain essential ecological processes. An integral component of this definition is the presence of viable human communities based on the sustainable, environmental and economic utilization of natural resources.

The area of greatest biodiversity impact and risk in Canada is the southern agricultural working landscape. Depressed wildlife population, particularly in areas that are cash cropped for grain and oilseed

production, serve as an indicator of an environment under severe stress. This stress has had equally devastating impacts on both the economic and social viability of the region.

The presence of farming per se has not caused this environmental and economic dislocation. Rather, ecological and economic integrity have been subject to the impact brought about by a substantial expansion of cultivated acreage beyond the sustainable land base onto marginal lands and wetlands -- an area of critical importance to biodiversity. By and large, this expansion was not fuelled by market forces alone. In the 1980s and early 1990s, cropping practices responded to agricultural policy and program support programs that were based on the area of land under commodity production. The negative impacts of these policies and programs have been unintended responses to market distorting and price depressing international agricultural trade disputes.

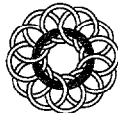
Canada leads the world in the development of a policy framework for the transformation to environmentally sustainable agriculture. The agriculture and conservation sectors have worked closely for a number of years and are in general agreement as to what needs to be done to restore the environmental sustainability of the agricultural landscape. However, the overriding negative impact of the international trade dispute has created an economic and political environment where changing agricultural policies and programs are perceived as a threat to the industry.

There is a ray of hope on the horizon. Ratification of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) and of the North American Free Trade Agreement (NAFTA) would

lead to a phased liberalization in agricultural trade. The current GATT text calls for a reduction in agricultural support programs amounting to 20 percent and 36 percent for domestic and export support programs respectively. Over a six year phase-in period, these reductions would grow to \$1 billion annually in Canada and would provide a strong impetus to modify agricultural policy and support programs to encourage sustainable development. In addition, UNCED '92 has raised expectations for new and expanded biodiversity conservation efforts in Canada.

Using trade liberalization to fuel sustainable agriculture and biodiversity conservation makes good environmental and economic sense. OECD countries are currently expending over US \$300 billion annually on agricultural subsidies. The negative environmental and economic impacts of these subsidies are not just felt domestically but are devastating to developing countries. The World Bank has recently estimated that a 50 percent reduction in trade barriers by Europe and the United States would raise the value of exports from developing countries by \$50 billion (U.S) a year, providing critical resources to address environmental and other problems.

Closer to home, Canadian grain and oilseed products receive annual subsidies in the order of \$45 per acre. In spite of this, farmers have demonstrated a willingness to set aside marginal lands for permanent cover for \$15 per acre. Using the Canadian prairies as an example, a set aside program targeted at the estimated eight to 10 million acres of marginal and fragile land in grain production, could reduce costs to the public treasury in the order of \$240 million per year.



History and Evolution of the Concept of Seed Banks - Where are We Today?

by Pat Mooney

People have been collecting seeds since the Pharaohs. History records Egyptian sorties down the Nile and Sumerian campaigns throughout the Middle East that brought home exotic flora for the delight and profit of conquerors. The Chinese included botanic collections in their first zoos long before Christ and the Mayans and Aztecs made botanic gardens a major cultural occupation. Europe's first botanic collections were herbal gardens collected by apothecaries in the early Middle Ages. Ancient monasteries also gathered and maintained botanical collections.

It was not until the turn of the century, however, that a small band of innovative scientists took over a tiny island off the coast of St Petersburg and made the collection and conservation of seeds their full scientific pursuit. Russia's Bureau of Plant Introduction and its famous leader, Nikolai Vavilov, became the first in the world to recognize that scientific plant breeding would lead to the extinction of traditional food seeds by farmers. Vavilov and his colleagues launched more than 60 expeditions collecting more than 150,000 folk varieties of seed from the rice-fields of Japan to the potato plots of the Andes.

By the late 1940s, U.S. agronomists began to observe what the Russians had predicted. The mass introduction of genetically-uniform, machine-harvested seeds was wiping away the genetic diversity of the world's food supply. Not until the late 1950s, however, did the U.S. establish its first gene bank. Only after the

Americans lost 15 percent of their corn crop and the Russians had experienced a catastrophic halving of their wheat crop in the early 1970s, did the scientific community fully realize the importance of crop genetic diversity. Without a conservation strategy, introducing new uniform seeds into traditional fields was like building your roof with stones from the foundation.

A worldwide effort to collect and conserve seeds began in 1974. More than 60 gene banks were built and close to three million seed samples were placed in storage. Offering both temperature and humidity control, scientists theorized that the hardiest seeds could stay alive in storage for virtually thousands of years. Collectively, the world's plant breeders breathed a sigh of relief and went back to the business of developing still more uniform new varieties.

In the 1980s, however, gene banks took on new scientific and political dimensions. First, studies showed that banks were more tombs than storehouses, and that the rate of genetic erosion was actually greater in storage than in the field. Poor funding, inadequate science, and fickle government interest were all to blame.

Secondly, developing countries -- who contributed more than 90 percent of the world's "banked" seeds -- began to wonder why their genetic heritage was tucked away in developed country banks rather than close to home. Further, gene banks were seen as part of the North's "food weapon" and the free exchange of Third World seeds was some-

times prevented for political reasons by industrialized countries.

Much of the political debate took place in the UN's Food and Agriculture Organization in Rome. By the mid-80s, FAO had established both a Commission and a legal Undertaking on Plant Genetic Resources. For the first time, gene banks came under international control.

Today, the scientific community largely agrees that the best way to conserve the world's food supply is through crop genetic diversity. The best way to protect diversity is by maintaining live seed samples at the community level -- where the seeds come from. Gene banks are a back-up emergency storage facility only. The world cannot afford to place all its genetic "eggs" in one "basket".

Pat Mooney has worked for more than 25 years as an NGO activist on international environment and development issues related to sustainable agriculture and biodiversity. Co-founder of the Rural Advancement Fund International (RAFI), his work on biotechnology and plant genetic resources has led to a series of international and regional dialogues with the Consultative Groups on International Agricultural Research (CGIAR) and FAO. (See insert article "Seeds of Hope" for more information). Author of several books on these issues, Pat won the "Alternative Nobel Prize" known as the Right Livelihood Award from the Swedish Parliament as well as the famous "Giraffe Award" given to people "who stick their necks out."

Patterson: Cont. from pg. 24

Rural development income options for alternative use of set aside lands could add to the performance of the rural economy. Payments to landowners that are consistent with international trade arrangements could help sustain farm families during the period of adjustment to alternative land use options that

build new economic activity into the rural community.

Effective biodiversity conservation in the agricultural working landscape can only come about through revitalized rural communities supported by more diverse and stable income opportunities that are economically and environmentally sustainable. Positive action would be a cost effective and affordable

imperative for Canada. Inaction would contribute to an economic, social and environmental liability of ever growing dimensions.

J.H. Patterson is Director of International and Government Relations for Ducks Unlimited Canada and President of the International Waterfowl and Wetlands Research Bureau.



The Consultative Group On Biological Diversity, Inc. (CGBD):

An Informal Group of Foundations

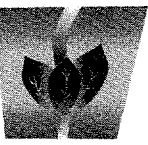
by Theodore M. Smith

MISSION STATEMENT

The Consultative Group on Biological Diversity recognizes that there is unprecedented urgency to protecting biological diversity as an invaluable global resource. Exploding human populations and high resource consumption rates are destroying natural habitats and accelerating the pace of irreversible plant, animal, and ecosystem losses. To arrest the rate of extinction and global biotic impoverishment, the Consultative Group will seek to:

- Increase foundation funding for biodiversity conservation;
 - Identify current gaps in funding and contribute to setting long-term program agendas for investments by foundations, government agencies and NGOs;
 - Improve the quality of foundation grantmaking through the provision of networking and informational services to Consultative Group members;
 - Assist grantseekers by providing information on foundation programs and funding sources.
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Seeing The Forest



Last October, the African elephant, mortally threatened by the ivory trade, was finally classified as an endangered species. Behind headlines covering the elephants' slaughter, and other alarming reports on the burning of Brazilian rainforests and the shrinking of habitats of the Chinese panda, lies a bigger, quieter story: the collective destruction of plants, animals and insects worldwide caused by human encroachment.

The real news is that our planet's biodiversity (short for biological diversity) is in great jeopardy. **A small community of scientists recognizes that the ultimate measure of the earth's environmental health is the diversity of life itself, not pathologies such as global warming, pollution, ozone holes or whatever commands the current environmental agenda.** So many species are disappearing that their rate of extinction, according to a 1989 National Science Report, comprises "the most catastrophic loss of species in the last 65 million years." Species of course have come and gone over time, but entomologist E.O. Wilson, an authority on the

subject, places the current annual rate of loss in the neighborhood of "1,000 to 10,000 times that before human intervention."

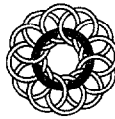
In scope as well as essence, the problem can seem overwhelming. But both the U.S. government and a group of American foundations have set out to do something about it. Three years ago, under congressional prompting, the U.S. Agency for International Development (AID) began making grants to non-profit organizations willing to work in the area of biodiversity conservation. One AID program funded the newly formed Consultative Group on Biological Diversity, a two-year-old consortium that encourages foundations to become active in the field. With additional support from the Ford Foundation and Rockefeller Brothers Fund, CGBD began to organize workshops and develop agendas for funders committed to the field.

Led by Colin Campbell, president of the Rockefeller Brothers Fund, the consortium opens membership to foundations wishing to explore grantmaking possibilities in the broad field of natural resource conservation. Economic policy and the environment, marine

biodiversity and Third World institution-building are among the specific fields currently attracting CGBD member attention. Members are encouraged to collaborate, and recently, several made grants to the Latin American Plant Sciences Network (based at the University of Chile) as a way to stimulate scientific progress in Latin countries. Conservation advocacy groups -- both at home and abroad -- are also drawing financial support from other members. In fact, to date nearly every biodiversity-related grant has come from one of the group's 35 members.

Biodiversity: Why Worry?

By definition, biodiversity refers to all living things: animals, plants, insects, worms, shellfish, fungi and so on. The number of species is estimated to be somewhere between 5 million and 30 million, a spread that illustrates our limited understanding of earth's life forms. Of these, less than 1.5 million species -- and their niches in terrestrial and marine ecosystems -- have been recorded by science. No turnstile clicks for those that expire: most species simply



disappear in what ecologist Norman Myers calls "the twinkling of an evolutionary eye."

If the unprecedented rate of extinction continues, it is predicted that about 25 percent of all species on earth will be lost in the next quarter-century. Peter Raven, director of the Missouri Botanical Garden, argues that 50 percent are at risk. Almost exclusively, the cause of these extinctions is the reduction and violation of habitats by humans; and the main forces driving such behavior are often-interrelated factors of population growth, poverty and greed.

Is the disappearance of unknown plants and invertebrates cause for real concern? We tend, naturally enough, to be indifferent to the loss of most species and to focus instead on the more newsworthy plight of the cuddly or dramatic ones. Insects and plants lack "stage presence". But given the complex workings of ecosystems, it is never clear which species, if any, are expendable. For example, a single insect may be the sole pollinator of a plant that serves humanity in an important capacity.

It's ironic that as modern biotechnology develops immeasurable benefits from the wealth of genetic material found in tropical forests, that pool of resources is being decimated. The genetic properties of plants not yet discovered would almost certainly provide vast stores of food and medicines to sustain a burgeoning global population. Yet plants, especially those undiscovered or unstudied, lack advocates and defenders.

In the 1980s, a common Mexican weed was found to be a pest-resistant strain of maize, a discovery that affects millions of the world's grain consumers and could be worth billions of dollars. One pharmaceutical company has profited handsomely from a drug used to treat hypertension that has natu-

ral origins in the toxin found in a South American viper's venom. And the rosy periwinkle of Madagascar contains properties effective in combating childhood leukemia and Hodgkins disease. Some species now being extinguished may be ones that could have cured AIDS, offered a safe and more effective birth control compound or reversed some forms of incurable cancer.

The Global Dimensions

About 70 percent of the world's plant and animal species are located in the humid tropics -- most of them in the rainforests that cover only about seven percent of the earth's surface. The highest levels of species diversity are found in the countries of Brazil and Colombia in Latin America and in the Southeast Asian archipelago of Indonesia. Islands often contain extraordinary levels of endemic, or native species -- notable examples being Madagascar, the Galapagos and New Caledonia. Multicountry regions at the head of the Amazon (Bolivia, Peru, Ecuador, Venezuela), central West Africa (Congo, Zaire, Cameroon), and parts of Central America and Malaysia harbor great endemic concentrations.

To put comparisons in sharp relief, Ecuador contains an estimated 20,000 plant species, while Minnesota -- twice the size of Ecuador -- has about 1,700. Ecuador is home to almost double the number of bird species found in all of Canada and the U.S., and has more than 100 species of the eastern U.S.

Endangered rainforests contain the vast preponderance of species diversity, yet they are among the most fragile of habitats. As a digital display at the Bronx Zoo informs all visitors, these primary forests are being destroyed worldwide at the alarming rate of 100

acres per minute. When primary forests are cut down, only a fraction of the original species survive to repopulate this land. That explains why rainforest losses are often used as a proxy for monitoring the loss of species.

Since most biologists reside outside the tropics, it follows that most funding for biological research is devoted to short-term needs defined by industrial nations. As a result, training and research in tropical biology are either grossly underfunded or virtually neglected. The same is true for biodiversity conservation.

Funders Respond

The need to train scientists and conservationists in developing countries has attracted the attention of a small group of American environmental grantmakers. The W. Alton Jones Foundation virtually pioneered in the field: in 1982, Jones established its Sustainable Society Program, which included a biodiversity component. In 1988, the Virginia-based philanthropy granted a total of \$1.7 million for 42 domestic and international biodiversity conservation initiatives; they ranged from building the institutional capacity of tropical conservation organizations to land acquisition and the management of protected areas. Last year, one Jones foundation grant was made to assist the government of Indonesia in setting national policies for biodiversity conservation. "We are getting vastly increased number of proposals from newly established nonprofits," says Jones' program director, Richard Johnson. "There is a great need for more funders to take an interest in international biological diversity."

Although many biodiversity grants do go to overseas organizations, funders also recognize the important connections between global, national and grassroots

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environmental issues. The John D. and Catherine T. MacArthur Foundation's program emphasizes worldwide diversity. In 1988, the foundation granted \$10.5 million, \$2.2 million of which went to its U.S. Tropical Initiative for the Protection of Resources in Hawaii, Florida, Puerto Rico and the Virgin Islands.

Other funders, limited to domestic grants by charter or trustee interests, find opportunities to support global protection through local organizations. The Geraldine R. Dodge Foundation supported the training of New Jersey secondary teachers in tropical biology by funding their participation in EARTHWATCH's tropical forest research expeditions in Central America. Dodge also supports National Public Radio reporting on international biological resource issues. The California-based C.S. Fund financed a pathbreaking study on marine biodiversity -- a topic almost entirely neglected until recently. Dodge, Jones, MacArthur, Ford and the C.S. Fund are among the original nine members of the Consultative Group on Biological Diversity; others are Rockefeller Brothers Fund, Pew

Charitable Trusts and the Jessie Smith Noyes and Rockefeller foundations.

New York's Frand Weeden Foundation, another CGBD member and one of a handful of foundations that has a specific grantmaking focus on biodiversity, took a bold step in 1988: a grant to Conservation International for the first "debt for nature" swap. With the foundation's grant, assisted in exchanging \$100,000 for \$650,000 of Bolivian debt, with the Bolivian government in turn agreeing to establish an endowment fund to pay for managing the Beni Biosphere nature reserve, home to hundreds of plant and animal species.

Other examples of CGBD members' grants include one by the Island Foundation to the nonprofit Caribbean Conservation Corporation to train Latin American biologists in field research techniques in Costa Rica; Noyes and Ford foundation support to boost the UN Statistical Office's efforts to develop a global handbook for environmental accounting; an A.W. Mellon Foundation grant to the New York Botanical Garden for research on tropical plants of economic value; and the Joyce Mertz-Gilmore

Foundation's financing of a World Wildlife Fund scientific conference on the impact of global warming on biodiversity.

The Consultative Group's forward agenda ranges widely. It seeks to engage such difficult questions as: How can national economic policies protect rather than destroy biological diversity? How can scientists more effectively communicate to humanity information on the high costs of ecosystem destruction? Can Third World nonprofits become a significant force for sustainable development? And, how might the "global commons" -- those parts of this planet, especially its atmosphere -- be best managed in the absence of effective international organizations?

Preserving our planet's biological diversity is a challenge. But as public policy challenges go, the demise of life forms has one compelling characteristic: irreversibility.

Theodore M. Smith, former president of the Agricultural Development Council, is Executive Director of the Consultative Group on Biological Diversity (CGBD) based in New York.

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natural resource continuity. For this reason, the suitability of such reserve zones, as a resource management tool for fisheries management on the Grand Banks, should be considered.

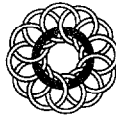
A more holistic approach to managing resources must be methodically worked out and implemented during the present hiatus in fishing effort, assuming, of course, that foreign overfishing is halted. Such a response would be in keeping with Canada's commitment, as stated in the Green Plan, to "set aside as protected space 12 percent of the country" and to "maintain

and enhance the health and diversity of our wild animals and plants". This change in approach is necessitated by the fact that attempts to manage Newfoundland and Labrador's fishery on case-by-case basis to date, have not met with any measure of success. The response must combine the energies and resources of all parties with a stake in the well-being of both the Grand Banks ecosystem, and its associated fisheries. To this end, a constructive and cooperative approach to the problems at hand must be forged and maintained, particularly between both orders of government, and among Canadian

and foreign governments. In the long term it is to everyone's advantage that this be achieved and as soon as possible given the present period of suffering and of economic and environmental dislocation in Newfoundland and Labrador.

David Vardy has been Deputy Minister of Fisheries for Newfoundland since 1989. Prior to this, he was President and CEO of the Newfoundland and Labrador Institute of Fisheries and Marine Technology.

*For further discussion contact:
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Commentary On "The New Economics" by Doug Miller



Phrases like "sustainable development" don't have much appeal or staying power with the general public.

Those of us that have been around since the days of the "conservation society" know this all too well.

While sustainable development has been an effective rallying point for a wide range of stakeholders, there is evidence to suggest the need for new terminology in order to engage the public. (Only one in five Canadians are even aware of the term sustainable development, let alone understand what it means.) Far from being a problem, this presents a significant opportunity for the Round Table movement in Canada, given changes in the broader public environment.

Recent public opinion research suggests that in the midst of widespread job losses and deep economic uncertainty, Canadians are intuiting a new economic paradigm - one based on lower expectations in order to achieve environmental and economic sustainability. For example, an *Environmental Monitor* survey of 1,500 Canadians found that fully eight in ten agree with the statement, "Simply buying environmentally-friendly products and recycling our waste is not going to be enough to solve our environmental problems. Canadians are going to have to consume less."

Other research shows Canadians don't believe current economic problems are a passing cyclical phenomenon, but rather believe fundamental structural change will be required. At the same time, their abiding environmental concerns continue to be reflected in both val-

ues and action. This unprecedented public receptivity for change presents a unique opportunity for the Round Table movement to provide the leadership needed to solidify this new economic paradigm.

Just what is the evidence to suggest that Canadians are ready to contemplate such a fundamental redefinition of economic "truth"? While more probing research has yet to be done, the *Environmental Monitor* has asked a series of questions over the last six months on related issues. The results indicate that a significant plurality of Canadians reject conventional wisdom in favour of a new view of economic reality.

Canadians were asked about two specific topic areas - the effect of tough environmental regulations on Canada's competitive position in the world, and whether tourism or harvesting generates the best economic return from old growth forest in Canada.

Industry has long argued that the tougher the environmental regulations are in Canada, the less competitive Canadian industry is in the world, since their competitors elsewhere are not required to spend as much money on environmental protection. When Canadians were asked what impact they believe tough environmental regulations in Canada will have on our competitive position, they were almost equally split between those believing that it will make us less competitive and those believing that it will either make no difference or indeed make us more competitive in the world. This no doubt reflects Canadians' belief that environmental protection is a growth industry that will benefit those countries leading the way.

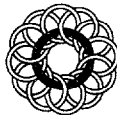
The second question addressed the forest industry, Canada's largest economic sector. While there are many competing values related to forests in Canada, in strict economic terms conventional wisdom says that cutting forests down to produce forest products is the way to maximize the economic value of our forests. However, in part to provide economic justification for their philosophical stance, preservationists in Canada have recently been arguing that tourism jobs in old growth forested regions of Canada could generate greater economic benefits than harvesting those same forests.

To establish where Canadians stand on this question, the *Environmental Monitor* asked them which of these two competing uses of old growth forest they believe can provide the most jobs and economic benefits to Canadians. Surprisingly, Canadians were equally divided on this economic benefits question.

Together, these findings suggest that Canadians' economic thinking is changing in fundamental ways, having been deeply affected by and linked to their environmental concerns over the last five years. This creates a receptivity to new economic theories that are starting to be advanced in other countries. (What is needed is nothing short of a replacement for Keynesian economics.)

"The new economics" appears to present the best framework for delivering sustainable development in Canada, and could catapult Round Tables into an even broader leadership role in the country.

Doug Miller is President of Synergistics Consulting Limited in Toronto and, together with Environics Research Group Ltd., produces the *Environmental Monitor* survey of public attitudes and behaviour.



Round Table Round Up

Nova Scotia Round Table

This fall the Nova Scotia Round Table on Environment and Economy will tour lands that have been actively managed for forestry for 50 years and visit a candidate site for designation under the Special Places Act.

This fall the Environmental and Sustainable Development Education Subcommittee will be finalizing its report regarding the incorporation of sustainable development education into the formal education system. The subcommittee has been working closely with the Department of Education.

Alberta Round Table

The Alberta Round Table on the Environment and Economy organized its first workshop in June with non-governmental organizations to examine the "sustainability agenda"; a second workshop in this series is planned for October on "the sustainability toolbox". A mini-conference with senior executives in the energy, chemical, and forestry industries is planned for the same day in October. An expert workshop is planned for September on indicator development. Several members have participated in teacher institutes over the summer, and a resource package was drafted for teachers, based on the Alberta Round Table's vision and principles.

Saskatchewan Round Table

Saskatchewan Premier Roy Romanow appointed a Cabinet Committee on Sustainable Development on June 4, 1992. The committee is reviewing the Conservation Strategy for Sustainable Development in Saskatchewan released by the Saskatchewan Round Table last June.

Manitoba Round Table

At its August meeting, the Manitoba Round Table on Environment and Economy passed a proposal to establish a Manitoba High School Round Table on the Environment and Economy. The main objectives of establishing this group would be to facilitate an understanding of sustainable development by youth in Manitoba and to provide input from high school students into the formulations of education and communi-

cation strategies for sustainable development through workshops, public meetings and class presentations.

New Brunswick Round Table

The Round Table presented Premier McKenna with its sustainable development strategy on May 15, 1992. The strategy documents consist of an action plan and a background document. The Premier has accepted the strategy in principle and has directed that an implementation approach for the government be prepared.

The New Brunswick Round Table will host the next national meeting of Round Tables. The meeting is scheduled for November 12-14 in Saint John.

Newfoundland and Labrador Round Table

Over the summer, the Newfoundland and Labrador Round Table on the Environment and the Economy (NLRTEE) was busy finalizing its first report to the Premier. It is anticipated that the report will be available in October 1992.

The Round Table has taken an interest in the area of State of the Environment Reporting. In this regard, it is pursuing an opportunity with Memorial University of Newfoundland, Centre for Earth Resources Research, to determine the feasibility of preparing a State of the Environment Report for the Province.

Prince Edward Island Round Table

The PEI Round table met four times during the past year. Much of the discussions focused on environmental education, sustainable development, and the Royal Commission on the Land. The Round Table formed two sub-committees to review position papers that came out of the Royal Commission on the Land. These papers dealt with the Arterial Highway System and the Coastal Area. The sub-committees will be reporting to the whole Round Table early in the year.

Ontario Round Table

On September 22, 1992, the Ontario Round Table released its "Re-

structuring For Sustainability" report. The 75 page report contains a series of proposals and recommendations that are geared towards reshaping Ontario's economy to reflect environmental costs and values. The focus is on ensuring the province has a healthy environment and maintains a strong economy. The release of the report completes this phase of work by the Round Table.

The next phase of work will be to promote and monitor the implementation of the recommendations, encourage the development of workplace and community Round Tables, and be a clearing house on multi-stakeholder problem solving strategies.

Yukon Round Table

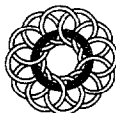
The Yukon Council has completed a review of proposed amendments to the Yukon's Employment Standards Act and submitted a consensus report to the Yukon Cabinet. The Council is initiating a review of the economic and environmental aspects of the Yukon Energy Corporation's management of Aishihik Lake and associated 31 megawatt hydroelectric generation facility at the request of the Minister responsible for the Corporation. The Council is also conducting its annual review of the implementation of the Yukon Economic and Conservation Strategies, and launching a project on the community-based indicators to determine the state of the environment and economy from a local perspective.

British Columbia Round Table

The B.C. Round Table recently appointed Ms. Joy Leach, former Mayor of the City of Nanaimo as the new Chair.

The Round Table has released the document *A Guide to Establishing a Local Round Table*, a "how to" document which outlines ways in which communities can establish local and/or regional round tables in their area.

The B.C. Round Table will soon be completing the Education element of its sustainable development strategy, which will include recommendations regarding sustainable development and education, to be released this fall.



Sustainable Urban Development: From Concept to Practice

This report, prepared by Dr. Virginia Maclaren for the Intergovernmental Committee on Urban and Regional Research (ICURR), contains three volumes.

Volume 1, Summary Report:

Outlines the methodology, presents definitions of sustainable development by municipal officials and concludes with important trends and lessons learned.

Volume 2, Annotated Bibliography:

Includes 43 references on sustainable urban development.

Volume 3, Compendium of Initiatives:

Is the focal point of Maclaren's report. It systematically describes 235 innovative sustainable urban development projects in 22 municipalities across Canada. The name, address and telephone number of persons responsible for these initiatives are also included. Diverse topics include transportation, hazardous waste management, water conservation, urban forestry, carbon dioxide and pest management among others.

To order copies please contact ICURR Press

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CORRECTION

In the Spring edition of the Review, we wrongly stated that Fiona Crofton was an engineer. She is an organizational research consultant. We apologize for misrepresenting her.

LIST OF NRT PUBLICATIONS

Sustainable Development Series

- ☐ Preserving Our World
- ☐ *Sustainable Development: A Managers Handbook
- ☐ Discussions on Decision Making Practices
- ☐ The National Waste Reduction Handbook
- ☐ On the Road to Brazil
- ☐ Toward Sustainable Communities
- ☐ Trade and the Environment (Available November 1992)
- ☐ Green Guide - Association of Canadian Community Colleges

Videos

- ☐ It's Our Future
- ☐ NRT Public Service Announcements

Other NRT Publications

- ☐ Exploring Incentives: An Introduction to Incentives and Economic Instruments for Sustainable Development
- ☐ Measuring Sustainable Development: Energy Production and Use in Canada
- ☐ NRT Multi-Media Diskette (MacIntosh Compatible)
- ☐ Interactive Computer Game/Quiz on Energy (MacIntosh Compatible)
- ☐ *Canada Japan Workshop on the Environment - A Summary of the Discussion
- ☐ Sustainable Development and the Municipality
- ☐ A Report on Waste Management for the Construction Industry
- ☐ Focus 2000: A Small Business Guide to Environmental Management
- ☐ NRT Poster: Objectives for Sustainable Development
- ☐ International Chamber of Commerce Poster

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