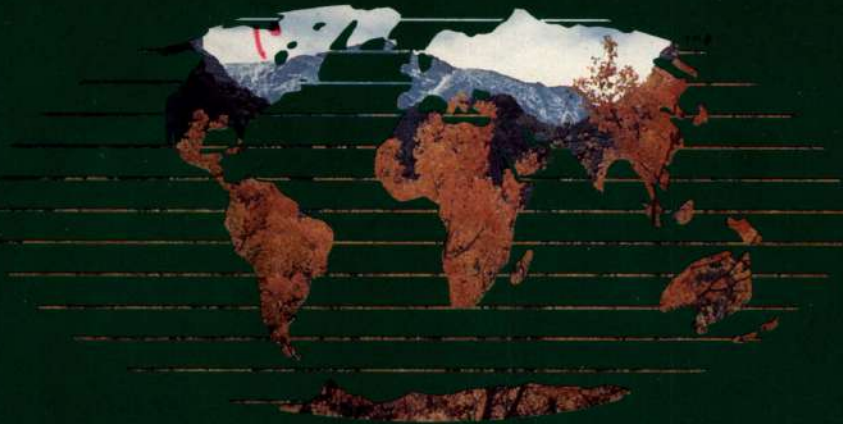


For the
CONSERVATION
of
EARTH



Vance Martin
Editor

For the
CONSERVATION *of* EARTH

WORLD WILDERNESS INVENTORY



Wilderness areas remaining in the world
The result of inventory conducted for
the 4th World Wilderness Congress.

For the
CONSERVATION
of
EARTH

Vance Martin
Editor



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Special thanks are also due to all of the participants in the 4th World Wilderness Congress whose work is published in this volume, to co-editor Darby Junkin, and for the help of Jack Armstrong, Craig Sarbeck, Alice Hubbard, Gina Magnum, Allison Tyler, Kenneth Player, Karen Groves, Kate Farren and Felicia.

From an idea in the Zululand wilderness grew the
World Wilderness Congress

Dedicated to
Sir Laurens van der Post, C.B.E.,
who understood what we were trying to do

"You are tired with years of civilization.
I come and offer you what? A single green leaf."
—Grey Owl, 1930

The symbol of the International Wilderness Leadership Foundation and the World Wilderness Congress is the three-pointed *Erythrina caffra* leaf. It expresses three relationships of man to his surroundings: Man to Man, Man to God and Man to Earth, and bespeaks the essential hope that man can reconcile the driving force of development with the sustaining power of the environment. Only in this way will we honor the spirit of all life and assure human survival.





FOREWORD

*Dr. Ian Player, Founder
World Wilderness Congress*

When the 4th World Wilderness Congress was finally over there were many emotional farewells. Differences in status, colour, nationality and religion had been put aside for a week in a search of answers for a common future for mankind. Friendships had been forged that would last a lifetime. The interlinking of science, art, music, politics and finance, poetry, religion and psychology as well as tribal lore had been powerfully demonstrated. There had been some unpleasantness and many crises, but we are human, after all.

I went for a short hike up into the mountains at Estes Park when all the delegates had gone. I sat looking over the splendid vista of the great Rocky Mountain National Park. It was a still day and in my secluded spot I was protected from the winds sweeping over the snow. I lazed in the warmth of the day and watched the golden leaves of aspen trees dance in the sun. Around me were high rock pinnacles and in my imagination I saw the feathered headdress of North American Indians watching me, or were they watching the herds of bison that once roamed in the valley below?

My mind drifted over the events of the past week and journeyed back through the years. I remembered how in 1955 I was a young game ranger stationed at Umfolozi game reserve with my companions Ken Tinley and Jim Feely. We talked often of the future of game reserves and conservation in southern Africa. We were a small, tightly knit, often lonely band of men in close contact with Zulu game guards such as Magqubu Ntombela, Gqakaza Ntombela, Mdiceni Mtetwa. It was the game guards who bore the brunt of the fight against poachers.

In many ways our task seemed hopeless. There was little money for the game reserves and our own salaries were a pittance. There was great hostility to conservation from Zulu tribesmen and white farmers. One could not blame them since they had suffered losses of cattle from a disease carried by the tsetse fly. The courts were most unsympathetic because for years there had been an official slaughtering of game in order to try and wipe out the tsetse fly. Now here

we were taking poaching cases to court. Magistrates imposed ridiculous fines: 10 shillings (\$1 in those days) for killing a warthog within the game reserve. The capture of poachers meant waiting throughout days and nights in the cold, wet bush, only to face a fierce fight with spear or gun. Frequently guards were badly injured. We were up against officials in government departments who had no sympathy for the game reserves or for conservation. They regarded both as a joke, at times a nuisance. We were subjected to delegations who came to discuss how the land would be used for other purposes such as cattle farms or settlements.

There was always some crisis or another and our morale was often at a low ebb. But after a few days walking out on long patrols and seeing the rhino, wildebeest, zebra, bushbuck and other animals, and after sleeping next to campfires while the jackal screamed and hyena whooped in nearby valleys, we would return to our main camp revitalized and ready to fight on for a cause we knew to be honest and just. We would have long conversations deep into the night, discussing how we could win public opinion to our cause.

One day Jim Feely, nicknamed "The Brain," because he had such an inexhaustible supply of knowledge, showed me the 10 fundamental principles of the wilderness concept in an American book on wildlife management. The words reverberated through my brain. Never before had I been so excited by the written word. Here before me was what I had experienced in the bush of Umfolozi, the rivers of northern Zululand and the coastal lakes with flamingo, crocodile and hippo. For years the wilderness had worked its magic upon me, but I had never been able to express it. Now here was the inner understanding, written down.

Jim Feely and Ken Tinley were scientists in the true sense of the word and their contribution to the science of conservation had already begun. My forté was in the political and administrative aspects of conservation and I immediately knew that there was a key to public opinion in the wilderness concept. I began corresponding with Howard Zahniser, the secretary of the American Wilderness Society, and he sent me the hearings by the senate on the National Wilderness Preservation Act. It became the most precious reference book I possessed. It inspired me to begin the protracted battle to have wilderness areas set aside within our game reserves and to initiate treks, which were called wilderness trails, into the area.

Slowly but surely, the people of South Africa began to walk the trails. They realized that here was a resource of enormous value to the country. We had begun making friends for conservation and many of those who walked the trails were touched by the same magic that had inspired Jim Feely, Ken Tinley and me.

I conceived the idea of the Wilderness Leadership School. The Natal Parks Board who employed me allowed me to use the wilderness areas of the Umfolozi and Lake St. Lucia to organize trails of leaders from the community. I found myself taking wilderness treks for the Natal Parks Board in official time and then for the Wilderness Leadership School during my holidays. It was exhausting work and I knew that we were contributing to a new conservation ethic.

For 22 years I served the Natal Parks Board, slowly climbing through the ranks, stationed in different game reserves in Zululand engaged in tasks that varied from the capture and translocation of the then rare and endangered white rhino, to surveys of hippo populations and bird-breeding colonies on Lake St. Lucia. There were also piles of official files to be attended to and correspondence and memoranda that never seemed to end. As I rose higher in the ranks, the administrative burden grew in proportion and field work became infrequent. There were official visits to the United States where I gained more knowledge of wilderness conservation. Magqubu Ntombela, the down-to-earth Zulu companion, guide and mentor of my early years was always there for me to consult and provide guidance.

In 1974 I left the Natal Parks Board to work full time with the Wilderness Leadership School and the International Wilderness Leadership Foundation. Laurens van der Post, a friend since 1969, came home frequently to South Africa, and he, Magqubu and I walked in the wilderness of Umfolozi game reserve. We sat around the fire of acacia logs and talked at great length until the early hours of the morning. We heard the jackal screaming and saw a leopard in the moonlight, moving from shadow to shadow, stalking an impala. We watched the sun rise and set and heard Magqubu say, "There arises from the ears of an elephant the sun." We heard how the old people used to say the sun has a very old blanket, full of holes, and when it goes to bed at night it pulls the blanket over itself and the stars are the light shining through the holes.

We walked for days in complete silence, feeling the changes in diurnal rhythms and seeing the ancient landscape where the brooding mysterious spirit of early man still lingers in hidden valleys guarded by the baboons, lions and snakes. The tribal people of Africa have guided our steps and we have realized that the world must learn from this ancient treasure house of a different kind of knowledge.

We boiled the billy can in the shade of the giant sycamore fig trees and drank tea from enamel mugs and talked about C.G. Jung who said, "Africa is God's own country." We agreed that the major task of the Wilderness Leadership School was to continue to bring people of all races and creeds into the wilderness of Africa, to meet in an atmosphere conducive to a better understanding of ourselves and the world in which we live. It was from the small *indabas* (gatherings) of six people at the end of a trail and a conversation Magqubu and I had that the idea emerged of an *indaba-nkulu* (great gathering) of those who knew the wilderness and what it could do for mankind. This led to the 1st World Wilderness Congress in Johannesburg, South Africa in 1977; Cairns, Australia in 1980; Inverness, Scotland in 1983; and Denver and Estes Park, Colorado in 1987.

These were the thoughts that passed through my mind as I looked down across the valleys of Estes Park to snow-covered peaks of the Rocky Mountains. It had been a long haul since the reading of the 10 fundamental principles of the wilderness concept at Umfolozi game reserve in 1955. The wheel had turned the full circle.



INTRODUCTION

*Vance G. Martin, Executive Director
4th World Wilderness Congress*

The environmental problems we face today no longer concern only individual species or the deterioration of local and regional natural areas. A wider, more dangerous scenario is beginning to emerge. Our global biological and environmental support systems—those natural processes that supply or help purify our air and water and which build the soil—are deteriorating rapidly because of our increasing abuse and neglect. We face an undeniable degradation of our basic life-support systems.

There have been successes. Occasionally the force of reason, personal commitment and political will have combined to help make progress on some of our conservation challenges. These have usually been too little or too late in order to offset the cumulative effects of overpopulation, deforestation, unwise industrialization and the proliferation of toxins and waste products in the global environment. Sadly, the solution of environmental problems has too often been hampered by politics or by professional and cultural differences. In virtually all cases, conservation remedies have been limited by lack of available finances or thwarted by prevailing economic theory. Clearly, new approaches are needed.

The World Wilderness Congress (WWC) is a response to this need for new approaches to the conservation and development dilemma. A project of the International Wilderness Leadership Foundation (IWLF), the WWC is an ongoing, worldwide forum which involves all aspects of professional and public conservation efforts. It has met on four occasions: South Africa (1977), Australia (1980), Scotland (1983) and the United States (1987). Each WWC has had a different emphasis with unique objectives, but the three general goals which help to guide each Congress are:

- To achieve practical results in specific environmental objectives, in order to stimulate new initiatives in worldwide conservation and sustainable development;
- To integrate wild land values and the protection of wilderness into all natural resource, economic and social development programs;

- To emphasize and demonstrate how a holistic approach to problem solving is necessary to deal successfully with increasingly complex conservation challenges.

A lot of work went into the 4th WWC. Four years of planning by a highly qualified executive committee were required to clarify the objectives and to develop the program. In addition, the funds to plan and implement the Congress had to be raised by the IWLF. In order to maintain its stance as an independent forum in the field of international conservation, the WWC is funded through a wide range of public- and private-sector support and from individual donations. The IWLF accomplishes a great deal with modest financing.

The 4th World Wilderness Congress met in Colorado, USA, September 11 through 18, 1987, with some 1,700 participants from 65 countries. True to the form of previous congresses, these participants included not only the scientists and natural resource managers that one expects to find at such a gathering, but also a wide range of other individuals who increasingly have a conservation mandate in their fields, including bankers, businessmen, politicians, educators, artists, cultural figures, psychologists and native peoples. Beyond the diversity of the participants, another unique and important aspect is that the WWC is a public forum: it is open to everyone.

We achieved a great deal together. A consensus emerged from the speakers, all leaders in their fields, and from all other participants throughout the eight days of global overview presentations, scientific symposia, educational demonstrations, workshops and cultural events. Four major points were emphasized.

First, because the environmental challenges facing us are increasingly interrelated with economics, agriculture, industry and health, a whole new perspective and type of planning is needed. The environmental challenges facing us demand more and better-directed information, applied through new methods of system-wide management at a global level.

Second, in the words of Maurice Strong, it is time for an "eco-convergence," a synthesis between economic planning and ecological thinking which can create new avenues for building, maintaining and conserving our world. While agreement was unanimous that conservation and development are inseparable partners in shaping our future, interpretation of their respective roles is open to debate. James Baker, U.S. Secretary of Treasury, insisted that "economic growth is essential for conservation." Conversely, Chief Oren Lyons, who spoke for native peoples, said that "conservation is a necessity, and development is a matter of choice."

Third, the solutions needed depend increasingly upon concerted action by non-governmental organizations and individual citizens. People everywhere must realize that the future is in their hands and is shaped by their actions and decisions. In an era when governments find themselves increasingly bound by budgetary considerations and bureaucratic structures, public involvement is a key to finding workable, effective answers. Governments alone cannot solve the

worsening environmental crisis; it requires attention by all individuals.

Fourth, there is a fundamental need for cooperation, which can only spring from new attitudes and perspectives. While at first this may seem somewhat simplistic, it may in fact be the most challenging task of all. In our increasingly global society, biological systems or ecological problems themselves show us the way to formulate solutions. Ecological systems and pollution pay no heed to national boundaries, skin color or religious differences. A new, cooperative approach must integrate national identities, professional or self-interest perspectives and cultural differences into a cohesive, collective response, unhindered by greed and politics, in order to assure human survival. Respect for all people, selflessness rather than self-interest, innovation and good stewardship of natural resources are not clichés; they are critical elements of an urgently needed approach.

The WWC is a demonstration of how this critically important need for information and effective global action can be addressed. It is a model for the new thinking and planning, and is evidence of the strength in cooperation, enthusiasm and concerted action which can be generated by such an approach. Practical solutions emerged from the discussions such as a World Conservation Bank (International Conservation Finance Program). These are presented in the following pages.

For the Conservation of Earth is structured to provide you with a variety of information and avenues for action. It brings to you, in edited and selected form, the unique proceedings of the 4th WWC, including global overviews by world leaders, specific case studies from a variety of developing nations, and the philosophical, practical wisdom of tribal peoples. It also offers information and addresses to enable you to become involved immediately in worldwide conservation.

Finally, as proceedings of the previous World Wilderness Congresses have been, this book is a benchmark against which future generations can measure the success—or failure—of our commitment to the survival of nature and of the human race.

We encourage you to use this book. Contact the people and organizations listed. Information, technical assistance, financial and other types of involvement are necessary to create cooperative, effective solutions. Worldwide conservation is an essential part of our lives and determines our future. It depends upon each of us.



THE DENVER DECLARATION

Preamble

Our earth is unique. All living things depend on its life-supporting, natural processes for survival. Over the millennia, self-regulatory processes inherent in its design have maintained a productive balance of natural resources as well as providing an inspirational foundation for human culture. Today, Earth's destiny is largely in our hands—where once humanity was surrounded by wilderness, now wilderness is surrounded by humanity. Only as we understand, respect and cooperate with the self-regulatory dynamics of Earth will we and future generations be capable of maintaining and restoring its processes which support all life.

The 4th World Wilderness Congress recognizes, in accord with the recent findings of the World Commission on Environment and Development, that:

- There is a direct connection between healthy natural ecological systems and the economic and political stability of all nations;
- The productivity of Earth's natural resource base is rapidly deteriorating, as evidenced by desertification, deforestation, accumulation of toxic wastes, polluted drinking water and oceans, diminution of wilderness habitat and loss of genetic diversity. It is clear that, under the demands of increasing human population, the overall situation will continue to deteriorate;
- While qualitative similarities and differences exist in the environmental problems of the nations of the world, there is an uneven capability among nations to redress this situation;
- Financial and development institutions (public and private), non-governmental organizations and all citizens have a significant role to play in defending and restoring the productivity of natural systems and environmental quality, working with governments to provide basic human needs for an expanding population.

A new initiative is needed in worldwide conservation:

- To halt the destruction of the Earth's remaining wild lands and its natural resource base, and to assist ecological processes in being restored to healthy balance;
- To ensure that development is sustainable by incorporating long-term natural resource concerns into economic development programs of all countries;
- To promote conservation education activities as well as cooperative exchange of knowledge, technology and financial assistance to meet global conservation challenges;

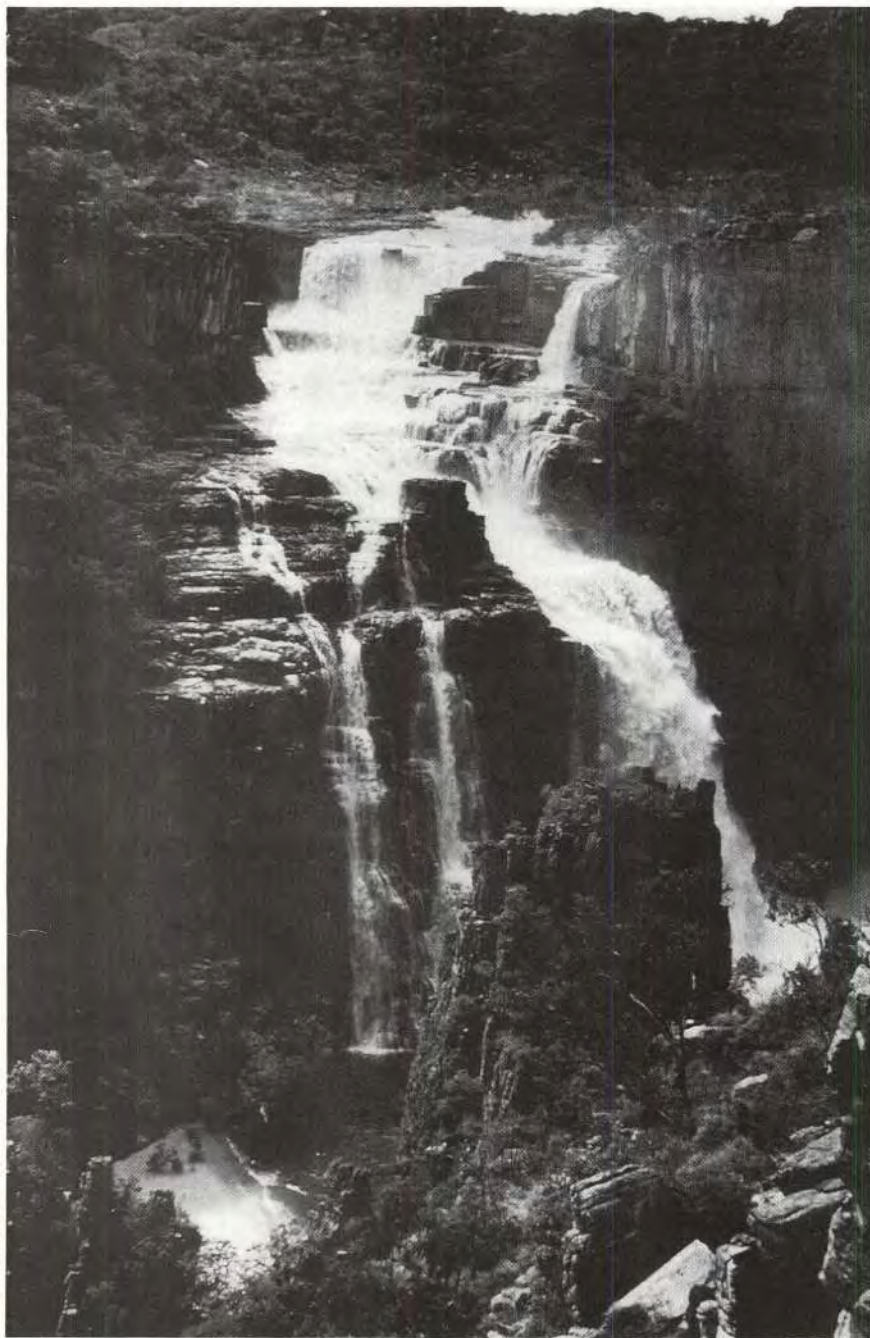
We therefore recommend that:

- The natural environment be recognized as a source of knowledge, well-being and inspiration essential to the highest achievements of mankind.
- Non-governmental organizations and the private sector should join forces with governments in a major effort to stimulate educational, political and technical actions for sustainable development and an enhanced environmental ethic. These coalitions would support mutual actions which respond to the recommendations of the World Commission on Environment and Development, under such established programs as the World Conservation Strategy, the World Charter for Nature and others.
- To strengthen the efforts of existing international institutions working in those countries whose natural resource base is in the greatest decline, a World Conservation Corps or similar service should be established which would enhance the international sharing of conservation information, technology and experience.
- Because new sources of funding must be mobilized to augment the expansion of conservation activities, a new International Conservation Banking Program should be created to integrate international aid for environmental management into coherent, common programs for recipient countries based on objective assessments of each country's resources and needs.

—Denver, Colorado, USA
September 1987



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The
**GLOBAL
CHALLENGE**

“If current trends continue, the atmosphere will warm by about 1.5° to 4.5° C by the year 2030. Warming of just 2° C will take the earth out of the range of anything that has been experienced in the last ten million years.”

—Dr. Irving Mintzer
World Resources Institute



POLICY

OUR COMMON FUTURE

Gro Harlem Brundtland, Prime Minister of Norway

The 4th World Wilderness Congress is a vivid and strong response to the call for action of the World Commission on Environment and Development. *Our Common Future* is also your report. It was formed through an open process as the WCED heard and received hundreds of submissions from people and their organizations in all parts of the world. The public hearings were as important as the private deliberations. Without continuous interaction with the people who cultivate the land, live in the slums, direct the companies, do the research, hold high political office, work in the media, and others, the report would not have been the same.

The process through which the report was formed has been of vital importance to its message and perspective. Bill Ruckleshaus, Minister Salim of Indonesia, a Soviet member of the Academy of Science, the Finance Minister of Zimbabwe, a Chinese and a Saudi Arabian scientific director, a Colombian environmentalist, and Maurice Strong, to mention but a few, all agreed on a common analysis, on shared perceptions and concrete recommendations addressed to the global community.

As the commission worked, nationalism and artificial dividers receded. In their place emerged a common concern for the planet and for the interlocking ecological and economic threats facing humanity. This experience is one that must be shared by millions of people around the globe. Only if mutual understanding can replace mutual mistrust, and only if mutual respect and solidarity can prevail will we be able to take the necessary corrective action. The commission offers its own consensus as one on which the international community can build.

Through the history of man a number of great political changes have taken place which have proven to be irreversible. Even temporary setbacks cannot detract from the fact that universal suffrage, large-scale decolonization and the establishment of a universally recognized set of fundamental human rights stand out as such great historic achievements.

The present world situation calls for new leaps forward. The world's political map and agenda have changed. The environment—previously viewed as a theme of protection—has now become a theme of survival. We must recognize that the interrelated issues of environment and development belong at the very top of the international political agenda, on a par with the vital issues of disarmament and security. If the commission succeeds in establishing this world agenda, gaining an irreversible foothold for this work, it will indeed have fulfilled its mandate.

There are many tragic examples of unsustainable practices that are the direct consequences of economic and social conditions and of mismanagement of natural resources: the slash and burn of vegetation; the felling of forests; the overuse of lands, causing soil erosion and desertification and ultimately threatening the carbon dioxide cycle which in turn threatens to alter the global climate. The excesses of affluence in the North, the burning of fossil fuels, the use of chemicals and treatment of industrial wastes threaten lakes and soil and cause damage to human health. The atmosphere's ability to absorb our emissions is approaching its limits. And all these phenomena interact across national borders and between continents.

Clearly these trends demonstrate that we have come to a point in our history where we can no longer act primarily as citizens of any single nation state. We have to behave as world citizens. We are entangled in the same destiny, and we have been brought closer together—so much closer that we no longer have the option of placing more distance between us—even though some gaps between us are widening.

We are drifting farther apart as the gaps between the rich and the poor are widening. But we have been brought closer through communications, capable of bringing news about people's life and destiny from around the globe in seconds. This gives hope of building identification and feeling of human responsibility. We have become closer through the sheer force of numbers. One hundred million people are added to the global population every year. We have come so much closer that we run the risk of ruining our future, but together we can also save it.

Since the Stockholm Conference, frustration has been growing over our collective inability to deal effectively with crucial environment and development issues. We have had a number of political conferences, but sufficient political action has not been forthcoming.

The establishment in 1983 of the WCED as an independent body reflected the high priority assigned to environment and development issues by the General Assembly of the United Nations. This happened at a time when we experienced the paradox of decline in international cooperation and multilateralism parallel to an obvious increase in global interdependence.

Our Common Future covers the entire political agenda. It discusses the international economic relations system, food security, industry, energy, the urban challenge, the protection of genetic resources and international institutions. How can we assure enough food for a growing world population, while at

the same time avoiding environmental damage from large-scale agriculture? How can industry produce all the goods required to remove poverty and squalor without depleting the world's natural resources? How can we meet the growing energy requirements of developing countries without a global environmental breakdown? How can we curb rapid urbanization and get rid of urban slums? Is it within our reach to protect the genetic resources of the planet's plants and animals?

The international imbalances which are at the root of the deadlock between environment and development must now be corrected. In a world ridden by poverty, only economic growth can offer hope for a better life for the poor who now number close to 800 million and create the capacity to solve environmental problems. The overriding political concept of the Commission's report is, in fact, a new concept for economic growth and we have called for a new era of growth. This new growth must be substantial but its content needs to be changed. The ability of future generations to meet their needs can be compromised as much by affluence—the excesses of industrial and technological development—as by the environmental degradation which is the result of underdevelopment. A new era of growth must be supported by a broad process of change, of policy reforms across the spectrum of human imagination. It requires more equal access to knowledge and to resources. It requires a more equitable distribution within and among nations. There are not limits to growth itself, but it can and must be managed in such a way as to enhance the resource base on which we all depend.

To pursue a new era of economic growth, we need to breathe new life into the multilateral approach to problem solving. There is no alternative to concerted and coordinated action. Deteriorating terms of trade, soaring interest rates, protectionism, declines in financial flows, and debilitating debts strangle development potential in the Third World and threaten to destroy our environment. Clearly, the developing countries will have real opportunities to follow sustainable paths of progress only when external conditions offer them reasonable hopes for a better future. We in the industrialized countries must do more to ensure that the international economy serves the interests of developing countries rather than leaving them behind in the poverty trap.

Consequently, commodity prices must be further increased and interest rates must come down. The debt crisis must now be seriously addressed, taking due account of the legitimate interests of both lenders and borrowers. Increased capital transfers and development assistance are clearly necessary, and new funds must be forthcoming for projects that aim at sustainable development.

Sustainable development is possible through a more equitable international economic regime. We must establish a world order based not only on equal rights among nations and people, but on more genuinely equal opportunities.

The reports analysis is clear. Environment is not a separate sector distinct from key economic sectors such as industry, agriculture and energy. It is not a question of environment or development. It is both or none. Ecology and economy will have to merge. Environmental concerns must become an integral

part of decision making at all levels. These goals will require changes also in the policies of the international organizations responsible for trade, aid, technological and financial assistance. Further re-orientation of the policies of the World Bank, the IMF, the regional development banks, GATT, UNCTAD, UNDP, WHO and FAO, to mention a few very key agencies, will be at the core of the process we call for.

During the international debate this year about the commission's report, some skepticism has been voiced about certain implications of the commission's call for incorporation of sustainability criteria into international financing. Applied to North-South issues, this has been perceived by some as implying a new form of conditionality, a constraint imposed on the developing countries from outside—an asymmetric burden-sharing, since the North would seemingly be exempted.

It must be noted, however, that the commission was emphatic in coupling its call for higher quality in aid and lending with substantially increased financial flows. Recipient countries bear an obligation equal to that of lenders and donors as regards setting their development priorities on the basis of long-term sustainability criteria. The notion is not one of unilateral conditionality, but of solidarity and equality among nations. It is one of common pursuance of mutual self-interest.

This integration of sustainability criteria into the decision-making process must be made operational by governments themselves as part of their national strategies. Developing countries will need external assistance from UNEP and other organizations in order to increase their capacity to manage this integration in practice. Such assistance must come from the international community at the request of the countries concerned.

When *Our Common Future* was launched in April, the commission had worked together for 900 days. Since then a broad public outreach programme has been conducted. The response and the interest generated by this work have strengthened us in the conviction that it is possible to reach the minds and hearts of people irrespective of where they live or their economic situation. All of the commissioners have a strong sense of dedication.

The report has been presented and discussed with governments and NGOs in Eastern and Western Europe. It has also been presented in China and Latin America, in south Asia, Africa and in North America. *Our Common Future* offers motivation and challenge to governments and peoples alike. It sounds a message of warning and of hope and has set in motion a process which will motivate governments to act. And act they will, if presented with enough broad public pressure to that effect.

In Norway, a broad campaign of information and education on environment and development has been launched as a joint venture between private organizations and public authorities. The Norwegian government has also asked all ministries of finance, justice, defense and others not normally perceived to be close to these issues, to review and study the commission's report and compare

our domestic and foreign policies against its principles and recommendations. They have been asked to note where our present policies differ and, if they do, to consider what steps can be taken to bring them into line with the report's recommendations.

The commission has called on the United Nations General Assembly to transform its report into a UN Programme of Action and Sustainable Development in the belief that responsible action by the world organization will strengthen its standing and authority. The United Nations can breathe new life into the multilateral approach to international cooperation and has a unique opportunity to demonstrate leadership in making a fundamental commitment to sustainable development. The secretary general himself should be the pivotal force for environment and development. What could be more appropriate than international civil servant number one taking responsibility for the basic elements of human survival, peace, environment and development?

Critics of the UN have long dominated the debate on its role, and it is true that there have been setbacks due to inefficiency, bureaucracy and lack of support. But at this juncture, where multilateral cooperation is at a low ebb, we need a renewed commitment to multi-lateralism and we need governments infused with a moral vocation which goes beyond pursuance of national interests. The time has come to restore the authority of the international institutions we have created. My work on the Commission has further strengthened my own conviction that we need the United Nations now, more than ever before.

We should ask ourselves: What happens next? Who should do what? What is my role in this? What can my organization do? My appeal to all of you is this: Use your influence. Do whatever is possible to create awareness and promote change.

Our report places a powerful tool in the hands of all interested citizens' groups, institutions, trade unions, businesses, executives, company boards, nations, the media, and not least, individuals. I call upon each of you to use that tool. We all face a challenge and opportunity. Sustainable development should be taken out of books and reports and implanted into decision-making processes. Sustainable development will depend on a decision-making process capable of securing effective citizen participation. It is the concerned public that can put environment and development issues onto political agendas.

We must build on present momentum. In particular we must build on the enthusiasm of young people. We must all do our part in launching a global campaign of information and education. We need a new motivation for a global transition to sustainable development. We must secure a constructive debate to persuade public opinion to heighten its pressures and hold governments, institutions and policy makers responsible and convince them of the merits of our overriding goal of sustainable development.

In light of the critical thresholds we are already approaching, the next decades are crucial. This one very finite earth must provide food and energy and meet the needs of double the world population. It may be required to sustain a

world economy five to ten times as large as the present. It is quite clear that this cannot be done by multiplying present patterns. Changes are needed. Decisions are due now. We must chart a sustainable course of action.

To secure our common future, we need a new international vision, one which looks beyond narrow, short-sighted, national and entrepreneurial ambitions. We must have a "new deal" in international cooperation. The time is urgent. The environment/development crisis is real. We must all join forces in a new partnership and start acting together. We are all dependent on one another and we share a common future.

THE THREE TIERS OF ACTION

Mostafa K. Tolba

There is something very wrong with the way modern man views the wilderness. We love it, and yet we often take a puerile delight in despoiling that heritage. At best, it seems, we are callously insensitive to the land we spend so much time extolling.

It is worth reflecting on the heroes of the American western frontier—Daniel Boone, Davy Crockett, Buffalo Bill and even Theodore Roosevelt. They were men who loved the wilderness, but much of their joy was derived from senselessly vandalizing the land they loved. William Cody slaughtered the plains game. When he didn't kill for food, he killed for fun.

On the other side of the Atlantic we find a similar paradox.

In the Federal Republic of Germany, 70 percent of all males, according to a recent poll, would like to be a forester. No less a figure than the German chancellor has said that the forests are the soul of the German nation. But the cars and power stations of the same Germans are destroying their beloved forests with the cocktail of pollution we call acid rain.

There are many such contradictions. If the wildernesses we hold in such high regard are to be conserved, short-term sacrifices will be required. And the most urgent priority will be the transfer of enough resources to give hard-pressed Third World communities incentives to safeguard wild areas for the benefit of all humanity.

The economic, aesthetic and cultural value of our remaining wild areas are many. They protect inland drainage systems, offer refuge to the five to 10 million species alive today and to beleaguered indigenous cultures, they generate income through tourism and their almost limitless value as providers of the genetic material for new crops, medicines and industrial products.

We need no longer justify why wild areas need to be conserved. We do need to sound the alarm among governments and the public at large that unless drastic steps are taken, humanity will preside over a holocaust which could remove one-tenth of the world's species before the end of this century. Most important, the environment and development communities need to be united on how we should go about persuading others to take these "drastic steps."

Perhaps most vital of all, we need to leave decision makers and the public in general with a firm impression that there are no simple solutions.

As H.L. Mencken, America's modern-day sage, put it: "For every problem there is a solution that is simple, direct and *wrong*."

Putting up fences around threatened wilderness areas is the wrong solution. Survival of wild places depends on putting to work the recommendations best and most cogently expressed in the World Conservation Strategy and the World Commission on Environment and Development.

I will briefly outline what UNEP is already contributing to the reconciliation between development and the conservation of natural habitats and then indicate what we perceive to be the drastic steps needed to keep wilderness areas intact.

While UNEP recognizes and regrets that, in the industrialized world, wild areas remain at risk from acid rain, clearance for farmland, urban development and replacement of indigenous tree species with "mono-forests," it also recognizes that there is a level of awareness and action which, for example, has left tree felling in rough balance with tree planting. I am fully aware that tree planting does not equate reconstructing a forest, but while we appreciate the value of northern habitats as sanctuary for wild species, we also recognize that their genetic value pales in comparison with the open and closed tropical forest.

The savanna and rain forest environment of the poor world is where the holocaust is happening. At the most conservative estimate, at least 225 million more hectares will be cleared or degraded before the year 2000.

Harsh experience has shown what ecologists have known for a long time, namely that the soils in rainforest areas are poor and usually unsuited for intensive cultivation. In countries like Costa Rica, Indonesia, Brazil and Ivory Coast, areas of tropical forest have been reduced to near desert.

The challenge facing the global community is to help give countries like these proper incentives to manage their forest resources sustainably; to ensure that tree growth is equated with economic growth.

UNEP is supporting a wide-ranging programme aimed at achieving this objective.

We have been working closely with our sister UN agencies to respond to the

crisis. With UNESCO we are helping to establish and support protected areas, and there are now more than 250 biosphere reserves which permit various types of land use in all but the core area. With FAO, UNEP is playing a supportive role in the Tropical Forest Action Plan. Good progress is being made toward realizing commitments of up to \$8 billion from many governments and agencies to stabilize and strengthen tropical sustainable forestry efforts.

Also with FAO and the International Board for Plant Genetic Resources (IBPGR), UNEP is participating in more than a dozen projects to conserve genetic resources. These include on-site stands in Africa and Asia and five pilot projects for the conservation of endangered animal breeds in five key countries.

UNEP is also involved with IUCN in a range of protected and wildlife initiatives. This includes providing secretariats for CITES and the Migratory Species Convention and core financing for the Conservation Monitoring Center which publishes the Red Data books.

Under our Earthwatch programme, UNEP is gathering and disseminating reliable environmental information. As governments were quick to acknowledge at our recent Governing Council, the data collected and distributed by our Global Environmental Monitoring System (GEMS) is a key element in sustainable planetary management.

There was similar recognition for the indispensable role our regional seas programme—now encompassing over 120 nations—is playing in conserving marine and coastal areas.

In a sense, it is invidious to single out any single UNEP activity as being more important in the preservation of the planet's wild areas than any other, be they within protected areas or outside their boundaries. Our programme is conceived and managed on an unshakable recognition of the realities of environmental interdependence.

We should be doing far more. But with a budget of just over \$40 million each year, there are severe limitations on what UNEP can be expected to achieve. Nevertheless, we are urgently working on ways and means to make our initiatives better targeted.

We recognize even more acutely that environmental interdependence is inseparable from economic interdependence. Again I will not rehearse the now familiar arguments which overwhelmingly favor the marriage of ecology and economic development. What I will say is that unless drastic steps are taken to move our ideas for sustainable development into action, the work of UNEP and our partners in the conservation movement in general will be discounted.

Let us not doubt that the natural habitats in the South will continue to disappear unless the major forces of destruction are tackled. A partnership between North and South is needed to head off catastrophe. I am talking of the need for highly organized environmental groups in the North to do much more to convince governments, industry, the development finance institutions and the commercial banks that new funding must be mobilized.

I am suggesting three tiers of action:

- Cooperative assistance to developing nations—UNEP and its partners need to step up their hands-on assistance to developing countries and to work in closer partnership with each other. We won't solve the crisis, but we can lead by our examples.
- Cross-Sectoral Response—There has been enough talk. We need to get the big-spending government agencies and the banks to take the environment much more seriously. We need to be vigilant to ensure the reforms announced by the World Bank and other institutions have the intended impact and to be mindful that loans by the development finance institutions build confidence for investment by commercial banks at four to five times their present level.

Ideal rallying points are: The Tropical Forest Action Plan; the international Tropical Timber Trade Agreement (which has yet to make an impact); the campaign to safeguard the world's threatened wetlands; the regional seas treaties, full of good intentions but seriously underfunded; and the new move UNEP is starting to establish a complementary network of riverain agreements.

- Changes in Global Economy—In the last analysis, the conservation of the world's wild areas depends on a global resolve to reform regressive terms of trade, alleviate the debt burden and slow down the arms race. These are the real motors of environmental destruction.

The environmental movement has had little influence in macro economic planning. But there are signs of radical change as the case for fair and sustainable development becomes overwhelming. Governments have seen how environmental cooperation can create goodwill and they are increasingly receptive to the idea that policies must be designed to effect change without bankrupting the environment.

There is a growing recognition from all quarters that if the industrialized countries want their poorer neighbors to conserve wild areas, ways and means will have to be found to assist them to do this. At our most recent Governing Council, I floated the idea that one 'way' and 'mean' would be to reschedule debt in favor of conservation. Would it not be possible for the creditor nations to recycle part of the debt repayments to finance conservation projects?

Other specific ideas I would like to see considered are:

- How can support to the 5,000 or so NGOs now involved in forestry be increased?
- How can we do more to interest the private sector in management of wild areas?
- How can developed nations be persuaded to pay, even partially, for the invisible benefits they get from the Third World's wild areas?
- And how can UNEP's efforts be better coordinated with our partners to ensure maximum impact?

Our time is now. We must all consider a partnership of different groups to step up the momentum. We have the sympathy of the public—modern mass media coverage has seen to that—and we have an increasingly receptive cadre of

decision makers who are eager not to repeat the mistakes of the past.

When we recognize that we need a new ethic for a new wilderness, then we will have made progress. When we realize that the wilderness that William Cody took to be infinitely vast and infinitely wild is actually fragile and threatened, then we will have made progress. When we learn to tread lightly on this earth, we will have begun to turn from the path of destruction.



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WORLD WILDERNESS INVENTORY

A RECONNAISSANCE-LEVEL INVENTORY OF WORLD WILDERNESS AREAS

J. Michael McCloskey and Heather Spalding

Almost everyone acknowledges that not all parts of the planet Earth should be developed. A balance must be sought between "man and nature," between the areas developed to sustain humanity and the areas where nature predominates. How to strike this balance may tax human wisdom; even to attempt the task requires that our species know something about where we are in the process of development and how much land still remains wild.

There are atlases which show how much land is arable. There are estimates of how much of the native tropical rain forests survive, and there are inventories of how much land around the world is protected in reservations for various public purposes. But there have been no inventories of how much of the world is still undeveloped—of how much is still primarily influenced by the forces of nature.

That such inventories have not been done should not entirely surprise us. Most of the world has been preoccupied with development and still is. Wilderness is generally appreciated when most of it is gone. And the task is Herculean: How do you get the data on a consistent basis, in enough detail, and from all nations regardless of their interest? And, of course, who is prepared to undertake the task?

Believing that no more time should be lost waiting for others to step forward,

we at the Sierra Club decided to undertake a first approximation of how much of the land surface of the globe still remains wild. Ours is a reconnaissance-level inventory that we think can be useful in providing a broad overview of where the major blocks of wild land still can be found.

In a rough sense, this inventory represents the opportunity to balance the equation between nature and development. It is from this inventory that reservations of major new protected areas can be made. Some have called for a trebling of the amount of land protected in nature reserves.¹ This inventory shows that this can be done.

Specific judgments still need to be made about the future of given blocks, but at least the question may now be asked whether the block should be preserved or not, in whole or in part. Inquiries can be organized into the specific values of each block and, most importantly, people around the world can watch to see what decisions are made and how they are made. This land will no longer be anonymous backcountry and bush which is nibbled away with impunity.

The remaining wild land is the patrimony of the world—of all living things, and of all generations to come. With this inventory, we can start to track what is happening and to mark trends as subsequent inventories reveal changes. Humanity can decide whether it is losing too much wild land and where.

As a reconnaissance-level inventory, this undertaking represents an approximation, which is probably accurate in the aggregate, but will be shown to have specific shortcomings. That probability is implicit in the methodology used, and we invite interested parties around the world to work with us to perfect the detail. The findings need to be verified on the ground—to be “ground checked.” We would like to stimulate collaboration around the world to develop an increasingly accurate inventory. The results of such perfected inventories can be presented when each World Wilderness Congress convenes.

In our research, we looked for wilderness tracts in 195 political entities plus Antarctica. The basic methodology we employed was to analyze a common set of highly detailed maps of the globe to look for “empty quarters”—areas showing no development, areas of so-called *de facto* wilderness. We used the Jet Navigation Charts and Operational Navigation Charts, at a scale respectively of 1:2,000,000 and 1:1,000,000, of the U.S. Defense Mapping Agency. These maps, used for commercial and military aeronautical navigation, show increasing levels of detail on human constructs to provide orienting landmarks as areas become sparsely settled and remote. Their information on such constructs is provided on a consistent basis around the globe. In our search for “empty quarters,” we eliminated all areas showing roads, settlements, buildings, airports, railroads, pipelines, power lines, canals, causeways, aqueducts, major mines, dams and reservoirs, and oil wells. While the maps did not always show areas subject to agricultural development or logging, these activities occur in proximity to roads and settlements. We identified areas removed from such developments.

Moreover, we only identified *major* blocks of so-called “empty quarter” land, land in blocks of at least one million acres, or 400,000 hectares. This limi-

tation arose primarily out of the practical need to make the project manageable. We did not have the time and resources necessary to search for smaller blocks. Moreover, our maps may not always have shown high levels of development detail for smaller blocks in areas closer to major settlements. We were also mindful of the fact that the larger blocks are probably of greater world significance because they are likely to harbor more viable ecosystems. Under theories of island ecology, which some have suggested may apply to islands of wilderness on large land masses, more of the habitat niches are likely to be occupied in larger units, and if preserved, such units may be able to sustain more biological diversity. Because of their size, 400,000 hectare units are less likely to have been destroyed since the last Jet Navigation Charts were published. Finally, we remembered that both Aldo Leopold and Bob Marshall had suggested that a wilderness area should be large enough for somebody to travel in for two weeks "without crossing his own tracks."² Such an area would have to be at least a million acres in size.

In limiting this initial effort to searching for units of 400,000 hectares or more, we do not want to suggest in any way that preservation of smaller areas is not important. It is, and this first effort would be far more complete and meaningful if it could have included all areas over 100,000 acres, or 40,000 hectares. Undoubtedly, the inventory of wilderness would be somewhat higher with these smaller units included, but it is impossible to know whether it would be 10, 20, or 30 percent higher. In any event, an expansion of this inventory will have to arise from a second phase which can best be undertaken by interested parties around the world who may wish to cooperate with us. Refined local data and maps are needed to identify such areas, as well as up-to-date information on adverse development.

The inventory attempted here basically seeks to identify undeveloped land and uses an approach similar to that used by the U.S. Forest Service in its RARE I and II inventories.³ These inventories were conducted under the legal framework of the Wilderness Act of the United States and sought to identify areas that were roadless and undeveloped without initially making any judgments about the suitability of the areas for status as potential protected areas.

Our world inventories are of such a broad level, though, that they do not need to be drawn into debates over fine points of defining exactly what wilderness is. By implication, our approach identifies more with the biocentric than the anthropocentric approach to defining wilderness since no criteria involving suitability for recreation (e.g., grandeur, ruggedness, etc.) were used.⁴ Flat tracts of desert, tundra and ice are included in our inventory, which few backpackers may ever want to visit. However, our inventory does look at land of all kinds, without regard to how much or how little biomass it may support or biological diversity it may have. We are identifying wilderness *per se*.

Our inventory does draw upon the approach of the U.S. Wilderness Act in the way it looks at the present appearance of the land in determining what is wilderness, rather than at the historical reality of how the land has been used.

Land is classified as wilderness if it looks like wilderness, even if it once had been developed. This inventory operates in the spirit of the U.S. Wilderness Act when it characterizes land as wilderness if it "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable."⁵ Under that act, wilderness is an area where man and his works do not dominate the landscape. Unlike the U.S. Wilderness Act, however, our inventory undoubtedly includes areas inhabited by traditional, indigenous peoples and in some cases peoples practicing traditional pastoralism. In our inventory, it is only modern man who is a visitor who does not remain.⁶

In the sense just described, it would appear that about one-third of the land surface of the globe is still wilderness. We found five billion hectares (50,887,300 square kilometers) of undeveloped land in over a thousand (1,050) tracts. The tracts were located in 78 countries plus Antarctica. The countries with the biggest aggregations of "empty quarters" are: the Soviet Union (39 percent wilderness), Canada (65 percent wilderness), Australia (33 percent wilderness), Brazil (28 percent wilderness), China (Tibet) (24 percent wilderness), Denmark's Greenland (99 percent wilderness), Algeria (64 percent wilderness), the Sudan (37 percent wilderness), Mauritania (74 percent wilderness), and Saudi Arabia (30 percent wilderness). One hundred and eight countries did not appear to have any of these large wilderness tracts.

Under our definitions, the continents with the most wilderness are Antarctica, Asia, Africa and North America. See TABLE I.

TABLE I

	Wilderness Sq. Km.	Percent Wild	No. of Areas
Antarctica	13,209,000	100%	2*
Asia	11,864,000	27%	306
Africa	9,177,700	30%	437
North America	9,006,700	36%	89
South America	4,222,700	24%	91
Oceania and Australia	2,666,300	30%	94
Europe	741,000	7%	31
World	50,887,400	34%	1,050

* This is really one contiguous block divided in two only for purposes of biogeographical classification.

In terms of the relative amount of wilderness, most of the settled continents are still between one-quarter and one-third wild, Europe being the exception. The European wilderness is largely in northern Scandinavia and European

Russia. Wilderness blocks on most continents average between 21,000 and 46,000 square kilometers in size, with the average being larger in North America (101,000 sq. km.), probably because of Greenland's inclusions in its totals.

If one looks at all of this wilderness plotted on a map of the world, the patterns are clear and in broad outlines match one's intuitive sense of where wilderness would be: Antarctica and Greenland are mostly wild; then one sees a broad band of wilderness sweeping across the northern latitudes of Alaska, Canada, and the Soviet far north. A diagonal band then is seen to run southwest-erly from the Soviet far east down through Tibet, Afghanistan, and Saudi Arabia to Africa, where a distinct east-west belt runs through the Sahel. A scattering of units also runs southward through Africa. In South America, as one might expect, the blocks are concentrated in the Amazon, with a scattering southward along the Andes. In Australia, a band runs north-south through the middle of the continent. Somewhat surprisingly, almost no wilderness in one million-acre blocks shows up in the United States. The frontier was lost long ago.

To analyze this inventory data in terms of its biological significance, we have overlaid it on Miklos Udvardy's classification system⁷ for the biogeographical provinces of the world. Using his system to look at our data, it is arrayed in TABLE II:

TABLE II

	Wilderness Sq. Km.	% of Total Wilderness	No. of Areas
Palaearctic Realm (Europe, North Africa, and Asia, except India and S.E. Asia)	16,774,400	33.0%	514
Antarctic Realm (including New Zealand)	13,249,300	26.0%	7
Nearctic Realm (North America and Central American highlands)	8,968,700	17.6%	84
Afrotropical Realm (sub-Saharan Africa and Madagascar)	4,786,400	9.4%	239
Neotropical Realm (South America, Caribbean, and lowland Central America)	4,260,700	8.4%	96
Australian Realm	2,516,500	4.9%	82
Indomalayan Realm (India, S.E. Asia, Philippines, and most of Indonesia)	221,800	0.4%	21
Oceanian Realm	109,500	0.2%	7
Total	50,887,300	100.0%	1,050

Running across all of these realms are biomes representing predominant vegetative cover types. When the wilderness data is arrayed by biomes under Udvardy's system, it is easier to see the distribution of wilderness by climate and habitat zones. Forty-two percent is in the high Arctic or Antarctic; 20 percent is in the warm deserts; 20 percent is in temperate regions; about 12 percent is in the tropics; nearly 4 percent is in mixed mountain systems; 3 percent is in the cold winter deserts; and only a fragment is in the island regions. By biomes, the inventoried wilderness is distributed in TABLE III:

TABLE III

	Wilderness Sq. Km.	No. of Areas	% of Total Wilderness
1 Tundra Communities	21,321,600	104	41.9%
2 Warm Deserts	10,158,600	391	20.0%
3 Temperate Needleleaf Forests	8,893,300	126	17.5%
4 Tropical Humid Forests	3,532,300	78	6.9%
5 Tropical Dry Forests	1,723,800	120	3.4%
6 Cold Winter Deserts	1,630,300	51	3.2%
7 Mixed Mountain Systems	1,463,900	75	2.9%
8 Tropical Grasslands	768,000	33	1.5%
9 Temperate Rainforests	457,700	15	0.9%
10 Temperate Broadleaf Forests	332,000	20	0.7%
11 Temperate Grasslands	310,000	23	0.6%
12 Evergreen Sclerophyllus Forests	186,200	7	0.4%
13 Mixed Island Systems	109,500	7	0.2%
Total	50,887,300	1,050	100.0%

Of the various provinces, the ones with the largest concentrations of wilderness, i.e., having over one million square kilometers or 100 million hectares of wilderness, are in Table IV:

TABLE IV

	Wilderness Sq. Km	No. of Areas
Maudlandia (Antarctica)	9,324,000	1
Sahara	4,382,000	197
Canadian Taiga	3,981,400	29
Marielandia (Antarctica)	3,885,000	1
Low Arctic Tundra	3,067,300	64
East Siberian Taiga	2,672,600	68
Arctic Desert & Icecap	2,348,600	13
West Sahel	1,997,100	45
West European Taiga	1,767,700	25
Amazonian	1,339,000	14
Madeiran (S. America)	1,152,400	15
Central Desert (Australia)	1,093,200	24
Arabian Desert	1,014,200	31

A comparison of the aggregate amount of wilderness within each realm or province with the amount of land now protected in that realm and province suggests something about the opportunity to establish more protected areas. And it offers some perspective on how good a job has been done of protecting remaining wilderness. Existing protected areas were not deducted from the areas inventoried. The comparison of the total amount of land in the inventory with that protected in a number of continents is interesting. Superficially, it suggests that 20 percent of the Nearctic Realm's remaining wilderness is protected; that 18 percent of the Afrotropical Realm's wilderness is protected; and that 12 percent of both the Neotropical and Australian Realms' wilderness is protected.⁸

This comparison, however, is somewhat misleading because comparable concepts are not being looked at. Many protected areas are not roadless at all and thus will not show up in the wilderness inventory. Moreover, most protected areas embody blocks smaller than 400,000 hectares, and the totals for protected areas usually aggregate many such smaller units. Furthermore, the wilderness inventory fails to show the opportunity to protect blocks of less than 400,000 hectares. For all of these reasons, the figures for Africa show that only 6.6 percent of the protected areas plot within the wilderness inventory.

Where the wilderness inventory shows land totals far in excess of the amount now protected, there clearly is the opportunity to protect more land in large blocks. Where no opportunity is shown, there may still be opportunity to protect smaller blocks should they be identified in other inventories.

With this inventory showing that generally less than 20 percent of the remaining wilderness is being protected, one is prompted to ask what the prospects are for the rest of this wilderness surviving without protection.

TABLE V.—DISTRIBUTION OF WILDERNESS BY REALMS AND BIOMES (IN SQ. KMS.)

Biomes	Realms									Total
	Aftrotropical	Antarctic	Australian	Indomalayan	Nearctic	Neotropical	Oceanian	Palaearctic		
Cold-winter deserts	0	0	0	0	0	0	0	1,622,600	1,630,300	
Evergreen sclero-phyllous forests	0	0	186,200	0	0	7,700	0	0	186,200	
Mixed island systems	0	0	0	0	0	0	109,500	0	109,500	
Mixed mountain systems	89,100	0	0	107,000	191,500	360,300	0	716,000	1,463,900	
Temperate broadleaf forests	0	0	0	0	0	0	0	332,000	332,000	
Temperate grasslands	0	0	0	0	0	0	0	310,000	310,000	
Temperate needleleaf forests	0	0	0	0	4,453,100	0	0	4,440,300	8,893,300	
Temperate rain forests	0	40,400	8,800	0	152,400	256,200	0	0	457,700	
Tropical dry forests	1,338,900	0	258,700	29,400	0	96,800	0	0	1,723,800	
Tropical grasslands/savannas	0	0	251,400	0	0	516,600	0	0	768,000	
Tropical humid forests	533,100	0	10,900	53,800	0	2,934,500	0	0	3,532,300	
Tundra communities	0	13,209,000	0	0	4,155,300	0	0	3,957,300	21,321,600	
Warm deserts/semi-deserts	2,825,300	0	1,800,500	31,600	16,400	88,600	0	5,396,200	10,158,600	
Totals	4,786,400	13,249,300	2,516,500	221,800	8,968,700	4,260,700	109,500	16,774,400	50,887,300	

This research effort did not attempt to determine what the threats are to this wilderness and how imminent they are. However, by their location one can deduce that the wilderness of the Nearctic Realm (principally in Alaska and northern Canada) is likely to disappear primarily in response to pressures for more oil and gas development and other mineral development. In the Palearctic Realm, the wilderness of the Soviet far north is disappearing under similar pressures and deliberate settlement policies, with logging important in certain areas too. In the Afrotropical Realm, population pressures may be the biggest factor, though ironically spreading desertification may be creating new wilderness in the Sahel. In the Neotropical Realm, Amazonian rainforests are disappearing in response to a cluster of development initiatives: massive land clearance schemes for grazing, huge hydroelectric projects, mineral development and logging. In the outback of Australia, mining provides the impetus to break up wilderness blocks, and the same is likely to be true of Antarctica. In the Indomalayan Realm, planned land settlement programs, logging and oil development are pressing the remaining wilderness blocks. In much of the developing world, smaller wilderness blocks (not identified in this inventory) are undoubtedly also disappearing in response to pressures from shifting cultivators who gain access to the wild land via new development roads.

METHODOLOGY

In developing the inventory, we used Jet Navigation Charts (JNCs)⁹ at a scale of 1:2,000,000. There are 65 of these maps for the world. In remote areas, these maps show a great deal of cultural data, such as the location of isolated shrines in the Sahel.

Basically, the approach taken was to draw lines around areas devoid of recorded development in polygons and irregular loops. The lines were set back at least four miles (6.4 km) from developed features such as roads and settlements to allow space for developments that may not have been recorded on the maps or new developments that may have occurred since the maps were prepared. The four-mile setback was chosen arbitrarily on the basis of judgment as sufficient for such purposes (representing about one-fourth of an inch on such maps). The setback could have readily been a little more or less. However, any errors in estimation based on unknown developments impinging on a wider band than this in some localities may be offset in the aggregate by the absence of any such developments in many other setback zones. In fact, it is likely that the use of such a wide setback may have led more to underestimation of the amount of wilderness than overestimation.

Additional information on development was obtained from the Operational Navigation Charts (ONCs) at a scale of 1:1,000,000. There were 212 of these, and they generally showed a greater level of detail. Deference was given to whichever map showed evidence of development in a given area. In a few cases where these ONC maps were dated, other maps were used to provide supplementary information. This was done particularly for Australia where the Reader's Digest Atlas

of Australia was used; prepared at a scale of 1:1,000,000, its maps provided highly detailed information.

Other map data was also used to spot check information, including various maps in the Cartographic Collection of the U.S. Library of Congress. The map collection of the World Bank was also made available to us to update information on recent development projects, such as in the Amazon.

The data on human culture on the maps dated on the average from the early 1980s, though in a limited number of instances went back well into the 1970s. Whenever the data on human culture dated before 1980, supplementary maps were used to check the findings. This was done particularly for Australia, Borneo, Canada, China, Greenland, Indonesia, Mongolia, Papua New Guinea, and the Soviet Union. Also because of the rapid pace of development in Brazil's provinces of Rondonia and Acre, World Bank maps were used to verify our results there. Supplementary maps were also used to verify results in several desert areas of North Africa.

The areas identified on the base maps were measured with a planimeter and given code designations by country. For purposes of further identification on smaller scale maps, the coordinates of the center of each tract were plotted. Also the biogeographical realm, biome and province were noted for each tract. The boundaries of each area were then digitized through use of equipment at the World Bank and can be readily revised and compared with data in UNEP's GRID system.

Early in the genesis of the project, we considered using NASA's LANDSAT images for this work, but concluded they were more appropriate for detailed investigations of a given area. A reconnaissance-level survey of the globe could not be easily accomplished if every LANDSAT image had to be studied. Because of the complexity of interpreting data on them and the way in which some developments are obscured in their images, it was much more workable to use maps based on interpretations of their data. Moreover, the budget for this project did not permit acquiring LANDSAT images. If, however, certain units in our inventory cannot be ground-checked by cooperators, we may be able to explore using LANDSAT images to verify findings in a limited number of instances.

A number of special problems arose in connection with the inventory. In some places such as the Amazon and Borneo, settlements appear along rivers where no roads are evident. In some instances where there was reason to believe that other development might cluster along the rivers between settlements (even though none is shown on the maps), these riverside areas were excluded from the inventory. In Iceland, four-wheel drive tracks are shown through the center of the island; these tracks were excluded. In the Soviet far north, corridors were excluded along arctic river systems spotted with settlements; this exclusion will probably eliminate rivers used for summer barge traffic. Moreover, the maps show the routes of winter ice-roads across tundra; these areas were also excluded. In Paraguay, small airfields were shown peppered across otherwise roadless areas; these areas too were excluded. However, areas with ruins and

isolated water wells, as in north African deserts, were not always excluded. And in a number of instances where we found traces of development in the midst of large wild tracts we often drew "holes in the donut," i.e., we excluded only the immediate developed area. In a few cases, inventoried wilderness areas straddled national boundaries. In those cases, the areas were disaggregated to show the portions of the wilderness in each country in their national totals, but the area by name is listed only in the country with the larger portion of the tract.

The inventory effort also faced the problem of how to regard land uses and occupation by traditional societies. For instance, portions of the Tibetan plateau may be in the inventory that are used by pastoralists who graze sheep and yaks at elevations up to 5,000 meters.¹⁰ They do so in areas devoid of roads and listed settlements. While we have eliminated areas of heavy use for this purpose, undoubtedly some such use occurs within units in this inventory. Such areas meet the criteria of this inventory in that they appear to be generally influenced primarily by the forces of nature. However, it is likely that small huts are found in the areas and that some change in vegetation has been induced by long-standing grazing. These vegetative changes are even more likely to have progressed in lower elevation steppe and desert areas because of pastoralism over the centuries.¹¹ No effort has been made to remove such areas from the inventory, but it is likely that the areas subject to the most evident change will not appear in the inventory because of the encroachment of roads and settlements. An extreme example of this is that none of the western American desert in the United States, where sagebrush has replaced grass because of excessive grazing, shows up in the inventory.

A related issue arises with respect to bands of traditional indigenous peoples in places like Papua New Guinea, Borneo and the Amazon. Undoubtedly, such people occupy areas within inventoried units. We did eliminate small settlements recorded along river systems in these places, and indeed inventoried units are sparser than one might imagine in these places, particularly in New Guinea and Borneo. Where no settlements were recorded, we assumed that the impact of such occupants was so slight as to leave the areas appearing to be generally influenced primarily by the forces of nature. However, it is quite likely that some use of motors, particularly on boats, occurs in these areas. This issue arises particularly in western Alaska where native peoples now widely use motorboats and snowmobiles. Since such use is transitory and leaves no lasting marks on the land, we did not assume any impact on the inventory. It is likely too that the areas where such use is heaviest are near recorded settlements and thus will not show up in the inventory.

A final issue concerns routes of passage by traditional societies. These can be trade or caravan routes in the desert or routes for taking flocks from summer to winter pastures in Tibet. A few such routes are recorded on our maps as "tracks" in Tibet and north Africa. They were eliminated from the inventory, though others undoubtedly exist and may not be precise in alignment. Moreover, indiscriminate vehicular use in flat desert areas and on steppes makes it hard to

know which areas should be disqualified. Again, following definitions used in the United States for wilderness inventories done by the Bureau of Land Management in desert areas, we eliminated only areas showing constructed roads, not areas showing evidence of mere vehicular passage. On-the-ground checks of units in the inventory may suggest removal of areas marred by too much cross-country vehicular use.

In conclusion, this inventory represents the first time in history that humanity has been able to look at how far it has gone in subjugating the Earth and bending it to its use. Two-thirds of the land of the planet is now dominated by our species.

But with one-third of the land still dominated by nature, there is still a chance to maintain some measure of balance between "man and nature." But this balance will not occur by accident. At least half of the remaining stock of wilderness is not self-protecting by virtue of its forbidding nature. Through encroachment it can slip away easily, with little notice, as billions more are added to the human population.

This inventory needs to be firmed up to provide a useful yardstick to measure what is happening and to prompt conscious decisions with regard to the fate of the wilderness that remains. The boundaries of the units need to be verified by those with access to better information in every country. We need to add data on units of less than 400,000 hectares, and we need to revise the information continuously.

We invite the collaboration of interested conservationists around the world to build this into a tool which can play a central role in maintaining a balance between our world and the world of nature.

FOOTNOTES

1. See, e.g., Edward C. Wolf, *"On the Brink of Extinction,"* (Worldwatch Institute, Washington, D.C., June 1987). Wolf calls for increasing the amount of protected land from 425 million hectares to 1.3 billion hectares.

2. See Roderick Nash, *Wilderness and the America Mind* (New Haven: Yale University Press, 1967), pp. 4-5 for Aldo Leopold's suggestion that an area be large enough "to absorb a two week's pack trip"; See also James Glover, *A Wilderness Original: The Life of Bob Marshall* (Seattle, the Mountaineers, 1986), p. 147.

3. RARE stands for Roadless Area Review and Evaluation. The RARE II process was completed in 1979.

4. For a recent discussion of the differences between the anthropocentric and biocentric approaches to defining wilderness, see R.G. Leslie and S.G. Taylor, "The Wilderness Continuum Concept and Its Implications for Australian Wilderness Preservation Policy," *Biological Conservation* 32 (1985), pp. 311-313.

5. See Sec. 2(c) of 16 U.S.C. 1131-1136 (1965); reprinted and discussed in Michael McCloskey, "The Wilderness Act of 1964: Its Background and Meaning," 45 *Oregon Law Review* 288 (1966).

6. *Ibid.*

7. Miklos D.F. Udvardy, *A Classification of the Bio-geographical Provinces of the World* (Morges, IUCN Occasional Paper 18, 1975).

8. For a convenient tabulation of this data, see Table 21.2 in *World Resources* (Washington, D.C., World Resources Institute, 1987).

9. For a discussion of the indications of data on human culture shown on these maps, see U.S. Defense Mapping Agency, *Product Specifications for Jet Navigation Charts* (1980), Chapter 1 Sec. 700.

10. See, e.g., Robert B. Ekvall, *Fields on the Hoof: Nexus of Tibetan Nomadic Pastoralism* (New York: Holt, Rinehart and Winston, 1968), Chapters 1 and 2.

11. For a discussion of these changes, see Pierre Bonte, "Ecological and Economic Factors in the Determination of Pastoral Specialization," in *Change and Development in Nomadic and Pastoral Societies*, ed. by John G. Galaty and Philip Carl-Salzman (Leiden, E.J. Brill, 1981), p. 33.

THE GEMS/GRID TOOLBOX

H. Croze and M.D. Gwynne

It was the dramatic views from spacecraft which showed for the first time the planet as a whole, floating in the emptiness of space, that finally brought home to most people the realization that our earth is a single entity—an entity in which all the elements are interconnected and what happens in one area can have consequences in others. Prior to these pictures the concept of the global whole was held by relatively few—mainly concerned scientists and environmentalists. At the time of the UN Conference on the Human Environment in 1972—which established the United Nations Environment Programme (UNEP)—these few, farsighted people realized that we simply did not have enough information on the global environment and what was happening to it. They called, therefore, for the establishment of an Earthwatch Programme, which was to be the environmental assessment process of UNEP. At the heart of Earthwatch was to be GEMS—the Global Environment Monitoring System.

GEMS gathers data on the state and trends of the world environment and identifies, as far as possible, the causes of these, so that corrective counteractions can be taken. The information monitored, therefore, must be of good quality and of a nature that allows data from different areas and sources to be compared. Co-ordinated by a Programme Activity Centre in UNEP, GEMS works with and through international and national agencies and organizations. So far there are

GEMS activities of one sort or another in 142 different countries—all in cooperation with the governments of those countries.

There are in GEMS, to date, 22 global monitoring networks in the fields of pollution, climate and renewable natural resources. Mention of a few will give you the feel of the GEMS programme. Urban air contamination—dirty air in cities—is a world wide problem. GEMS-Air, run by UNEP and the World Health Organization, looks at the sulphur oxide and suspended particulate content of city air. GEMS-Water, again a joint UNEP/WHO network, is concerned with the water quality of rivers, lakes and aquifers. Carefully chosen representative sites allow the global picture to be kept under review. In order to determine the background or baseline levels of contamination in an ecosystem, UNEP, UNESCO and the World Meteorological Organization run an integrated monitoring programme in very remote areas to determine the pollutant content of organisms and their environment. One such station is in the Torres del Paine area of extreme southern Chile. Global atmospheric contaminants are looked at through the UNEP/WHO Background Air Pollution Monitoring Network which has stations in very remote areas—such as the South Pole, Cape Grim in Tasmania, and Point Barrow in Alaska. These determine the lowest levels of atmospheric pollutant content. Against these results, measurements made of a global network of regional stations allow the local levels to be viewed relative to the basic levels for the planetary atmosphere near the ground.

In renewable natural resources, GEMS' concerns are with soils, forests and other constituent resources of the living world, including habitat and the state of rare and endangered species. As you will have realized, work with the latter is done through the International Union for Conservation of Nature and Natural Resources (IUCN) and the Conservation Monitoring Centre. The natural resources area of GEMS is most relevant to the work being conducted on the World Wilderness Inventory.

Wilderness and protected areas are now perceived to be a global, and no longer just a national, patrimony. This is why it is presumed possible to discuss from afar the possible management and potential fate of land areas in some 150 other countries. The presumption is justified by the mandate given to those organizations which were conceived and mandated by the world community, such as UNEP and IUCN. I sense, however, a persisting gap between the "internationalists" and the well-informed and sponsored NGOs on the one hand, and the actual owners of the land on the other. We must not lose sight of the essential need to close that gap, quickly, before the wilderness areas are put to other, perhaps less sustaining and sustainable uses.

But let us be optimistic and assume that our concern will find an ear with the national decision makers and that a mechanism can be found among the tangle of global economy which will allow the message to be taken to heart. As the *I Ching* says, "It is common for travellers on the same road never to meet."

If our plans for wilderness and protected areas are to be coherent and coordinated and, therefore, credible and effective, they must be based on

common data sets and common data handling techniques so that data collected at one scale can be compared to and married with those collected at another. Most of our questions and concerns are about particular places on the earth's surface. Geographical location is the common denominator: all the areas have measurable characteristics—soil type, topography, a spectrum of plant and animal species, land use, an hydrology regime—all of which we can now capture, analyze and display using the toolbox of Geographical Information System (GIS) technology.

A GIS is a special set of computer hardware and software systems which is designed to deal with that which can be located on a map. One of the most powerful GIS functions is "overlaying," in which "layers" of geo-referenced data are superimposed to produce a picture and richness of information far greater than any of the data sets on their own. Deforestation, for example, is not just a question of trees. If we are to truly understand—and therefore, be able to alleviate the problem—we have to combine information on trees with data on soils, topography, climate, vegetation cover, land use and the like to produce a composite picture of the interaction of these factors which manifests itself in the symptoms of deforestation.

The need for such technology, as well as the need for environmental data in useful and usable forms, led us to establish GRID, the Global Resource Information Database, within the GEMS Programme at UNEP headquarters in Nairobi. GRID was established in a two-year pilot phase with generous donations from governments and private organizations of hardware, software, facilities and seconded professional staff. GRID is designed to be a distributed, networked system, and already there are three communicating nodes—GRID-Control in Nairobi, GRID-Processor in Geneva, and a technical support node at NASA's Earth Resources Laboratory in the southern United States. A regional node for southeast Asia in Bangkok is planned for early next year, and GRID nodes for other regions are under discussion.

GRID's main objectives are to provide data, to develop methodologies for handling global data sets, and to provide access to GRID's GIS technology. The three functional areas are data collation, data supply and technology transfer. The technology transfer task of GRID is especially important because GIS is quite new. Thus we have regular major training courses for Third World experts sponsored by the Swiss government. In this way, we hope to create a global-user community for GRID peopled by national practitioners and not just western experts.

The initial work of GRID has concentrated on two scales: global and continental, and national. A number of global data sets have been obtained, geo-referenced and made available within GRID. Thus data sets are now available for: global elevation, which can be extracted in any subset and overlaid with any other geo-registered data on a global or continental scale; global ozone distribution and surface temperature of the earth's crust, which are also available for scientists to model global processes; and the FAO-UNESCO soils map of the

world, which is now available in digital form as a basic data layer for small-scale studies of natural resource states and trends.

The beauty of the GIS is that it allows merging of resource data from many sources: maps, monitoring stations on the ground, or satellites. Thus, we have added a global vegetation index to the database, which shows the amount of green biomass present at any particular time.

While building a repository of global data in readily usable GIS form, we are at the same time providing help to developing countries with national-scale case studies to demonstrate GIS capabilities and provide training for national experts. For example, a comprehensive environmental database was constructed for the entire country of Uganda to examine, among other things, the erosion hazard. Thus, a model was developed by GRID using all available information from thematic maps of topography, climate, soils, land use and population pressure.

It was also possible to examine land-use change during the turbulent years in Uganda. Land use in 1964 was digitized into GRID from a map of the colonial period. From a mosaic of satellite images, land use in 1973 was derived, analyzed and interpreted by a team of Ugandan experts with firsthand knowledge of conditions on the ground. Then it was compared to a similar interpretation from 1986 data. In GRID's computers, the time periods were "subtracted" from one another to show change in land use during the period. It was possible to detect many areas of significant change. Many intensive agricultural areas have reverted to woodland for the most unfortunate and tragic of reasons.

The agricultural potential of Uganda was also analyzed for a wide range of crops, such as the major cash crop, *Robusta* coffee. GRID also allowed us to examine the potential consequences of global climate change, showing that the potential for *Robusta* would diminish should there be a climate warming.

The results of the Uganda national database (which took five months to construct) were presented to the prime minister of Uganda and his ministers, who immediately saw the potential of the GIS approach for resource management and land-use planning and requested that we assist them in establishing a national GIS capability.

A GIS thus allows us to merge data, model their interactions, and thereby provide a greater understanding of cause and effect. One can combine basic resource data sets for the entire continent—soils, topography, climate, number of rain days, wind speed, vegetation and so on, to attempt to point to areas at risk from desertification.

The model is, of course, preliminary and imperfect. The use of a computerized GIS means that we do not stick our necks out and produce a map of desertification, for example, which is an historical document as soon as it is printed. We invest instead in a process which, by its very nature, accommodates improvements in both the basic input data as well as the model rules themselves. In the case of desertification and soil degradation, UNEP is doing both at the moment with its agency partners.

GRID's philosophy is not to wait for perfect data because, if we wait,

decisions will certainly be taken with no data at all. Thus, we obtain the best available, such as early vegetation maps of Africa which were first used in the desertification exercise. Then we explored with the world experts ways and means of improving the data set. We carefully qualify data sets, and caution users in their reliability and limitations.

Thus, GIS capabilities allow us to move from simple description to analyses: We not only need to know where things are, but how they interact to produce the symptoms we observe. We believe that the assessment and husbandry of wildlife, wild lands and protected areas require both the kinds of resource data and the GIS toolbox offered by GRID. We need to plan our campaign of deploying parks and protected areas against not only the current expanse of wilderness, but also against the realities of species distributions and ecological constraints as typified, for example, in a synthetic ecological classification such as that of Udvardy. There are many examples in Africa alone which can illustrate how overlying the data set of current protected areas with that of the habitat of a particular endangered species can show us a great deal.

Threatened animals, such as the Crested Mangabey, have a relatively restricted distribution confined to central African forest zones. It is evident, however, that this threatened species is little helped by current deployment of protected areas. The aardvark, or African antbear, though rarely seen because it is nocturnal, is widespread, albeit thinly, throughout Africa covering a wide range of habitat types and is well represented in many protected areas. The Namibian desert rose is highly restricted both spatially as well as ecologically. Fortunately, it appears to enjoy congruency with a large national park. *Embelia schimperi* is a medicinal shrub used by local herders for deworming themselves and their stock: It is localized but widespread, and it occurs over a range of arid zones, but is not particularly well represented within protected areas. Such information would help us plan a campaign for preserving this particular genetic resource.

It is also possible to zoom in on particular parts of GRID's African database for more detailed analysis of IUCN data. For example, the protected areas of east Africa can be overlaid on Udvardy zones and a good ecological distribution can be seen. Focusing on Tanzania, we can ask the computer to pull out these areas—the Serengeti, Mkomazi and the Selous—and then look at their potential protective effect on the distribution of seven endangered bird species provided to us by the Conservation Monitoring Centre. It would be apparent that those particular species do not derive much benefit from the protected areas.

Recently, GRID helped direct the search for an endangered tree species. The world's musicians may be running out of the basic ingredients for woodwind, the heartwood of the *Mpingo* (*Dalbergia melanoxylon*). Before starting a search of all of central Africa, experts visited GRID-Control in Nairobi and outlined the *Mpingo's* requirements in terms of soil type, vegetation zone, and rainfall. The result was a "road map" of where most profitably to begin the search in Tanzania for potential in situ remnants of this very special genetic and cultural resource.

Finally, GRID has a potential for even more complex conservation mod-

elling. For several decades, individuals and organizations have been compiling information on the distribution of the African elephant. The extent of elephant range is now quite well known, and the data on range were recently updated and reviewed by the African Elephant and Rhino Specialist Group at Nyeri, Kenya in May 1987. Current data concerning elephant numbers are less comprehensive than range data. Although numerous aerial surveys, ground counts and other estimates have been made, there remain many areas for which elephant numbers are unknown. This lack of information hampers the ability of planners to manage and conserve the species.

In conjunction with World Wildlife Fund and the Elsa Wild Animal Appeal, GEMS has attempted to fill in missing information by using the analytical powers of GRID. First, the existing estimates of elephant populations were combined with other datasets in order to perform analyses to determine the relationship between elephant density and factors such as human population density, effectiveness of protection, GNP and vegetation type. A model was developed from which elephant densities were extrapolated for the section of range which were lacking in estimates.

In the course of the analyses, effective protection emerged as the factor with the highest correlation to elephant density. This suggests that increased protection could play an important role in the conservation of elephants. We therefore updated IUCN's latest protected areas map for the continent with national-scale maps to produce a detailed picture of the continent's protected areas with a categorization of effectiveness: from one (very good) to four (virtually nil).

Finally, we combined these data on protected areas with the data on elephant distribution. By examining the results, one can determine which sections of elephant range are not well protected and plan conservation management strategy accordingly. These data were, in addition, presented to the last meeting of CITES as a basis for the establishment of realistic elephant quotas.

Everyone in the conservation community is reaching for common goals—let us work together to achieve them. We in UNEP in Nairobi watch with concern our own east African back garden, where at least half a dozen conservation bodies trip over each other while doing more or less the same thing. The examples of application of GRID technology demonstrate how cooperation can occur and help break down sectorial barriers toward a common end. Eventually, perhaps we will all share a common resource data heritage and talk to each other more often, if only through our networked computer terminals.

As a gesture toward continued, increasing cooperation and integration, UNEP will make a concrete offer. We are prepared to make both GRID data and the GRID toolbox available to the conservation community. Provide your data and experts and let them come and work on an existing system to do the necessary analyses leading to comprehensive and workable conservation campaigns.

ACHIEVING A WORLD NETWORK OF PROTECTED AREAS

Kenton Miller

Wild lands are protected for a variety of reasons. In some countries the main concern is to maintain natural scenery, sites of grandeur and places for outdoor recreation and education, while in others the protection of watersheds, marine fisheries and habitats for endangered species are paramount. These differing goals vary with the needs of conservation and the requirements perceived by people. The connection between protected areas and the needs of local peoples has become increasingly important, particularly in developing countries.

In recent years, science and resource management have shown that underlying these considerations are fundamental biological concerns which require careful consideration. Maintaining maximum biological diversity, for example, and ensuring future access to plant and animal genetic materials of value for medicines, food crop development and industrial chemicals are two such considerations.

These and similar concerns have led conservation managers to ask ever more complex questions as they select and plan national parks and other reserves: How many areas, of what size, are needed to ensure that as many plant and animal species as possible are retained into the twenty-first century and beyond? Can areas bear various kinds of uses and still retain their diverse species?

In dealing with these complex questions, conservation scientists and managers have realized that, in order to achieve the conservation of nature, various kinds of reserves need to be established, which provide different types of management and a sufficient habitat for the long-term survival of our natural heritage. Achieving conservation goals through protected areas requires careful and professional planning, international cooperation and coordination with surrounding development within the ecosystem and adjacent land and water uses.

The International Union for the Conservation of Nature and Natural Resources (IUCN) was established as a non-governmental organization (NGO) in 1948 to deal with these and other conservation challenges. In 1959 the Economic and Social Council of the United Nations (ECOSOC) mandated IUCN to monitor the status and trends of the world's national parks and other types of reserves. In response, the Commission on National Parks and Protected Areas (CNPPA) was established. In the early years, all data collection and analyses were done by hand by such pioneers as Jean-Paul Harroy and Fred Packard. As technology became available, IUCN established its Conservation Monitoring Centre in the United Kingdom, with a specialized Protected Areas Data Unit (PADU).

In 1980, in partnership with UNEP and WWF, IUCN launched the *World Conservation Strategy*. UNESCO and FAO were important collaborators in the long process of consultation. This landmark document was prepared by worldwide participation of scientific experts, political leaders, resource managers and citizen conservation groups from all continents. It provides the policy framework for a strategic perception of reality whereby "there will be no conservation without sustainable development, and development cannot become sustainable without conservation." Working within this global framework, IUCN and its partners have found the following approach helpful in achieving the worldwide network of protected areas:

- *A network of professional managers*, scientists and conservation supporters provides the expertise and the synergy required to study and prescribe needed action;
- *A data management center* gathers, organizes and publishes information on the status and trends of protected areas, and highlights problems warranting international attention;
- *Regional working sessions* of the network are held on a regular schedule, in all parts of the world, to analyze the status of protected areas, the challenges facing managers in achieving their goals and to assist their search for solutions to local problems. These sessions are backed by extensive field work and site visits;
- *Strategies for action* are prepared which outline the activities required to achieve the global network of protected areas, guiding investments toward sites of highest priority for maintaining maximum biological diversity and other conservation goals;
- *Cooperation* is established with partner organizations to design programmes and projects, seek funding and support actual tangible implementation. This usually includes joint efforts with banks, industry, various levels of government, NGOs, funds and foundations, development aid agencies, private landowners and resource user groups;
- *Integration* with other actors and sectors involved is essential. The National Conservation Strategy enables resource managers to work with lawyers, economists, scientists, agronomists, foresters and political leaders to formulate a strategic plan for conservation and development. This normally includes activities in education and training and linkages with ongoing international programmes and conventions.

No one organization could begin to implement this approach alone. For IUCN this depends upon the cooperation of UNEP, WWF, UNESCO, FAO, the 590-member governmental and non-governmental organizations including the U.S. Park, Forest, and Fish and Wildlife Services, NOAA, Environment Canada and over 3,000 volunteer professionals from around the world.

Since the Yellowstone National Park was established in 1872, the global system of protected areas has increased to over 3,500 areas covering 425 million

hectares, an area larger in size than the whole Indian subcontinent. Information on these areas and the species they contain is managed by IUCN's Conservation Monitoring Center, which publishes the United Nations List of National Parks and Protected Areas and the Red Data Book Series.

Most countries in the world have some form of protected-areas system. One can best assess how well these established systems protect biological diversity by looking at their distribution within each country and by assessing coverage within each biogeographical province or region. Within the world's protected-area system, particular significance is attached to those areas which, although set up nationally, are given a degree of recognition under an international convention or through their participation in an international programme. Ninety-six countries are now party to the World Heritage Convention, and within these countries 70 natural sites have been inscribed on the World Heritage List. Forty countries have acceded to the Convention on Wetlands of International Importance, listing some 350 sites amounting to well over 10 million hectares. Seventy nations have set up 266 biosphere reserves under UNESCO's Man and Biosphere Programme.

The rate of growth of the protected area network is encouraging, particularly over the past 25 years in many developing countries. But, based upon principles from the science of conservation biology, there are serious concerns over inadequate size of many individual areas. Conservation of biological diversity and preservation of wilderness values rely upon the establishment of relatively large areas. Currently the vast majority of established areas are less than 100,000 hectares in size. At the other end of the spectrum there are more than 30 areas greater than two million hectares in size, including the immense North East Greenland Park and Australia's Great Barrier Reef.

Within the last few years, IUCN and UNEP have assessed the protected-areas systems in three of the four major tropical regions: Africa, Indo-Malaysia, and Oceania. Africa provides a good case study.

Today there exist some 88 million hectares of land in 426 protected areas in sub-Saharan Africa. This is an area equivalent in size to California, Oregon and Washington combined and equal to the total amount of land under protection in Canada and the USA. Of these, 174 are national parks or equivalent reserves.

Virtually every country in Africa has established parks and reserves, with the result that fully 4 percent of the biogeographic region is devoted to nature protection. Scientific documentation of all these reserves is contained in IUCN's recently completed Directory of Afro-tropical Protected Areas.

The growth of Africa's system of protected areas began in 1885 with the establishment of the Umfolozi and St. Lucia Game Reserves. Since the end of the colonial era in the early 1960s, African governments have effectively doubled the number of areas that have been established. Although the majority of Africa's protected areas are less than 100,000 ha in size, there are 20 areas over one million, with eight exceeding two million ha. The single largest national park is Salonga in Zaire, which is roughly four times the size of Yellowstone National Park.

IUCN and UNEP have recently completed a four-year continent-wide assessment of the system of protected areas in Africa. Conservation biology principles were used to answer three basic questions:

- What are the most important areas in Africa according to biological diversity criteria?
- How well do existing protected areas cover the full range of Africa's diverse natural heritage?
- Where are the underrepresented bio-units and the gaps in the system?

In other words, all protected areas in Africa were rated as to their importance to conservation on strictly biological grounds. Among the areas that stand out are:

- The Salonga National Park and World Heritage Site in Zaire, Africa's largest national park;
- The Tai National Park of the Ivory Coast, also a World Heritage Site and the last remnant forest of its type;
- The Virunga Volcanoes in Zaire, Uganda and Rwanda;
- The Bale Mountains National Park in Ethiopia;
- The proposed Ras Tenewi Coastal Park in Kenya.

There is still much to do. Of Africa's 17 bio-units, only four are regarded as having sufficient area under protection. At the other extreme, four others stand out as needing a much greater conservation effort. These units, which lack sufficient area under protection, are some of the most biologically rich in all of Africa and also are sites with high species conservation programmes to date.

Despite Africa's impressive record in establishing 88 million hectares of land for conservation, we also recognize that the stewardship and security of the existing estate is increasingly beset by a variety of threats. Within the context of the World Charter for Nature and the World Heritage Convention, IUCN annually compiles a register of Threatened Protected Areas of the World. This list, supported as well by UNEP, now numbers 76 sites, 24 of them in Africa.

The case of Sudan's Dinder National Park illustrates the problem. This park, established in 1936, has suffered a gradual loss of biological diversity caused by five interrelated pressures:

- Loss of access to wet season habitat by migratory species. Much of this area has been turned over to settlement and agriculture.
- Poaching in the park and heavy hunting pressure in the adjacent area have resulted in the loss of at least five major species in the past 20 years. Even giraffes have been eliminated, and the large herds of gazelle have now disappeared with only scattered individuals remaining.
- Heavy domestic stock grazing in the park has resulted in competition, loss of

cover, introduction of diseases, excessive trampling and soil erosion. Regular, uncontrolled wildfires set by local people exacerbate the problem.

- Surrounding land-use pressures on the park have built up over the years. The park now stands as a desertified island in the middle of a degraded landscape dominated by subsistence use.
- Despite early advisory reports of FAO wildlife experts and others, there has been no commitment to implementing a management regime in the park. Fundamental park facilities such as boundary markers are not in place. Patrols are rarely carried out, there are no extension programmes to gain support of local people and almost no tourism.

Although every park has its management problems, Dinder's are so severe that its very viability as a conservation area is being lost and its existence in the twenty-first century is in doubt.

The root causes of the threats to Africa's protected areas, such as Dinder in Sudan, are imbedded in historical, social, environmental, economic and political factors. Corrective actions that are required are outlined in the *Action Strategy for Protected Areas in the African Realm*. This document, prepared over the course of several years at the working sessions of IUCN's Commission on National Parks and Protected Areas, is a bottom-up assessment of what needs to be done to ensure more adequate coverage and more effective management of Africa's protected areas. Some 244 specific recommendations are made for the 45 countries involved. The document stresses that it is the human dimension in conservation planning which requires the greatest thrust in years to come as rural populations of Africa intensify their dependence on wild living resources.

Effective management needs to be consciously designed and implemented to provide people with the benefits for which the protected area was established. Implementation implies that the application of our concepts and principles in the field is dependent on a supportive public and a trained and committed cadre of staff, such as those trained at the College of African Wildlife Management. The complexity of the task and the full range of talents involved were reviewed at the Third World Congress on National Parks, held in Bali, Indonesia in 1982 and published in basic reference manuals on management of protected areas in both terrestrial and marine environments. These are practical how-to manuals that outline experience from park and reserve managers worldwide.

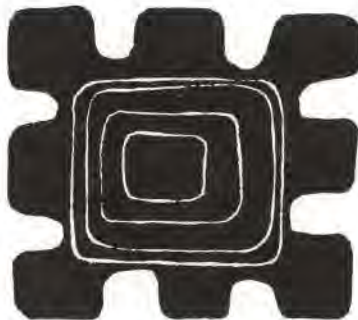
Many organizations are implementing conservation field projects in Africa. One specific example in Tanzania's Ngorongoro/Serengeti region is noteworthy. Here, assistance from Norway's bilateral aid and the World Heritage Fund is being used to help the Ministry of Natural Resources to strengthen management not only of the national park, but also of the surrounding controlled hunting areas and pastoral buffer zone. Initially a workshop was held involving individual experts and government agencies concerned. A planning process is now under way. Training workshops are being held, relations with local people are being strengthened, and regional resource-use schemes including harvesting of

wildlife and improving livestock and range management are being proposed. An overall aid package amounting to \$6 million is now being sought to restore and retain this internationally important ecosystem.

This case study of Africa's protected areas illustrates four conservation programming needs:

- Database management on species and protected areas;
- Networking among experts in the region and through local and international cooperation;
- Preparation of plans and strategies, including the identification of opportunities for integrated regional development; and finally,
- The actual execution of projects designed and managed in cooperation with national governments to strengthen conservation activities on the front line.

Although one can make plans and develop activities which strengthen park systems or improve and support their management, this should be set within the context of the whole picture of conservation and development at the national level. Our experience shows that this can best be accomplished by preparing a National Conservation Strategy to ensure that both conservation and development are sustainable. This is the *World Conservation Strategy* in action.





SCIENCE AND MANAGEMENT

THE NEW RESOURCES MANAGER

Walter J. Lusigi

It is just a little over a century since the first protected area was set aside at Yellowstone in the United States of America, marking the beginning of the present modern conservation movement. If the participants of that crucial campfire meeting who made the decision to set aside Yellowstone would, by some miracle, come back today, they would definitely be horrified at what we have made of the world since that time. As predicted by authors of *The Global 2000* report to the president of the United States in 1980, the world is presently more crowded, more polluted, less stable ecologically and more vulnerable to disruption than the world they lived in at that time. Despite greater material output, the world's peoples are poorer today. These clearly visible stresses of population, resources and the environment are a definite concern to conservationists, especially inasmuch as they were predicted for year 2000 and it is only 1987 now.

The biggest danger from the growth of the human population to the natural resource base does not result directly from the increased demand on the resources due to the numbers, but from the lack of understanding and sympathy of the greater part of the population to the cause of conservation. Conservation has remained the concern of a few despite the rising human population of the world. Those who were originally responsible for creating the system of protected areas like those in the United States were a few foresighted, unselfish and idealistic men and women who foresaw the national need and got the areas established and protected in one way or the other. They were, in fact, attempting to establish buffers against the greed and rapacity of their fellow citizens, fighting public inertia and selfish commercial interests at every step. Today the added

population to the globe, which is more urbanized, either lacks the understanding for conservation, or is not the slightest concerned about the fate of man. Inasmuch as the democratic processes demand popular support for any resource conservation measures, those charged with responsibility of managing natural resources must make a bigger effort to bring about this understanding and sympathy.

The problem regarding the widening gap between conservationists and other resource managers could sometimes be blamed on the conservationists as much as the other parties. It is unfortunate that conservationists have, at times, been overprotective of natural resources. We have frequently interpreted too strongly the saying "wise use without abuse." We have sometimes forgotten that the values of many renewable resources can be enhanced by proper use. We have laid ourselves open to the claims of many that conservationists can be equated with preservationists. There is a need for a common ethic for all managers of land-based natural resources.

As a concept, conservation seems to be well accepted as a sound guideline for resource exploitation and use. But two major problems usually arise when attempting to implement the concept. First, there is a mistaken presumption that conservation represents a single philosophy or school of thought and action. On closer examination, profound differences in means and goals separate the many organizations and institutions bearing the conservation label. Second, with goals and objectives defined, there is no assurance that conservationists themselves perceive the same thing. This has been perhaps the biggest weakness of the conservation movement because different resource managers have been known to apply different management strategies for even the same piece of land. This has not only sometimes led to clashes between various conservation groups, but it has also led to confusion within the populations who are expected to take conservation advice.

In order to alleviate the above concerns, and in order to ensure effective conservation of our natural resources in the face of various pressures, I submit that there is an urgent need for the development of what could be referred to as the "New Resources Manager." It is unfortunate, but true, that although the complexity of the problems of natural resources use has been more appreciated in the last few decades, and the multidisciplinary approaches to the solution of these problems recognized, many approaches have still remained sectoral, falling within the traditional disciplines such as forestry, wildlife management, agriculture and fisheries. To overcome the complex, present-day problems in resource management, a new, more broadly based manager will have to emerge. There are major and key problems in resource management which will need to be addressed by the new resources manager, and numerous ways in which we can stimulate development of such a new function.

POPULATION PRESSURES ON NATURAL RESOURCES

Predictions about the state of the world in the short term—the next 20 years—are uniformly disquieting. By the year 2000, the projected growth in human population can be expected to create enormous economic and political pressure for making more productive use of the world's remaining "natural" ecosystems. However, because thus far the world has always been able to feed itself, and because more improved production practices and technology could expand food production even more, the concern of conservationists and those charged with the management of the world's natural resources should go much farther than human statistics, supply and demand. We should also be concerned with the level of understanding of the increased population and its sympathy for the conservation of our natural resources. Wherever there exists a human population, it is certain that there will exist also a complex of ethnic, biological and social influences which, unless they are understood and incorporated in resource management plans, will introduce an unpredictable element into a desired outcome.

I am convinced that the majority of people who are being added to the world's population today neither understand nor sympathize with conservation. Although the number of conservation organizations and their members has increased, the percentage has gone down in terms of the total population.

In the last five decades since the industrial revolution, the majority of the people, especially in the industrialized nations, have been largely concentrated in urban centers where their occupations are largely in the industrial, commercial and administrative sectors of the economy rather than in land-based resources. The attachment of these people to the land keeps becoming more and more remote. Those born and brought up in urban centers even have a fear of the natural environment—nature is supposed to be insecure and primitive. Indeed because of the petty crimes which take place in natural parks surrounding urban centers, the city dwellers have come almost to resent the wild. These populations, however, wield a lot of political and economic power. The natural resources manager must have full understanding of this group, its thinking, its structure and how it operates. This group must be made to understand the importance of natural resources in supporting life within the urban ecosystem—clean water and air. Although this group might never visit a national park or a natural area, if they have this broad understanding they will be able to vote in the right direction when it comes to important conservation decisions.

Most of the highest recorded population growth rates are in developing countries, or the so-called Third World. Although now there is a strong tendency toward urbanization and industrialization, most of the population in the Third World is rural-based and derives all or most of its livelihood from the land. Land-use practices in the Third World are also still largely traditional and mainly for subsistence. The large-scale commercial exploitation of natural resources is still relatively minimal and land use also fulfills cultural traditions which form the pillars of those societies. The Third World, however, has some of the most

valuable natural resources in terms of both natural areas, minerals and, perhaps, oil. There is now growing opportunism from entrepreneurs from the developed world encouraging some wanton exploitation of these resources. There is also an increasing tendency, because of the bad state of most of the Third World economies, to overexploit certain resources in order to meet the increasing demand for food and other essential products for survival. Since most Third World countries are relatively desperate and have limited resource bases other than the land, they must develop the full potential of the land. But development must take the form most suited to the prevailing circumstances and the purposes to which an area is best adapted. The development of faunal resources is as important as the development of any organic natural resource and should be undertaken to the maximum extent consistent with its perpetuation. The natural surplus can be legitimately used and tourism can be instituted without detriment to the continuation of the resource.

The resource manager needs to be well acquainted with the various cultures in these areas and how they affect natural resource exploitation. He will have to learn to have certain tolerance and understanding of other viewpoints which might not necessarily be in agreement with his own. He has to develop an understanding of the constraints on resource exploitation in certain situations and have the capability to design alternatives that can improve resource exploitation without necessarily destroying it. It is only with improved land-use practices that recognize limitations of the land and the significance of the lives that depend on it that conservation will succeed and become a reality to millions of people.

There is further evidence of need for a new resources manager. The fact that most major world ecological systems are unstable or in some form of deterioration does seem to give clear evidence that present resource managers have had some shortcomings or that the management systems being implemented are not working.

Tropical forests are an example. What happens to tropical forests affects the whole ecological stability of the globe, yet decisions regarding their exploitation lie with individual states. This points out a new orientation needed by the resource manager. He must first understand the forces at work in the exploitation of tropical forests, including political, cultural and economic forces. He should be able to address himself to all of these concerns. Biologically, the resource managers should start addressing themselves to the problems of the restoration of stability. As most of the tropical forest ecosystems across the globe are in some form of instability, their restoration should take priority in all research and management.

What has been said about tropical forests is also true for temperate forests. Temperate forests have had the longest history of pressure from modern man through increased population growth and industrialization. Because of their structure and limited species diversity, they are fragile and vulnerable to many kinds of malpractice. Solutions which have been applied to the management of

temperate forests have been largely sectoral. Either the forests are being managed for the sustained production of timber, or as a hunting reserve for a specific group, or as a water catchment, for example. In many instances these utilizations are not usually coordinated to realize that the forest is one whole ecological system. Individual states, especially in Europe, have also had different approaches to the management of their bit of the forest, although it is one continuous belt. The latest threat through acid rain has clearly pointed out the need for new thinking and the evolution of new strategies for the management of this ecological system.

The instability of river systems, lakes and oceans is also another factor of concern to the survival of man on this planet. Those charged with the management of these systems are realizing how limited they are in the face of clear signs of pollution, overexploitation of fish resources and threats through offshore drilling of oil and accompanying threats of spills—to mention only a few. Yet here again, one finds all kinds of managers who are preoccupied with their specific bits of the resource. For example, the marine specialist starts at the shore of the ocean when it is clear that part of his problem starts in the mountains where the river originates. Likewise, the river manager seems not to take note of the forester at the source of the river or the agriculturalist who is applying chemicals and eroding the land. The new manager should have a better overview of the entire functioning of the ecological system and be less biased toward resource managers. He can only do this if he thoroughly understands other land management concerns.

One other example, which demonstrates the need for new approaches, is the world's arid lands. The deterioration of the world's arid lands has been the subject of world concern in the last two decades largely because of the droughts which have led to the starvation and death of millions of people. As it has clearly been pointed out by experts in this area, drought alone is not to blame for this situation. The situation arises from the cumulative effects of long-term abuse and misuse of the resources of the arid lands which have completely destabilized these ecological systems. The challenge that confronts the arid lands resource manager is to restore human dignity that has been undermined through starvation and poverty and then to design land-use systems that would restore the stability of the land and balance resources use in this area in both the short and long term.

Finally in this regard, let me take a look at the threat to the world's fauna and flora. Experts estimate that we are now losing at least one species per day and that by the end of the 1980s we could be losing one species per hour. Another estimate suggests that, if present trends continue, at least 500,000 of the 3 million to 10 million species of animals and plants now present on earth will be extinguished during the next two decades. The major cause of these extinctions will be the disruption and degradation or destruction of natural habitats, particularly in the forested areas of the tropics. To have any chance of preempting such predictions, two main problems need to be tackled: first, that of providing a sound scientific

basis for the planning and management of protected areas; and second, that of convincing land planners and resource users, particularly at the local level in developing countries, that conservation is not necessarily inimical to their daily social and economic needs.

These are but a few examples of the major ecological systems, the management of which must be thoroughly understood by the new resources manager. The list is long and includes concerns for the ozone layer and nuclear winter, the Arctic and the Antarctic, all of which have a bearing on the ecological stability of the planet.

ECONOMICS AND RESOURCE CONSERVATION

Modern society as we know it today is almost wholly run by various economic forces. This is an outgrowth of prevailing values of the Western world. The Western world is a human-oriented society, in which it is believed that reality exists only because humans can perceive it; that the cosmos is a structure erected to support the human race—its pinnacle—and that man exclusively is divine and has been given dominion over all things. Indeed since the Industrial Revolution, nature seems to have always presented a challenge which modern man has always tried to overcome. Development seems to be equated to overcoming nature and making man-made systems. But development is not bad per se. What causes concern to conservation is the waste that accompanies development. It is not until natural systems started giving in and human welfare was threatened that a few individuals started to see the necessity for conservation.

There is another aspect of economics as it affects conservation. Even in the wealthiest nations that have high conservation consciousness, not enough fiscal resources are devoted to conservation. Budget allocations to conservation are a drop in the sea compared to spending on things like defense. It is depressing that we never hear of environmental issues being on the top of the agenda when heads of the six most wealthy nations usually meet.

In the Third World the economic picture is grave and, in some instances, hopeless. As Jon Tinker of Earthscan said, "The African crisis can be summed up in two words: 'environmental bankruptcy.'" The term is useful because it stresses that the problem is caused by both environmental and economic factors, and that bankrupt environments can only lead to bankrupt nations. The somber reality is that the cancer of ecological collapse is eating away at nearly every country in sub-Saharan Africa.

What we are now seeing, from Ethiopia through Chad to the Atlantic and down to Mozambique and the Bantustans of South Africa, may well be the biggest disaster of our generation. There is probably no way of saving millions from a miserable death. It is increasingly clear that these deaths will be the direct result, predictable if not predicted, of foolish agricultural and environmental policies on the part of both African governments and of Western and international aid agencies. The seeds of environmental bankruptcy have been sown by government policies and watered by three decades of misdirected foreign aid.

The most obvious symptom of this failure is hunger and starvation. The ultimate failure of African development has been to convert the continent, in three short decades' independence, from a region which could by large feed itself into one that is increasingly dependent on grain imports, which ultimately come mainly from the United States.

This example of the African situation could with various exceptions apply to the greater part of the Third World. Its implication on conservation is obvious—that a poor man cannot conserve. It seems necessary that to even talk about conservation, one must start by developing means by which people can adequately feed themselves. The economies of these countries must be strengthened and only then can they develop realistic conservation policies.

The new resource manager has two challenges in this regard. First, to assist in developing realistic consumption and resource utilization patterns in the developed world while bringing about the necessary change in the economic yardsticks for measuring development. There is no reason why the new resource manager should not be a highly qualified economist or banker, but we must not be required by economic forces to quantify the unquantifiable in order to be recognized in a world dominated by powerful economies. Second, in the Third World the new resources manager should understand the root causes of poverty and help alleviate the present disparity. To do this he must assist in developing policies that will improve people's welfare through proper resource use. They should work with governments to set realistic targets for economic growth and acknowledge countries that have to base their development on agriculture alone will never be able to develop in quite the same way as the Western world.

POLITICS AND RESOURCE CONSERVATION

All final decisions with regard to the implementation of resource management policies lie with the legislative authorities of individual nations. These legislative authorities are usually composed of politicians. There are two objectives toward which a resources manager should work: to make the politicians and the political process more understanding and sympathetic to conservation, and to be involved in that process themselves by being politicians.

Many times resource managers have considered the political process to be something almost out of their control. They have many times preferred to withdraw to the rural communities and enjoy the protected areas "while they last." It is almost a defeatist attitude. Rather, they should see that it is quite possible, with the right training and attitude, for resource managers to participate actively in the political process. Only then can we be sure that conservation is appropriately taken care of in decision making.

In the Third World, one cannot be so optimistic since stable political systems have not yet quite evolved. In Africa, for example, the wave of independence was followed by a bewildering wave of violence, manifested in coup d'états, secession and tribal clashes, which swept across the continent from east to west. The past three decades have been characterized by ever-changing

policies and political systems, and this trend is still going on today. These political upheavals are taking their own toll on the protected areas and on efforts to enforce a realistic conservation policy. Amid warring factions, wildlife has of necessity often been the only source of food for hungry soldiers. And wildlife and other valuable resources from protected areas have often been made to supply the quick gains needed by the ones who emerge as the temporary winners in these struggles. It is a simple fact that a civil war undermines resource conservation and food production.

It is impossible to say when the situation will stabilize, but conservationists should not only hope for the best but also prepare for the worst. Resource managers should, therefore, try to develop policies that can maintain the wholeness of protected areas against this background. As mentioned earlier, it seems to me that the only hope is for the conservationists to turn their attention to the rural populations that live around protected areas. If such populations can be brought to realize the benefit of these protected areas, they will be able to hold them against any army.

INTERNATIONAL COOPERATION IN CONSERVATION

"In the 5,000 days between now and the end of this century, over a billion people will be added to the planet. During the next century another two to seven billion people could be added before the size of the human family stabilizes at somewhere between eight and 13 billion people. Thus we and our children must plan to squeeze perhaps two new human worlds into only one Earth. We must plan to support them with the same ecosystems from which we today draw our food, fish, energy, wood products, minerals and other materials." This message is from the authors of *Only One Earth* from which I would like to view this section. It is also the message that is given to us by the Brundtland Report, *Our Common Future*.

With the increase in the world population and improved communication, the world is much smaller than it ever was before. One can fly from Africa to Colorado on the Concord in just four hours. We can communicate by telex, photo copying, electronic mail and telephone directly to any part of the world. Decisions made in New York on resources use can be implemented in Indonesia thousands of kilometers away at the same time. The approach to international cooperation in the field of conservation should be based on the principle that the unique resources we are seeking to conserve, although they are contained within the national boundaries, are of significance to mankind as a whole. Furthermore, the distribution of strategic resources is not equal. There are some states that are more endowed with resources than others. This calls for a concerted spirit of sharing—experiences, expertise and resources—and for helping each other in every way to conserve the resource base for human survival.

Faced with financial problems and bare survival, it is unlikely that conservation will be a priority for many countries of the Third World. It is unfortunate but true that many Third World nations will not afford the bill for conservation

when their foreign debt keeps rising and amount of aid escalates. The report of the independent commission on international humanitarian issues on famine in Africa, 1985, indicates that in sub-Saharan Africa as a whole, official annual aid per person amounted to \$18 a year in 1982. In the low-income, semiarid countries, aid has, since the famine in the mid-1970s, reached more than \$44 per person. In south Asia, aid amounts to only \$4.80 per person. In Africa, aid finances from 10 percent of gross domestic investment up to 80 percent for low-income, semi-arid countries. Between 1973 and 1982 sub-Saharan Africa's debt increased fivefold. In the two years 1980-82 following the oil price increases and a slump in world trade, Africa borrowed heavily to maintain its level of imports of essential goods. Public-debt service payments amounted to \$9.9 billion in 1984 and are expected to rise to \$11.6 billion this year. It's against this grim picture that we must look at cooperation in conservation, since despite this these countries still harbour some of the world's most strategic resources, for example tropical forests and wildlife. Can the countries of South America afford to protect the Amazon Forest, or Zaire the Congo Forest or Tanzania the Serengeti? Yet if these areas are destroyed, is it these countries only that will lose or suffer?

As the authors of *Only One Earth* put it, "The problems we face as a world community are planetary, but not insoluble. Our two greatest resources, land and people, can still redeem the promise of development. If we take care of nature, nature will take care of us. But the huge changes sweeping over us and our biospheres demand fundamental changes in our attitudes, our policies and in the way we run our societies."

For the past 20 years the world community has perceived periodically a need for long-term analysis of problems relating to natural resources, population or the environment. For the most part responses have come too late when faced with a crisis like drought and flood. The result is that too many organizations have been created to deal with each individual crisis while there has been insufficient recognition of the interrelationship within the environmental crisis. Also, most of the responses have been national, whereas the harmful effects of population growth, resource consumption and pollution spread across borders and oceans. These are the challenges that confront the new manager. He must have a broad understanding that encompasses all these problems and help work out realistic solutions to them. A comprehensive reform of international economic relationships is essential and environmental crisis must form a new basis for cooperation among nations for their survival. This may require powerful institutions with adequate resources and political backing to do the job.

THE NEW RESOURCE MANAGER

Although we have realized the complexity of the problem and the need for a multidisciplinary approach, in practice we have been reluctant to depart from the conventional or traditional disciplines like forestry, outdoor recreation, soil schemes, agriculture and geology. Whenever a new threat to a resource has developed, we quickly adjusted to that need by developing a course in the

existing disciplines or an altogether new course dealing with that specific threat, but within existing institutions. We have been reluctant to think of a new institution that would be based on a completely revised thinking on the whole problem of the deterioration of natural resources. This perpetuates the continued segmentation, and each discipline jealously guarding its territory to the extent of being hostile to other disciplines.

Conservationists have tried to solve the problem of natural resource deterioration with professionals who are very competent in their own biological fields, but largely weak in the broader realities of how society functions. The new resources manager should be a broadly educated person with equal emphasis in social as well as biological sciences. Of increasing importance, the new resources managers will have to be shrewd economists and politicians. They should be able to develop economic models and make legislation that they themselves can see and sponsor through to the end. They must be able to lobby in legislative chambers and corridors.

The present conservation efforts have succeeded in delineating various tracts of land, which have been put into some form of protection or the other. What is needed now is how to manage these lands considering the realities of the present state of the world. There is no place in the present world for resources which are not properly managed. If this cannot be done for the areas under protection, it is simply only a matter of time before other interests could exceed the value of the resource. We would then stand the danger of losing these resources. Present resource managers have been too shy and have locked themselves within the boundaries of the protected areas and thrown the blame at others. The new resource manager will have to be more outward looking and lay emphasis on managing the whole region where the resource is situated. This will mean dealing with people of all walks of life as well as other resource managers and new resource management strategies being implemented at the regional level.

In the past decades, we have addressed ourselves to various threats to the natural resources base by creating new organizations to address specific threats. Because of the number of organizations involved, it has been difficult to gather resources to support the organizations. The result has been the existence of thousands of organizations which have virtually been weak and ineffective. The new resource manager will have to help reorganize the existing institutions which will make a visible impact in solving the resource management problems that confront us today and help design new strategies to mobilize more resources for conservation.

We must look at the world as one. The new resource manager should have a thorough understanding of other cultures and people, resource-use strategies in other cultures and how to exchange good ideas on resource management between cultures. The problems confronting the Third World will need a special understanding by the new resources manager and he should assist in designing strategies to reverse the downward trend and reduce suffering in those areas.

It is doubtful that the new resource manager can come out of existing institutions, although many could claim to be doing exactly just this. The biases which also presently exist in these institutions for various approaches, and the identities which have been developed, prevent the development of such a discipline which will be acceptable to all concerned. A new postgraduate institute is needed, one which would accept students who do not necessarily have a biology bias but have a good first degree in any discipline. The only other qualification should be a commitment to the cause of natural resources conservation. The program should, therefore, be organized to produce resource managers who can be plugged into various institutions—finance, administration, business, etc., according to the original bias of the first degree. The most important thing is that they will be resource managers wherever they are. You do not necessarily have to be sitting or standing on a specific resource to be a resource manager.

Last but not least, the solution to the crisis confronting the world's natural resources today needs to be treated as an emergency. We cannot afford to lose any more time in debate. We know where the problems lie and we have seen what can happen if we don't act, so let us act now.

THE RAMSAR CONVENTION AND WETLAND PROTECTION

George Archibald

Wetlands are often thought of as wastelands, habitats for mosquitoes, crocodiles, and schistosomiasis. They are difficult to traverse. And, to most people, they are out of sight, out of mind and destined for development. This is particularly true in temperate climates where, once a wetland is drained, its rich soil provides excellent agricultural land, minus the mosquitoes. Consequently, wetlands have been ruthlessly destroyed and their merits largely unknown and ignored. It is estimated that one-half or more of earth's wetlands have been lost to date and that most of the destruction has taken place in this century. In the USA for example, 50 percent of the wetlands in colonial times have disappeared between the mid-1950s and mid-1970s. In the USA, 200,000 hectares of wetland are lost each year and 87 percent of this loss can be attributed to agricultural development.

But, wetlands are important. They provided the biological soup from which the first vertebrates moved to dry ground. In temperate zones, wetlands support

the greatest biological diversity and productivity. Some wetlands can produce up to eight times as much plant material as an average wheat field of equal size.

There are many types of wetlands with a diversity of functions. Fresh water wetlands help prevent floods as well as maintain streams. They act like enormous sponges absorbing water in seasons of high rainfall and melt. In periods of drought, the wetland's stored water is slowly released. Wetlands are also enormous filters acting as cleansers transforming turbid and polluted runoff into clear, clean water. Coastal salt marshes are huge nurseries where two-thirds of the world's fish are harvested. They subdue wave action, minimize erosion and protect inland regions during storms. Wetlands are also home to a wide variety of colorful aquatic birds that have inspired and fed mankind since times untold.

If one individual might be selected as the father of wetland conservation, it would have to be Sir Peter Scott. Fascinated since childhood by the waterfowl of his native Great Britain, Sir Peter maintained a private collection of free-flying, semi-captive ducks, geese and swans at his country home near an estuary where large numbers of wild waterfowl spent the winter. His collection of birds and his passion for wild animals and wild places were the ingredients that led to the founding of the Wildfowl Trust at Slimbridge.

After World War II, hunters and other conservationists in western Europe were concerned about the welfare of waterfowl. It was this concern that led to the founding of the International Waterfowl and Wetlands Research Bureau (IWRB). Its first director was Dr. Edward Hindle of the London Natural History Museum. From 1962 to 1969, its headquarters were in Camargue, France, where Dr. Luc Hoffmann was director. In 1969 when professor Geoffrey Matthews became director, IWRB headquarters moved to Slimbridge.

Still headquartered at Slimbridge, IWRB is the leading organization for wetland conservation. Supported by grants from member nations and private organizations, particularly the World Wildlife Fund (WWF), IWRB's small but industrious staff coordinates waterfowl research and helps stimulate wetland conservation in many nations. It is an international, non-government body that encourages annual waterfowl counts, draws up inventories of wetlands of international importance, and convenes meetings of its members—often at a location where there are pressing conservation problems. It supervises and encourages the activities of 14 research groups, each of which specializes in a particular type of wetland bird family or problem.

Although many nations collaborated closely with IWRB, there remained a need for a formal intergovernmental agreement, a convention that these nations might adhere to in advancing the conservation of wetlands. There had never been an international conservation convention, however, and some parties were skeptical that such a convention be restricted to just one type of habitat—wetlands. Realizing the importance of international cooperation in the conservation of migratory birds and the vulnerability of wetlands, the International Council for the Conservation of Nature (IUCN), and the International Council for Bird Preservation (ICBP) joined forces with IWRB and cosponsored meetings

of governmental delegates in France (1962), Scotland (1963), Netherlands (1966) and USSR (1968) to draft an agreement for wetland conservation. Their nine years of labor, masterminded by IWRB Director Professor Geoffery Matthews, resulted in an historic meeting in the city of Ramsar, Iran in 1971. Delegates from 18 nations advanced a document known as the Ramsar Convention, or the Convention on Wetlands of International Importance, especially as waterfowl habitat.

A wetland was defined as areas of arch, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tides do not exceed six meters. The convention further recommended that nature reserves be established for important wetlands in signatory nations and that these wetlands be warded to assure their preservation and the welfare of the waterfowl. The convention was careful not to infringe upon the sovereign rights of member states. To join the convention would be a declaration of intent which involves a strong moral obligation to wetland conservation.

In 1971, the documents of the Ramsar Convention were deposited with the United Nations Economic, Scientific and Cultural Organization (UNESCO). IUCN became responsible for "continuing bureau functions" (i.e., secretariat duties) under the Convention and IWRB, the scientific advisor. IUCN's Conservation Monitoring Center in England maintained the List of Wetlands of International Importance. In 1975, the Ramsar Convention was officially accepted by seven nations and it became a legal entity, the first of its kind to address the conservation of a single type of habitat. From the start, the Ramsar Convention has been administered on a shoestring budget. The Ramsar List of Wetlands grew as member nations developed a new interest in wetlands and as more nations were encouraged to join the convention. Budget constraints, however, limited the productivity of the convention.

The first official conference of governments belonging to the Ramsar Convention was at Cagliari, Italy in 1980. The topics discussed included conservation measures taken at sites designated for the List, and the conference established criteria to guide member states in what constitutes a wetland of international importance. Criteria based on unique or representative wetlands and on the general importance of wetlands to fauna and flora were supplemented with quantitative criteria related to waterfowl and were agreed upon. Waterfowl were considered as "indicators" of wetlands. On the northern continents, most waterfowl migrate and require a series of wetlands between their breeding and wintering habitats. The Ramsar Convention encouraged member states to protect their links in those chains. These wetland areas to be added to the Ramsar List should have at least one percent of the population of a migrating waterfowl species that uses that wetland.

The Cagliari conference also addressed the need to amend the text of the Convention. The 1984 conference, held in Groningen, Netherlands, once again reviewed the status of listed Ramsar sites and established a task force to advise

on a secretariat, a budget and a standing committee. At the latest round of meetings in Regina, Canada in May/June 1987, a further Extraordinary Conference adopted amendments to the Convention Text which allow a budget to be established, while the third ordinary meeting approved the level of the budget and set up a permanent bureau (or secretariat and a Standing Committee). It is proposed that member nations would provide an annual budget of U.S. \$400,000 with developing countries paying as little as \$41. For the first time since its inception, the Ramsar Convention now has stable funding and a formal secretariat with two sections, one attached to IUCN headquarters in Switzerland and one at IWRB headquarters in Slimbridge. Today 45 nations are party to the Ramsar Convention, and 380 wetland sites are listed, thereby assuring a safer future for some 27 million hectares of wetland, an area the size of New Zealand, or larger than the whole of U.K.

All sites initially listed are still listed. Being included on the list helped thwart development plans for wetlands in Italy and Great Britain and curbed commercial fishing at a site in Pakistan. Unfortunately, one Ramsar site in Spain has been affected by drainage, 11 sites in Greece are seriously damaged and sites in four other western European nations are threatened. Some countries have listed sites that are already strictly protected, while others strive to expand wetland protection by listing sites that need better protection.

The Ramsar Convention had its birth in Western Europe and initially concerned itself with migratory waterfowl. Wetlands are worldwide, however, and there is a need to include more developing nations in the convention and to expand the criteria for identifying wetlands of international importance. Particularly in tropical regions, wetlands are the basis of the livelihood for millions of local people living near the water. Great flocks of migratory waterfowl may be entirely absent from these wetlands, and the local waterfowl are usually widely scattered in small groups. A major topic for discussion at the Regina meetings was the wise use of wetlands—the conservation of wetlands so that they will benefit both man and wildlife. We must promote wise use defined as “their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem.”

Joining the Ramsar Convention indicates national interest in and commitment to wetland conservation and international cooperation. Wetlands gain status as important regions that should be protected. Member nations benefit from the expertise and motivation of wetland researchers and conservationists from many nations. Issues that require the cooperation of several nations, challenges ranging from migratory waterfowl to watershed and waterways, can be addressed and perhaps resolved through the convention. Signatory nations are stimulated to make inventories of their wetlands and resources within the wetlands and then to take stronger steps to protect the wetlands. The Ramsar Convention is not expensive to join, and it has no authority over sovereign rights.

The secretariat of the Ramsar Convention soon hopes to be in a position to influence technical and financial assistance from developed nations and interna-

tional aid agencies to help assure that environmentally damaging projects are curtailed. The Ramsar Convention has matured and is now able to help nations meet the challenges of wetland conservation. Every nation has much to gain by being party to this Convention.

GLOBAL CLIMATE CHANGE AND ITS EFFECTS ON WILD LANDS

Irving Mintzer

Modern industrial and agricultural activities release gaseous pollutants that are changing the composition and behavior of the atmosphere. The release of some of these chemicals into the atmosphere is affecting the earth's radiation budget. The continuing release of these pollutants represents a giant uncontrolled experiment that threatens to alter the climate of the planet.

If current trends continue for the next several decades, the atmospheric buildup of greenhouse gases is likely to change global climate more than any other event during the period of written human history. The changes in regional climates that result from this buildup will have profound implications for economic societies, for managed ecosystems, and in particular, for wild lands. The following discussion explores five basic questions about the buildup of greenhouse gases, its effect on global climate and implications for wild lands. The key questions are:

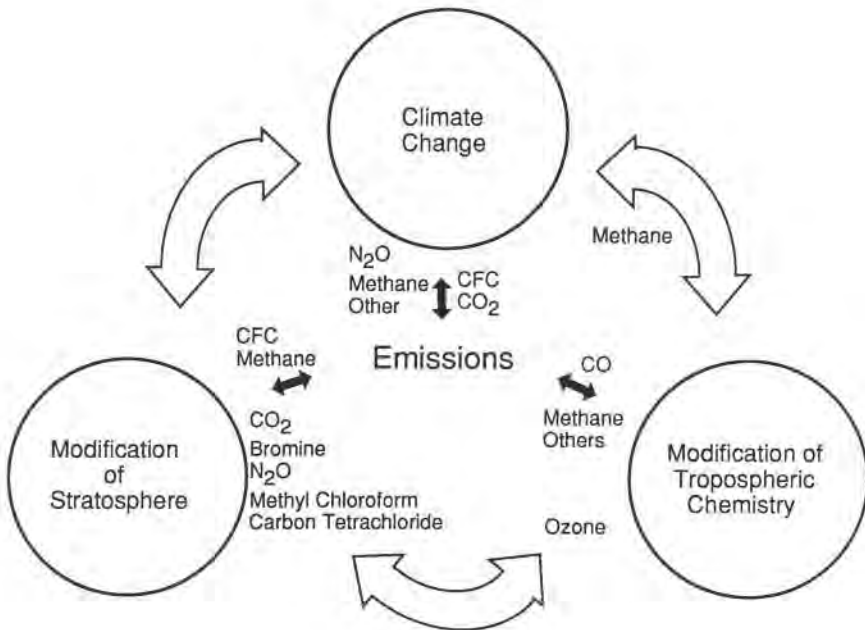
- How is the atmosphere being changed by human activity?
- How large are the changes that have occurred so far?
- How much additional change is already in the pipeline from activities?
- How much additional change is already in the pipeline from activities that have taken place within the last hundred years?
- What are the likely consequences of these changes?
- To what extent can policy choices made today affect the timing and the magnitude of the damages which result?

It is important to note that the greenhouse problem does not exist in

isolation from other important international environmental issues. Much popular rhetoric would suggest that there is one atmosphere with an acid-rain problem today, and at some future time, perhaps in the lives of our grandchildren, there will be another atmosphere with an ozone-depletion problem and with regional climates altered by the greenhouse effect. Many would suggest that these air-pollution problems are unrelated to the more dramatic problems of tropical deforestation and species loss. This is both false and misleading.

In the last several years, the leaders of the international scientific community have come to recognize that there are strong and pervasive linkages between these important problems. The three atmospheric problems—global climate change due to the greenhouse effect, modification of the stratosphere due to ozone depletion, and the complex modifications of tropospheric chemistry that are commonly referred to as acid rain—are all linked at several important levels. Fig. 1 illustrates some of these linkages.

Figure 1



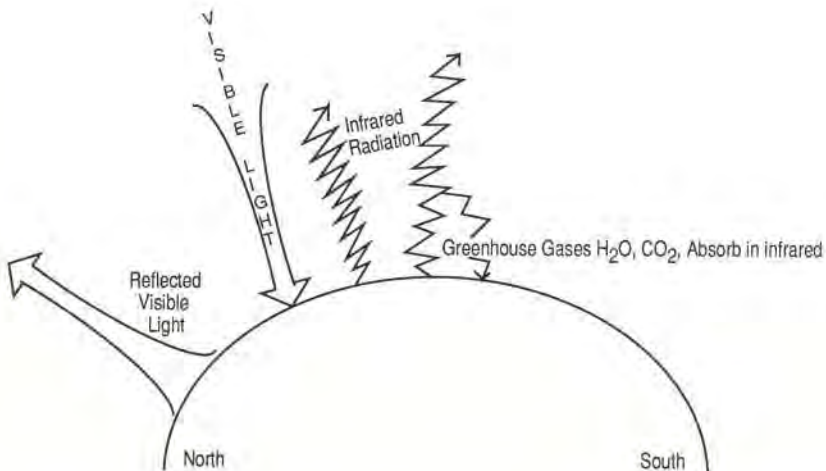
The three problems are linked at the level of emissions, since many of the same chemical pollutants participate concurrently in several of the effects. They are linked economically because the same industrial activities that produce the emissions contribute simultaneously to all three problems. They are linked politically because policy choices made today to try to relieve the pressures of any one set of effects will inevitably affect the others. In particular, the timing and severity of each of these problems will be strongly affected by the energy strategies chosen today and implemented over the next several decades. For example, efforts to limit the damages due to acid rain by putting sulfate scrubbers (i.e., flue gas desulfurization equipment) on power plant exhaust stacks will accelerate the rate of climate change and the rate of ozone depletion by increasing emissions of CO_2 and N_2O .

THE GREENHOUSE EFFECT

Fig. 2 illustrates the greenhouse effect schematically. Most of the light that comes in from the sun is in the visible part of the electromagnetic spectrum. A large portion of it is reflected back out into space but much of it is absorbed at the surface of the planet. In order to keep the earth from getting continuously hotter (and eventually melting), an equal amount of energy must be constantly reemitted into space in the form of infrared radiation. Certain chemicals, called "greenhouse gases," are transparent to incoming solar radiation, but absorb the long-wave, infrared radiation emitted from the earth's surface, warming the atmosphere.

Figure 2

EARTH'S TEMPERATURE IS RAISED BY EXISTING GREENHOUSE GASES



The greenhouse effect was not always a problem for human societies and natural ecosystems. In fact, it was one of the key phenomena in earth's history that permitted the evolution of familiar forms of life. Early in our planet's history, background concentrations of naturally occurring greenhouse gases, especially water vapor and carbon dioxide, absorbed some of the incoming solar energy and trapped it near the earth's atmosphere. This natural greenhouse effect caused the planet to be about 33° C warmer than it would otherwise have been.

Today, the average surface temperature of the planet is approximately 15° C. Without warming due to the natural background concentrations of greenhouse gasses, average global temperature would be minus 18° C. This difference has allowed water-based organic chemistry to evolve into a rich fabric of life.

THE HISTORIC BUILDUP OF GREENHOUSE GASES

In the last century, the greenhouse effect has been transformed from an important natural phenomenon into a global environmental problem. Steadily increasing concentrations of greenhouse gases in the atmosphere are altering the thermal emissions' spectrum of the planet. It represents the band of wavelengths through which infrared radiation can escape the earth's atmosphere, maintaining the earth's radiation balance with outer space and keeping the planet from melting. Industrial and agricultural activities are releasing increasing amounts of gases that absorb in this wavelength band. These gases are muddying up the window and causing more and more radiation to be trapped close to the earth's surface. If current trends continue, the increasing concentrations of greenhouse gases threaten to alter global climate more rapidly than economic societies or natural ecosystems can adapt to successfully.

Five families of gasses are principally responsible for covering up the atmospheric window. The compounds which have historically contributed the most to the risk of global climate change are: (1) the chlorofluorocarbons (CFCs), the halons (brominated relatives of the CFCs), methane (CH₄, commonly known as natural gas), nitrous oxide (N₂O, known in the U.S. as laughing gas) and carbon dioxide (CO₂). Each of the first four amplifies the warming due to CO₂ alone.

All five also affect the concentration and the distribution of ozone in the atmosphere. Figure 3 summarizes these linked affects. The chlorofluorocarbons, important industrial chemicals that do not occur naturally, contribute to the greenhouse effect while they reside in the troposphere and increase the rate of ozone depletion when they percolate up into the stratosphere. The Halons, a related family of man-made chemicals used principally in fire extinguishers, also contribute to global warming and accelerate ozone depletion. Similarly, increasing atmospheric concentration of N₂O warms the troposphere and depletes ozone from the stratosphere. Methane buildup, by contrast, counters some of the effects of stratospheric ozone depletion, although it does amplify the tropospheric warming. The steady buildup of CO₂ warms the troposphere, but ultimately because it causes the stratosphere to cool, reduces the rate of ozone depletion by slowing down the reactions that catalytically destroy ozone.

WARMING EFFECTS OF MAJOR COMPOUNDS

Compounds	Stratospheric Ozone	Global Temperature
Chlorofluorocarbons	Depletes	Increases
Halons (Bromine)	Depletes	Increases
Methane (CH ₄)	Counter Depletions: Adds Ozone (Troposphere)	Increases
Nitrous Oxide (N ₂ O)	Depletes	Increases
Carbon Dioxide (CO ₂)	Slows Depletion	Increases

Figure 3

Substantial emissions of these greenhouse gases have occurred during the industrial era. Measurements of air samples trapped in ice cores removed from glacial areas of Greenland and Canada indicate that the concentration of carbon dioxide in the atmosphere has increased by approximately 25 percent over the last century, from about 280 parts per million by volume (ppmv) in the pre-industrial period, to about 346 ppmv today. For the period since the International Geophysical Year (i.e., since 1958), substantially more accurate CO₂ concentration measurements are available. The carbon dioxide concentration of the atmosphere has been growing even more rapidly during this period, increasing by more than 10 percent in the last 30-year period.

Similar increases in atmospheric concentrations have been observed for the other principle greenhouse gases. Based again on ice core measurements, scientists now believe that the concentration of N₂O has risen about 10 percent since the beginning of the industrial era. Atmospheric concentration of methane remained stable for about 10,000 years, but it has increased by a factor of two in just the last 200 years. Recent changes in the concentration of methane in the

atmosphere have followed an exponential growth curve with a rate of growth equal to about 1 percent per year. The change in the concentration of methane is a little bit more puzzling to the atmospheric science community than is the growth in other greenhouse gases. Although the sources of methane emissions are known, other factors resulting from human activity also affect its concentration. For example, automobiles, woodstoves, the burning of tropical forests and other activities emit carbon monoxide (C). These emissions reduce the ability of the atmosphere to cleanse itself by eliminating hydroxyl (OH) radicals, the natural cleansing agent that would otherwise combine with methane and remove it from the atmosphere.

Not all human activities contribute equally to the risks of global warming and ozone depletion. For example, although all fossil fuel combustion adds CO₂ to the atmosphere, not all combustion contributes equal amounts of CO₂. Table 1 illustrates the range of CO₂ emissions per unit of energy supplied for a range of commercial fuels. Natural gas releases about 14 million tons of carbon as CO₂ per exajoule or per quadrillion of heat supplied. By contrast, burning coal releases about twice as much CO₂ per unit of energy and burning synfuels derived from coal releases three to three and one-half times as much CO₂ as natural gas per unit of energy supplied.

Furthermore, the contribution to global warming of non-CO₂ chemicals also varies substantially. Some pioneering investigations conducted at the National Center for Atmospheric Research (NCAR) have explored the impact of a one part per billion by volume (ppbv) increase in the atmospheric concentration of many greenhouse gases. The work done at NCAR has demonstrated that the greenhouse problem is not a problem of CO₂ alone, and has revealed that almost half of the current contribution to future global warming is the result of emission of non-CO₂ trace gases. The NCAR analysis suggests that if current trends continue, the atmosphere will warm by about 1.5° to 4.5° C by the year 2030.

Although this sounds like a small and insignificant effect, it is, in fact, an absolutely unprecedented rate of change. An average global warming of just 2° C will take the earth beyond the range of anything that has been experienced in the last 10,000 years. It will thus take us outside the range for which human societies have any written record of how they adapted in the past. Such a warming will stress the ability of organisms and ecosystems to adapt and evolve rapidly. And it will certainly put great strains on wild lands and nature preserves. But even this level of warming is not the most extreme possibility.

THE EFFECT OF TODAY'S POLICIES ON THE ATMOSPHERE OF TOMORROW

Recent research at the World Resources Institute has investigated the effect of various policy options on the rate and timing of future global warming. Four different policy scenarios were considered, each supporting the same population and the same rates of regional economic growth. Two criteria are used to compare the effects of policies implemented in each scenario. The first criterion

is the timing of commitment to a warming of 1.5° to 4.5° C, a warming equivalent to the effect of doubling the pre-industrial concentration of CO₂ with all other gas concentrations held at their pre-industrial levels. This is the benchmark that is used in the atmospheric science community as a common measure of climate change. The second criterion is the total commitment to future warming due to all projected emissions between the present and 2075.

The studies conducted at the World Resources Institute indicate that if current trends continue, the world will be committed to a warming of 1.5° to 4.5° C by 2030 and to a warming of about 3° to 9° C by 2075. On the other hand, in a high emissions scenario in which policies to expand the use of coal and the use of coal-based synfuels are implemented, the rapid-cutting destruction of tropical forests is encouraged and the use of the most dangerous chlorofluorocarbons increases, the planet could be committed to a warming of 1.5° to 4.5° C as early as 2015, less than 30 years from today. In this scenario, by 2075 the total warming commitment has increased to between 5° and 15° C. By contrast, in the WRI slow buildup scenario, in which strong and aggressive measures are taken to improve energy efficiency, to reduce the use of the most dangerous chlorofluorocarbons and to protect the tropical forests, the date at which the planet is committed to a 1.5° to 4.5° C warming could be postponed to well beyond 2075. The difference between the results in the high emissions and the slow buildup scenarios, a shift from 2015 to 2075 in the date of commitment to a 1.5° to 4.5° C warming, may seem insignificant, but it represents an important window of opportunity for human societies and ecosystems in which adaptive responses can develop to that part of the climate change that can't be avoided.

Unfortunately, however, there are no options that will allow the planet to avoid all future global warming. The earth is now committed to a significant global climate change—committed by actions that have already taken place as well as by the industrial infrastructure that is in place throughout the world. The best recent analyses suggest that emissions from 1880 to 1980 have committed the planet to a warming of approximately 0.7° to 2° C.

Although some future warming cannot be avoided because of past and present emissions, the resulting damages and dislocations can be minimized if the available time is used wisely. By slowing the rate of growth in future emissions, it may be possible to slow the rate of change enough to develop and implement adaptive responses that protect the most vulnerable societies, species and geographic areas. In order to identify what such prudent responses might entail, however, it is necessary to look beyond the globally averaged warming discussed above and focus some attention on the regional distribution of the expected impacts.

IMPACTS OF A GREENHOUSE GAS BUILDUP

The global warming and the stratospheric ozone depletion that accompany a buildup of greenhouse gases in the atmosphere will not be uniformly distributed. The greatest warming will occur at the poles, in the vulnerable high-

latitude areas of arctic communities and in high-latitude countries. The warming in the polar regions is expected to be two to three times the global average. The concurrent warming of tropical areas is expected to be only 50 to 75 percent of the global average.

The latitudinal distribution of warming effects is critical to the ecological impacts that will result. By changing the natural thermal gradient of the earth between the poles and the equator, the greenhouse effect will weaken the great heat engine that drives the global weather machine. It is this heat engine which generates the rains, winds and the ocean currents, and is responsible for the familiar patterns of regional climate.

The principal effects of a global warming are likely to be: 1) a rise in sea levels, varying in magnitude between regions and communities; 2) changes in winds and ocean currents; 3) changes in precipitation and water resources; and 4) changes in the frequency of extreme events. These physical changes will have major implications for the earth's wild lands and unmanaged ecosystems.

For example, a warming of 1.5° to 4.5° C is expected to cause a rise in sea level of 20 to 140 centimeters. The effects of this sea level rise are likely to be important not only for ecosystems but for human communities as well. Human populations and wetland ecosystems in low-lying areas and river deltas, such as the Ganges-Bhamaputra system, the Nile, the Mississippi and the Yangtze are especially vulnerable to rises in sea level. In these regions, much of the population is concentrated in a broad alluvial delta area that is flat and close to sea level.

It is important to note that the effects of sea-level rise can place devastating pressures on wild communities and on ecosystems. Sea-level rise can push coastal wetland habitats up against the edge of human development, giving their inhabitants no place to run and little area in which to hide. This problem is especially important for the migratory birds and other animals who must use critical habitat areas that are spread over large geographic ranges.

In addition, sea-level rise can lead to saltwater intrusion into aquifers and deeper saline penetration into tidal estuaries. These effects can cause severe disruption to the ecosystems that require the presence of fresh water in these areas.

Changes in ocean currents could affect the presence and distribution of sea ice and the upwelling of nutrients that feed oceanic and aquatic ecosystems. Shifts in the location of major currents are likely also to affect the polunias, the open water oases of the arctic region. If high latitude areas are warmed by the greenhouse effect, these areas could become greatly enlarged, altering the balance among local species. Such changes are likely to be a mixed blessing—good for some, perhaps for fish and whales, while potentially creating great difficulty for mammals and certain other species. The migratory patterns of these latter inhabitants of the arctic wild lands would be severely disrupted if they could not move from one ice island area to another in the winter.

Changes in the frequency and distribution of precipitation could also have important impacts on wild lands and unmanaged ecosystems. Precipitation and temperature combine to effect both evapotranspiration and soil moisture.

Recent analyses with large-scale computer models indicate that a global average warming of 1.5° to 4.5° C might be accompanied by a decline of as much as 40 percent in summer soil moisture in the Great Plains of the United States and in the grain belts of the Soviet Union, Australia and in Central Europe. In addition, the models suggest that these changes could occur simultaneously in a way that would be extremely disruptive to the world food system. In a world with growing human populations, any failure of the global grain economy would increase pressure for poaching and harvesting of wildlife to meet constantly increasing demands for food and fodder. While modelling exercises have produced somewhat different estimates of the regional distribution of changes in rainfall and soil moisture, unfortunately, one of the biggest weaknesses in atmospheric science today is the limited ability to predict changes in regional climate with the same degree of certainty that we can forecast changes in global climate.

The enormous changes in the earth's thermal gradient described above are likely to produce some predictable alterations in regional climates and some potentially surprising effects. For example, as a result of global warming, the warm waters of the Gulf Stream current could move as much as 300 kilometers to the west. If this occurred, the warm climates of Iceland and the United Kingdom, both anomalies for their latitude, would grow much colder even as the rest of the world warmed rapidly.

Another type of expectable surprise likely to accompany a greenhouse warming is an increase in the frequency of extreme weather events. These will include heavy rains and heavy snowfalls occurring at untimely periods, droughts and severe storm surges in coastal areas.

The kinds of impacts these events will cause have already been observed. Along the polar bear paths that cross the Canadian Yukon, an unseasonably heavy, early and wet snowfall in 1973 severely disrupted the species balance. It resulted in the untimely deaths of 75 percent of the local muskoxen and two-thirds of the caribou in the area. Similarly, heavy storms in the Bay of Bengal in 1972 created a national disaster. One particular storm produced a great surge into the Ganges Delta that resulted in extensive flooding and the deaths of 100,000 people.

The United States has recently observed some indications of the kinds of effects that changes in climate would have upon our society. These include the drought in 1986 in the southeastern United States, the rise in the waters of the Great Lakes and the floods on the edges of the Great Salt Lake. Although not necessarily caused by global climate change, these events dramatize the kinds of disruptive impacts that could be expected to occur as the world warmed.

CLIMATE CHANGE AND THE MANAGEMENT OF WILD LANDS

Climate change will alter habitat boundaries and inter-species relations in ways which will effect wildlife refuges and unmanaged ecosystems. Many species now have limited access to suitable habitats. Like others more generously endowed, they face the natural random genetic events that decimate popula-

tions. With changes in global and regional climate due to the greenhouse effect and human encroachment upon their limited habitats, they will be severely at risk. Birds and other migratory species which must periodically use widely dispersed yet critically important habitat areas will be especially vulnerable.

Robert Peters of the Conservation Foundation has provided several useful examples of the potential impacts of changing climate on natural habitat. Figure 4 illustrates schematically how these changes might affect the habitat of an imaginary species. The line in the middle of the figure bounds the suitable habitat range for this species. The white area represents the unsuitable habitat and the shaded area is the range in which the species survives and prospers. The hexagon is the site of a future reserve. As climate changes, the limit of the range shrinks around the reserve, reducing the buffer zone that protects the inhabitants or the preserve area from human society and its pressures. As local climate shifts, the natural inhabitants are pushed closer to the periphery of the suitable range. At some future time, the entire former reserve, though originally suitable to protect the vulnerable population, exists outside the limits of the now-suitable range. The lesson here is simple: In the selection of preserve sites, ample consideration must be given to the effects of changes in climate patterns on the ability of the

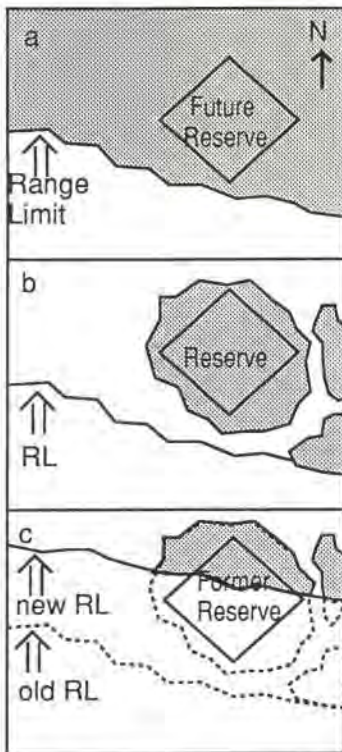


Figure 4

reserve to support the vulnerable species the preserve is meant to protect.

Species at high latitudes and species in mountain communities are vulnerable in yet another way. Figure 5 illustrates the ranges of four species A, B, C, D in a mountain reserve before a climate change. As the world warms and species retreat to suitable habitats at higher altitudes, the range available to species A has disappeared entirely. Species B has been forced to move to the top of the first mountain and off the second mountain. Species C has now colonized the second mountain and the base of the third and species D, which was outside the original frame of reference, now dominates the area at the bottom of the illustration.

Climate change, ozone depletion and acid rain will present new challenges to the management of wild lands and to the selection of sites for preserve areas. Those concerned with the successful management of wild land preserves may ask how present species

and ecosystems could possibly respond successfully to future global warming. Unfortunately there is no simple formula; small steps may improve the resilience of those species which dwell in the reserves whose sites are being planned.

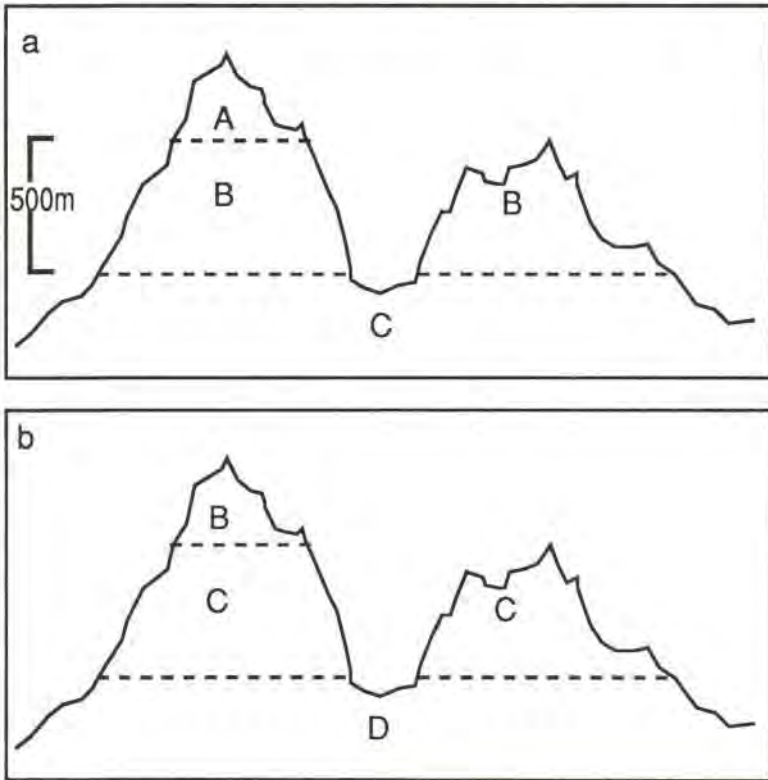


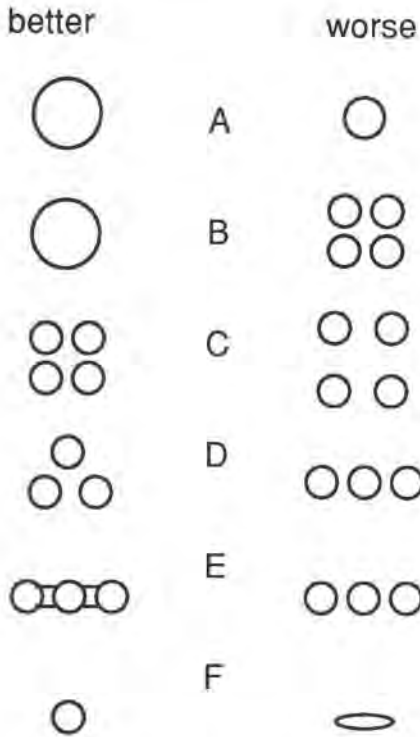
Figure 5

Figure 6 illustrates some of the geometric principles of preserve design developed by Dr. Jared Diamond of the University of California at Los Angeles.

- 1.) Because the number of species that can be supported in a preserve is a function of size, where the option exists a large site is better than a small site and one large site is often better than several small sites.
- 2.) Because they increase the likelihood of successful migration as conditions change, contiguous or closely spaced sites are preferable to widely separated locations.
- 3.) Sites which are symmetric around a point are preferable to locating all sites in a linear array because of the danger of isolation of sub-groups at the extreme edge of a range, where it is not possible to choose contiguous sites.
- 4.) It is better if the sites are connected rather than separated because land bridges will increase the likelihood of migratory success in the face of changing conditions, if the sites must be stretched out along a line (as when all available land borders a highway).
- 5.) If

only one site can be chosen, round is preferable to linear, as this will again decrease the probability of isolating pockets of inhabitants in untenable micro-climates.

Figure 6



CONCLUSION

It is reassuring to note that with enough time, whole communities and even major biomes have, in the face of past global warmings, moved great distances. The critical factor is not just the magnitude but the rate of change in climate. If current trends continue, the rate of global warming over the next 50 years will exceed that of the last 10,000 years. Under these conditions, the rate of change for the next century will exceed the rate for the last million years. And, if policies now under consideration to increase the use of coal and cut down the remaining tropical forests are implemented, over the next several decades the rate of change in climate could be even greater.

Fortunately, the results from recent studies at the World Resources Institute indicate that the earth is not locked into the worst of these hot-house futures. Policies to improve the efficiency of energy use, to shift the balance of commercial fuels away from coal toward less carbon-intensive fuels

and to limit the rate of tropical deforestation can substantially slow the rate of greenhouse gas buildup and ozone depletion. Equally important, such strategies can buy time for human societies and natural ecosystems to adapt to those aspects of climate change which cannot be avoided. There are two principal challenges for those who would preserve our heritage of biological diversity through the careful management of the earth's wild lands. The first is to stimulate the choice of energy and industrial policies that can sustain economic growth while they slow the rate of growth in emissions of greenhouse gases. The second is to choose carefully the sites of future preserves and the management strategies with which they are operated to maximize the resilience of vulnerable species to the stresses of a changing and uncertain environment.

CONSERVATION, LAND USE AND SUSTAINABLE DEVELOPMENT

Raymond F. Dasmann

We are trying, in this Congress and in our collective work, to confront the issues of conservation and development, specifically as they refer to wilderness.

If I were to sum up my ideas in one sentence it would be this: Beware of bankers bearing gifts. They are unnatural, like pigs with wings. Now I don't want to disparage any particular banker, I am only using them to illustrate a concern. When conservationists deal with developers, the odds are not even. Wealth and power tend to be concentrated on one side only. I worry that in the new alliance between conservation and development, the conservation forces will give away too much and get little in return. There was a saying in my family that "He who sups with the devil should use a long spoon." It may apply here as well. If I may extend my imagination a bit further, there was a short film going around in the early 1970s which may apply to this situation. It was called "Bambi meets Godzilla." I don't have to remind you who Bambi is.

There is a great deal of information on the need for growth and development. But the people who are involved in these areas don't always mean the same thing when they use these words. If we hear the term economic development, we must always ask: Development of what? In what way? For the benefit of whom? At whose expense? Development of resources for the benefit of the elite at the expense of the poor is not going to work for very much longer. Similarly, there can be no sense in talking about continuing economic growth unless we recognize that there are limits to growth imposed not only by the physical realities of our planet, but by our human desire to keep the planet a fit place for all species to live. This desire itself may express a physical necessity of limitation.

There are some kinds of development that can go on forever, without known limits, such as development of knowledge and understanding, development of human potential or the human spirit. Development can be applauded wholeheartedly if it moves toward those goals, not just for the elite but for all.

There are many ideas offered about sustainable development, but we must once again question the meaning of this term. Sustainable development must mean ecologically sustainable development, and that implies that it will take care of all of our essential life support systems—our air, water, soil and vegetation. Sustainable development must be based on the preservation of biological diversity—not in a deep freeze or a seed collection, but out there where it belongs, in its native habitat. Sustainable development must also, first of all, take care of the needs of the poorest people. Not by giving them food, but by

restoring their ability to look after themselves. By helping them to return to what they always used to be: self-reliant. Sustainable development must always move toward ecological sustainability, using living resources only in ways that maintain or increase their renewability.

That kind of sustainable development is compatible with wilderness conservation. In fact, the two go hand in hand. But don't buy any other brand. Look under the label. Be cautious. Remember Bambi.

Global generalities must always be put into practice locally. Several years ago, a few of us began a study of the Santa Cruz mountains in California, intending initially to answer the question, "Why are the mountains wild?" And, leading from that, "How do we keep them that way?"

This mountain system extends from San Francisco for a distance of 75 miles to the Pajaro River in the south. The total area is close to 1,400 square miles, of which about 1,000 square miles are not urbanized. They are not particularly high or precipitous (the highest elevation is near 3,800 feet), yet they are a barrier to urban development. They stand between the five million residents of the San Francisco Bay metropolitan area and the small towns on Monterey Bay and the Pacific Coast. Visually they give the impression of an extensive area of wild land, mostly covered by redwood or mixed evergreen forests. The question of why they are still wild becomes significant when we realize that there is no extensive federal presence—no national forests or parks. Most of the land is privately owned.

In the absence of a federal presence, state and local governments have taken a more active role. There are six state parks, mostly established to protect the last of the old-growth redwoods, starting with Big Basin State Park in 1901. However, only 40,000 acres are included in this system. There is also an important state fish and game refuge protecting the watershed of the San Andreas and Crystal Springs lakes. There is an impressive network of county parks and two university reserves. However, even in the aggregate these protected areas do not explain the wild quality of the mountains.

Unquestionably, natural phenomena affect development. The California climate features wet and dry cycles—flood years and drought years. In flood years those who have built on unstable slopes or in river bottoms see their houses washed away. In drought years, forest and brush fires often sweep through the mountains, destroying houses built on vulnerable sites. One could say the mountains defend themselves against excessive development. However, it is the attitude of people toward growth and development that is more important. This is particularly evident in Santa Cruz County, on the ocean side of the mountains. People come to Santa Cruz for its beaches and spectacular scenery and to escape the big-city confusion of the San Francisco Bay area. But once they have arrived in Santa Cruz, their tendency is to shut the door behind them and say "no more room" to those who would come later. This leads to antigrowth legislation at the city and county level.

Thus, to attempt to protect the wild country of the mountains, one must confront one of the major global issues of today: the issue of population growth.

The more manageable side of the population problem is the one resulting from an excess of births over deaths. But the growth of population in the San Francisco Bay area does not result from San Franciscans breeding like rabbits. It is immigration from other areas. Declining birth rates are matched by increasing immigration rates. This is a problem confronting governments in many parts of the world, and in a democratic society or even a loosely controlled autocracy, it is difficult to deal with. There seem to be two directions that are being followed. The first "leave it to the market" approach is popular today. Land and housing prices are allowed to increase to the point where enclaves of the rich develop and the poor are pushed to the margins, often into the remaining wild land. The other approach involves increasing governmental control over land use through planning, zoning and strict regulation of permits to build or develop. This has not been highly successful in protecting choice agricultural land. It seems less likely to succeed in protecting wild land of more indeterminate value.

There are two other approaches to this problem that show some promise of reinforcing the ability of local governments to control growth and development. One of these is the Pinelands National Reserve model which is being tested in New Jersey. In this, a core area of wild land, the Pine Barrens, is protected by a state park. Other areas are protected as prime agricultural land. Other sites are determined to be suited for development, for industry, commerce, roads, housing, etc. The federal government is more actively involved. Both reinforce the ability of local governments. Growth is not prevented, but channeled in appropriate directions.

The other approach that is also being used in the pinelands is that of a Biosphere Reserve. This is an international designation derived from the UNESCO Man and Biosphere (MAB) program. It has no strict legal status in this country, but indicates a commitment of the federal government to meet international standards of protection, management and research. It places an international layer of protection over the existing federal, state and local authorities.

Ultimately none of these approaches, or any others, will work unless the local people are behind them. But the local people, by themselves, cannot protect wild country or wilderness when the forces acting against such protection originate outside of the local area and override local controls. Thus, it is important to always question the meaning of growth and development. Let us be careful in joining the new alliance of development and conservation.

OCEAN WILDERNESS— MYTH, CHALLENGE OR OPPORTUNITY?

Nancy Foster and Michele H. Lemay

In the months preceding the 4th World Wilderness Congress, the organizers of the Ocean Wilderness Seminar and colleagues in the marine conservation community were confronted with several questions:

- Does the concept of “wilderness” apply to ocean areas and, if so, what is ocean wilderness?
- And how does a country or a region provide for wilderness in its national agenda for ocean resource management?

The discussion that followed our early inquiries provided insights into the value of the concept of wilderness for integrated marine resource management. Simultaneously, the rapidly growing experience of countries that have established marine protected areas raised questions concerning the practical, legal and political aspects of ocean wilderness. The discussion culminated in a resolution at the 4th World Wilderness Congress which marks initial progress in placing the idea of ocean wilderness in a broader context. The following is a brief account of the thinking that led to this collective statement.

The century of thought that has gone into defining wilderness on land provides a starting point for understanding ocean wilderness. At first glance, the physical attributes of terrestrial wilderness seem to have little relevance in an ocean environment. For example, we could argue that since ocean areas seldom show permanent visible impact of human activity and since people are always transient, these areas all qualify as wilderness. Alternatively, ocean systems are completely open to external processes and impacts and cannot be viewed as pristine in the conventional sense. It is also doubtful whether the absence of mechanical transport, a criterion used for terrestrial wilderness, applies to ocean areas. Given the scale and openness of ocean systems, it is unlikely that many of the physical criteria used to define land wilderness will apply to the ocean.

However, philosophers have explored the concept of wilderness in much broader terms than its physical characteristics. Many have pointed out that wilderness is also a driving force which has led to significant changes in Western society's attitudes and beliefs. In the early 1900s, wilderness evolved as an ideology which was instrumental in the development of grassroots environmental movements and which ultimately led to legislation now considered the foundation of our land conservation ethic. In the process, areas such as Yosemite

National Park in the United States and Banff National Park in Canada gained unprecedented societal value.

Hence, while it may not be possible to apply totally the terrestrial concept of wilderness to ocean areas, it is valuable to examine wilderness as an evolving relationship between people and natural areas which serves as a catalyst for institutional change. For those now working toward raising awareness and appreciation for ocean areas, it is clear that today's public support for marine conservation has to evolve to a point where it can motivate the grassroots activism necessary to change the way institutions manage ocean environments. And there are important lessons in understanding the role played by the Yosemite of the ocean in triggering that change, whether in the Great Barrier Reef in Australia, Lancaster Sound in Canada, or the Waddensea in western Europe.

OCEAN WILDERNESS AND MARINE PROTECTED AREAS

For the past 30 years, the world's network of protected areas has helped the exchange of information among nations administering wilderness areas. This network has led to the development of improved guidelines for land and wildlife management, and most importantly, increased the international commitment to wilderness as an essential ingredient for sustainable development.

Marine protected areas have played a limited role in this global experiment, due partly to their small numbers and recent acceptance. At the 1982 World Congress on National Parks and Protected Areas in Bali, participants observed that marine protected areas were still at an early stage of development and lagged behind terrestrial sites in worldwide coverage. There has been considerable progress since that time. By 1985, 430 marine protected areas had been proclaimed by 69 nations, with another 298 proposals under consideration. Early attempts to manage marine protected areas have led to a more practical understanding of ocean wilderness. There is now a growing recognition that ocean wilderness represents one end of the spectrum of marine protected areas ranging from multiple-use areas to strict nature reserves. Taken in its entirety, this spectrum is the key to achieving sustainable development in ocean areas.

Countries that are establishing national networks of marine protected areas are already facing many challenges that relate to the question of ocean wilderness. One of the first challenges has been the identification and delineation of marine areas that are representative of an ocean region and that function so as to maintain the integrity of the system being managed. Unfortunately, drawing boundaries in the ocean has never been easy. However, some of the pioneering work in large marine ecosystems may hold the key to designating workable areas that are representative and functional. This work represents a significant step away from the single-species focus of conventional fisheries management. The research may suggest management strategies that can adapt to the variability of ocean systems.

In the meantime, managers need to recognize that marine protected areas are part of variable systems closely linked to other coastal and inland habitats.

As the emphasis in many countries, including the United States, is shifting from simply identifying sites to making marine protected areas fully operational, many other challenges are being faced. Agencies responsible for marine protected areas are confronted with the harsh reality that ocean areas are a common property resource administered by an array of sectoral jurisdictions. When a site is designated as a marine protected area, the people whose livelihood depends on that common property resource, and the layers of government agencies that manage economic activities (fisheries, transport, tourism), still remain. The ability of sectoral agencies to deal with shared management processes has been limited, but long-term arrangements are emerging at the community level.

This recognition leads to a basic principle emerging from the experiences of small developing islands of the Caribbean and the Pacific. These small island nations are undertaking integrated programs for marine conservation that have to balance objectives for resource protection, food production (fisheries and aquaculture), traditional lifestyles and economic development. In the context of a small island, the management of marine protected areas and ocean wilderness involves a broad social responsibility to local communities. Management plans must involve these local stakeholders and be implemented with a view toward the objective of long-term community well-being.

Another lesson is that one fundamental mission of marine protected areas is to encourage community involvement in marine conservation. The voluntary marine reserves of the United Kingdom and the municipal reserves of the Philippines offer convincing evidence of this principle. In both instances, local users recognized the importance of responsible resource management to ensure their continued use and enjoyment of the marine habitat. The marine protected area provided the opportunity to become involved through special projects such as volunteer naturalist programs, community-based habitat management, volunteer patrols and participation in field inventories.

OCEAN WILDERNESS AND INTEGRATED MARINE RESOURCES MANAGEMENT

Clearly, those committed to marine protected areas and ocean wilderness cannot ignore the greater task at hand: long-term, wise use and management of ocean ecosystems. Although marine protected areas and oceanic wilderness are certainly part of the agenda, how do they contribute to the development of integrated marine resource management?

If such questions are left unanswered, governments may well grow content with designating relatively small portions of their territorial waters as "protected"—assuming that conservation objectives for marine areas have been adequately addressed. Yet the ocean systems that support world fisheries, for example, are much larger than any area that could be contained within such legal boundaries.

There are several initiatives addressing this problem that deserve international attention. The Antarctic Treaty System (ATS), including its more recent

developments, represents one attempt to implement a regional conservation regime for marine resources. The ATS is a complex array of international agreements, management guidelines and cooperative efforts which focus systematically on protected species, populations, habitats and harvesting of renewable resources. Recent scientific research which demonstrates how the Southern Ocean is best understood (and therefore managed) as a large marine ecosystem has been instrumental in the elaboration of some of these agreements, particularly the Convention for the Conservation of Antarctic Marine Living Resources (CAMLR). While the ATS is not without flaws, it has shown that we have reached the point where protected species, protected areas and sustainable use must be linked together.

Canada has been moving in similar directions with the formulation of its Arctic Marine Conservation Strategy. In a broad and comprehensive policy, Canada's Department of Fisheries and Oceans has outlined six strategies for sustainable use of the Arctic: Science for Management; Shared Management; Integrated Resource Planning and Management; Marine Environmental Quality; Public Knowledge; and International Considerations. Marine protected areas are understood to be one of the many tools available to achieve the goals of the policy.

The United States has made preliminary attempts to integrate formerly isolated objectives into marine resource management. While much of the work is still in its infancy, it is possible to anticipate a time when fisheries management, marine mammal protection, marine habitat management and marine protected areas will be understood as part of an integrated framework for resource management.

OCEAN WILDERNESS: CHALLENGE AND OPPORTUNITY

Though not easily defined, the concept of wilderness applied to ocean areas holds some promise. It is not a myth to the extent that it can serve as a catalyst of new ocean policies. However, it offers both a challenge and an opportunity to the marine conservation community. Non-governmental organizations need to broaden grassroots support for, and involvement in, responsible marine resource management. This support must evolve from its current focus on a few "flag-ship" species to an ethic for the stewardship of ocean areas. Governments need to take on the chief institutional challenge of the decade as identified by the World Commission on Environment and Development by focusing on sustainable development rather than short-term economic benefits and by making shared management work at the local, national and international levels.

WILDLIFE VALUES

Joyce M. Kelly

Each of us has had special wildlife experiences in his lifetime. Those experiences which capture and recall my wildland experiences include the eerie tremolo of a loon on a northern lake, which I thrill to no matter how many times I have heard it. The staccato beat of the pileated woodpecker on dead timber, the grizzly lumbering along on the mountainside well above me, battling a 21-pound northern pike into a boat in northern Saskatchewan. Or the experience I hope to have, to hear the rich crescendo of a wolf's howl and the wild echoing response of a pack member in Yellowstone National Park. Experiences, memories and visions we cherish. They are experiences which enhance our appreciation and emotional ties to wilderness, ecosystem preservation and wildlife.

Those same wildlife experiences must be used to build public support for wildlife which is critical to our own survival. If we continue to limp along with our recovery efforts, not only will we impair the value of these laws such as the Endangered Species Act (ESA) and the Convention on International Trade in Endangered Species in Wild Flora and Fauna (CITES), we will have failed to translate our feelings and commitment to wildlife into action.

Wildlife is important to our health and well-being. Wildlife has aesthetic values; subsistence values to native peoples; medicinal values which benefit all mankind; and commercial values, trade or tourism which benefit the economics of states, regions and countries.

Survey results here in the United States indicate a growing interest in the preservation of natural areas and in what is termed watchable wildlife or non-game uses. The President's Commission on Americans Outdoors, which recently completed its report, found that 87 percent of the American public supported the preservation of natural areas and were willing to pay extra to protect and maintain these areas. The U.S. Fish and Wildlife 1985 Survey of Fishing, Hunting and Wildlife Associated Recreation revealed that:

- 46.6 million, or more than one in four, adult Americans fished.
- 16.7 million, or about one in 10, adult Americans hunted.
- 109.7 million of all adult Americans, actively participated in non-consumptive wildlife related activities such as feeding, observing or photographing wildlife.

It is clear that recreational interest in wildlife is growing. To a large extent this interest has been stimulated by U.S. wildlife conservation groups, each of which originated in response to a wildlife crisis. The challenge before us is to translate this awareness and concern into action to protect and recover species and their habitats.

The ESA and CITES are matters of national and international pride. They reflect the idea that wildlife is important to us and that we suffer a loss when a species of wildlife vanishes from the earth. Both provide the tools for preservation and recovery: good biology, good planning and effective consultation.

For recovery to succeed, which is the goal of both the ESA and CITES, those who are most affected by these laws must be included in the decision-making process. Sociopolitical and economic considerations are as important as good biology in the decision-making process and may be more important in ensuring effective implementation.

Both CITES and ESA were signed in 1973 in response to the concerns over species decline and the rapid escalation in species extinctions. They were both established to protect species: the ESA primarily through conserving ecosystems upon which threatened and endangered species depend; CITES through regulating the buying and selling of endangered wildlife. They both established systematic processes of identifying those species in danger of extinction and providing for their recovery.

The ESA also authorizes a program to protect the habitats of endangered and threatened species, hence the critical importance of maintaining wilderness areas.

The United States was the first country to ratify CITES with enactment of the ESA, which also implements U.S. participation. Thus, the successes and difficulties of the ESA are illustrative of administrative and legislative history.

CITES' philosophy now is to manage, not prohibit, trade in wildlife products and thereby strive to create financial incentives for saving species and preventing overexploitation. It does this by:

- prohibiting commercial trade by its parties in species threatened with extinction,
 - controlling trade through permits in those species that may become threatened unless commerce in them is strictly regulated, and
 - providing for a secretariat, biennial Conference of Parties and direct communication among Management Authorities and Scientific Authorities of Parties.
- By recognizing the economic value of species, CITES acknowledges an important source of income to wildlife producing countries.

The 1987 CITES meeting held in Ottawa, Canada had the largest participation of Third World countries in the history of CITES. This is particularly significant because the developing countries have most of the world's wildlife and secondly, to quote Eugene Lapointe, Secretary General of CITES, "their presence brings developed country delegates and environmentalists closer to the realities of endangered species problems in Africa, Asia and Latin America."

A great many specific issues were discussed:

1. Strong support was expressed by all the delegates and non-governmental organizations for the principle that endangered species can be saved from extinction largely through their rational exploitation.

2. Canada and others expressed concern that:

a. Proceedings need to become more scientific and rational; too large a number of species are placed in appendices without meeting criteria (no evidence the species is threatened by illegal trade). For example, trade in hummingbirds basically stopped in the 20th century, yet a decision was made to list 350 species in Appendix II.

b. Advice of IUCN and Traffic is disregarded too often.

3. Downlisting activities of note included:

a. Report by animal experts that leopard numbers are sufficiently healthy to allow controlled commerce; this was a reaffirmation of a quota resolution adopted at an earlier meeting.

b. Renewed commitment and support for the quota system on elephant ivory that gives profits from the legal sale of the tusks to African governments and people, instead of to poachers and illegal traders.

c. Downgrading the vicuna so the animal can be sheared, its wool woven into cloth and legally sold outside Peru and Chile.

4. A resolution was adopted banning all trade in rhinoceros horns both in international trade as well as domestic commerce and destruction of existing stocks of rhino horns. This led to the first withdrawal of a country, the United Arab Emirates, from the convention.

5. There was overwhelming support from the delegates, wildlife user groups and wildlife conservation organizations to increase the budget for CITES.

6. There was considerable discussion over reported infractions. In a report the secretariat was directed to prepare, three countries were singled out for criticism. There was increased willingness by many members to take note of each other's reported infractions and request explanations.

There are interesting parallels between the ESA and CITES in terms of problems and successes. Unfortunately recovery of species under both the Act and the Convention has been painfully slow. The Endangered Species Act and CITES both seek to protect species and recover them, using different tools. The crises inhibiting effective recovery know no national boundaries and include:

1. Habitat destruction and illegal hunting.

2. Wildlife trade.

3. Few recovery efforts, some plans, but few being implemented.

4. Overemphasis on listing.

5. Not enough funding.

6. States' right, the argument that states must be able to manage wildlife within their own jurisdiction as they see fit.

7. Lack of administrative leadership and enforcement.

8. Failure to involve more affected publics in the decision-making process, to build the awareness necessary to ensure viable wildlife populations.

While funding is a critical need and must be at reasonable levels, we also know that there will never be enough funds available to stop extinctions or recover all those species in need. I do not believe the future of either CITES or

the ESA is in serious jeopardy in spite of the extremely difficult financial situation they both currently find themselves in. The public commitment to wildlife preservation is too strong to let either effort vanish.

Of the crises listed I believe the greatest challenge is recovery. We need to determine which endangered wildlife are the most significant with respect to critical land-use decisions being made at the national and international levels and move to protect and recover those species quickly. While the listing process is an important first step, I believe we have let ourselves fall into the trap of focusing too much attention on the listing process to the exclusion of the recovery process.

The greater and more difficult challenge is in the recovery of species. Recovery is more political and requires tougher decisions, hence requires more time and effort. As one well-known wildlife manager said to me: "To list you just have to sign a bureaucrat's name. To recover requires funds for habitat acquisition, time, and planning. To be sure, the listing process lends itself to litigation which gives it more appeal than the tough negotiating and decision making that is required for recovery."

Let's look at a few facts drawn from the U.S. experience. Recovery plans are being written at a much slower rate than the rate at which species are being listed. Only 57 percent of the total U.S. species listed had recovery plans at the end of 1986. The funding is minimal at best. It has been roughly \$6 million per year since 1981. In a review currently being done of 18 recovery plans, actual expenditures are running approximately 0 to 1 percent of the estimated three-year costs for listed priority tasks. The priority tasks are:

1. Forestall extinction.
2. Stabilize the populations.
3. Bring the species to recovery.

The recovery efforts, however, do not proceed in that order. The funding is directed very often at Level II tasks, which involve habitat acquisition, prior to Level I.

It would cost \$75 million per year to accomplish the Level I tasks currently stated in completed plans. Sadly, but realistically, funding at that level is not, nor will it be, available in the near term. I am not suggesting we should be satisfied with the current dollar levels, but given the limited funds available, we must do a more responsible job of determining how to best utilize those funds.

There has been little hard assessment of how successful the recovery process is, and whether the dollars are being used as effectively as possible. The economics of recovery appears not to be a question even asked. While the right biological questions are perhaps being asked, the economic, social and political questions are not. Perhaps this is why the ESA is being increasingly viewed as a repository of lists with little real effort or interest in "delisting." Because of this, economic interests, which might be enlisted in support of the Act's intent, become wary and see the legislation as an attempt to lockup lands for aesthetic wildlife values with no intent to ever delist. CITES faces a similar problem. By appealing to the

emotional and the aesthetic and ignoring the legitimate economic values of wildlife and wilderness, we are losing constituencies, not winning them.

If we are unable to demonstrate the values of recovery, we will have failed. Let us face it— economic arguments have considerable merit and appeal. By proving the value of recovery, we will be in a stronger position to win broader support and acceptance of the entire listing and recovery process and obtain more funding. After all, early in this country's history we had two billion passenger pigeons and no chickens. Now the situation is reversed, we have two billion chickens and no passenger pigeons. Economics did play a part. In fact, we probably know more about the health and welfare of chickens than we do about people. I wish we could say the same about Florida panthers and timber wolves, to name a few.

I am using economic or market values here in their broadest context. For example, I may choose to visit Glacier over another national park on the chance that I may see a wolf or a grizzly bear. That decision has an economic value—a value that more and more communities are beginning to recognize, albeit slowly. The recovery of the peregrine falcon has brought excitement to many of our major cities. The trials and tribulations of Scarlett, Baltimore's famed city falcon, did much for the corporate image of US Fidelity and Guarantee as well as for the potential of city release elsewhere. Market value? Of course. We also need to look at the question of whether collective or public ownership of the habitat is the most effective way to protect endangered species. It may not be in all instances. After all, the black-footed ferret was found on private land.

CITES, perhaps of its overt economic goals, has been successful in obtaining funding from non-governmental sources. I realize there are many who will question whether or not CITES has been successful in recovery. But by giving enhanced economic value to species which can survive trade (5 billion in export income is no small number), CITES has provided an incentive to people to protect habitat and indirectly to protect numerous other species.

I doubt there is any disagreement with the premise that conservation is an indispensable element of sustainable development, including tourism. You may or may not agree that we have been slow to point up the economic values of wildlife conservation. I believe we have been, partly because we are uncomfortable in accepting market values in the environmental arena generally.

The agreement at the Ottawa CITES conference to permit Peru and Chile to sell vicuna cloth is an excellent example of how safeguards for a species can combine with their economic use. In the past the vicuna was overexploited, trade was restricted and the population subsequently recovered to the point where its wool can be harvested, as sheep's wool is harvested. This will benefit those nations' economies in several ways: wool production, cloth manufacture, export and the species will be able to survive indefinitely.

Using economic incentives through the legal harvest of elephant ivory, the quota system provides a reason for the poor in Africa to protect the elephant that uses coveted land. While conflicts continue over competing use of the land and

poaching, there is now an incentive for positive action on the part of the population directly impacted to conserve the resources and reduce the illegal intake. In addition, the economy benefits directly as opposed to indirectly from illegal, black market operation. Will the quota system succeed in protecting the elephant? It is still too early to tell. Hopefully, yes.

Some of the African nations recognized early the increasing economic value and importance of wild resources for external trade and tourism, as well as for internal consumption. In the United States the value of wildlife as a "financial resource" is only beginning to be recognized. Its contributions to state treasuries and the U.S. treasury are not small. In recent remarks, the Colorado State Wildlife director recognized the critical contributions wildlife is making to the state economy. Fishing and hunting contribute a billion dollars a year to the state economy, not even considering the expenditures of those engaged in nonconsumptive wildlife uses.

Those kinds of dollars should lead to a policy of land use that promises and enhances fish and wildlife opportunities and then recovery and protection. It also means it is time to look creatively at the concept of wildlife market value.

This may mean taking a new look at the potential for game ranches. Under CITES there is a mechanism which permits captive breeding of endangered animals for economic purposes, as occurring in Zimbabwe with Nile River crocodile ranches. Will it be allowed to work? Can we say that the sea turtle is made more secure by prohibiting sea turtle ranching—a recent CITES issue?

In the United States in one area instance due to what I will call enlightened management, the American alligator is ranched. The law enforcement agents developed a way of marking hides that prevented illegal hides from being "laundered" and which followed the hide through to the finished product. It was a rational approach that worked; the species won.

If recovery is to work, it is important to carefully select species to which limited resources can be devoted. I suggest that this be a collaborative process to determine what criteria should be used to select species for limited recovery dollars. While we can't totally objectify the process, it can be vastly improved through greater administrative leadership and institutional awareness which may have to come from outside government. The process must build on good biology, but involve other considerations.

Obviously it won't be easy to draw the line between those species which may need the efforts the most and those species where you can achieve the greatest good. The process does need some order. Focusing on achievable goals would be a good first step. While existing legislation provides considerable flexibility, we may also need additional legislation simply to get the attention devoted to recovery that is desperately needed.

All governments must be persuaded to invest in recovery now, for their own long-term benefits. It is a form of insurance. The financial needs of CITES and ESA exceed what the governments are now putting into them to list and recover species, to adequately enforce existing regulations and legislation and to deter-

mine which species, populations and habitats may be at risk and how best to manage and conserve them. Control is still hampered by poor enforcement, scientific uncertainty and disputes about where to draw the line between safe exploitation of a species and dangerous pillage. Private groups, both profit and nonprofit, have done much to contribute funds and provide monitoring. But we need to do more.

We must also enlarge the organized constituency for wildlife. For instance, opportunities exist to link hunters with nonhunters. While our respective motivations to preserve species may be different, we share the same goal, species preservation. Trade associations provide another opportunity for cooperation. While they may be operating in terms of enlightened self interest in maintaining the resource base, aren't we all? Let us not forget, exploitation is in the eye of the beholder. The challenge is too great to continue to emphasize our differences at the risk of losing wildlife. To the extent we do broaden our constituency base, there will be greater acceptance of and support for the process and results.

Developing nations, which possess 80 percent of the world's wildlife resources, have a valuable asset. The United States can provide technical expertise and management experience. We certainly do not have a corner on all the right answers. We can hope that others can learn from our own mistakes and that we can learn from the mistakes and successes of other nations.

We know wildlife is critical to our own survival. So how can we ensure that we both survive? Sometimes strict "protectionism" helps wildlife far less than it helps the illegal traders, smugglers and poachers. We need to look at creative new arrangements involving nontraditional alliances, utilizing and not rejecting entrepreneurial skills, and developing new operating definitions for wildlife market values. The Rockefellers and Du Ponts created values for a number of goods which were considered valueless before their involvement, like the early Americans. Why can't we find and utilize those same talents to create market values for wildlife preservation? There does not need to be a conflict over environmental values and the market; the public good and private ownership can work synergistically.

No one will dispute the important values of wildlife, whether we are talking about subsistence values for native peoples, or the aesthetic values of wildebeest surging over the African plains, or the Porcupine caribou streaming down from the mountains to the Arctic coast in northern Canada and Alaska. What we clearly need is a stronger demonstration of our commitment—in terms of funding, institutional awareness and political leadership. Each of those requires action from the government and the private sector. CITES and the ESA owe their births and effectiveness to the private sector; it is time to strengthen our political leverage to prove that recovery works.

We cannot let the ESA or CITES become simply listing documents; they must remain broad wildlife management tools used to solve problems.

We should take heed of what Chief Seattle of the Suwamish tribe of the state of Washington wrote in a letter to the president of the United States, in 1855:

"If all the beasts were gone, men would die from great loneliness of spirit, for whatever happens to the beasts also happens to the man. All things are connected. Whatever befalls the earth befalls the sons of the earth."

FURS—AN ENVIRONMENTAL ETHIC

Alan Herscovici

(*Editor's Note:* This presentation was prepared by Alan Herscovici for the International Fur Trade Federation.)

The word "ecology" was coined by the German naturalist Ernst Haeckel in 1866 to describe the interdependence of living organisms with their environment. This concept had little impact on laymen until 100 years later, with the publication in 1962 of Rachel Carson's *Silent Spring*, an expose of the indiscriminate use of pesticides. The book made the interdependence of life clear: DDT moved up through the food chain, accumulating in ever-higher concentrations, and resulted in egg shells too thin and weak to support the nesting birds.

Rachel Carson's *Silent Spring* was a turning point and signaled the birth of the modern environmental movement. By the late 1960s, attempts were being made to assess the extent of the damage caused by a century of extremely rapid growth and to legislate controls.

In the field of wildlife conservation, it was estimated in the 1960s that about half of the animal species which had become extinct in the past 2,000 years had disappeared during the first 60 years of this century. At least one-tenth of all remaining plant and animal species were now endangered.

This alarming balance sheet led to the drafting of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) in 1973 to monitor and regulate commercial traffic in wildlife at the international level. Ninety-five nations are now parties to this agreement.

Controlling trade, however, is only half the battle. By itself, this can accomplish little so long as wildlife habitat is being steadily eroded. Endangered species, in fact, are usually only a symptom of more profound environmental degradation. In 1980, scientists under the auspices of the International Union for the Conservation of Nature (IUCN) began work on a comprehensive World

Conservation Strategy, which confirmed that conservation and development are inextricably linked.

A fundamental objective of conservation strategy is to achieve sustainable use of renewable resources. In other words, we must learn to live within our means. We may use the interest made available by the inherent productivity of nature, but we must refrain from squandering our environmental capital.

It is estimated that close to one-third of the world's arable land will be lost by the end of this century. The extent of tropical forests will be halved. Up to one million species of animals, plants and smaller species (especially invertebrates like mollusks, insects and corals which promote the productivity of the land and oceans) will become extinct, largely because of habitat destruction. Meanwhile, in this same period, world human population is expected to rise by almost 50 percent—to some 6,000 million.

Despite our impressive advances in agriculture and industry, wild plants and animals still provide us with food, medicines, clothing, building materials and fuel. They provide a gene pool from which our domestic plant and animal breeds are improved and strengthened, to resist parasites and disease. They are also the models or building blocks for many of our most important technological innovations.

The principles of the World Conservation Strategy may be summarized in three main objectives: maintenance of essential ecological processes and life-supporting systems; preservation of genetic diversity; and sustainable utilization of species and ecosystems.

Sustainable management of wildlife and animal products, by the fur trade or any other industry, must clearly support these objectives if the best ends of conservation are to be served.

One way to measure adherence to these objectives is by the concept of reciprocity, which could be adapted as the creed of true conservation effort. Whenever we take from nature we must give something back. Our relationship with nature must be reciprocal, for despite our scientific and technological advances, we remain part of nature and dependent on it, ultimately, for our very survival.

The modern fur trade is a well-controlled industry that provides a high quality, natural product. It is also more ecological than most industries—making use of renewable resources without polluting or damaging wildlife habitat.

From the woodcraft of American Indian trappers to the art of the dresser and the fur artisan, the trade encompasses the expertise of a remarkable range of cultures. It also provides income for tens of thousands of people, often in rural or remote regions where alternative employment may be rare or nonexistent. As an industry based upon the responsible use of a valuable natural resource, the modern fur trade has an important role to play—and a direct interest—in promoting the protection of wildlife habitat and the natural environment as a whole.

From an ethical perspective the fur trade clearly has special responsibilities

because it uses animals. The reciprocity of the fur trade may be explained in four main areas:

1. *Respect for the land.*

Habitat destruction is the single greatest threat to the survival of many plant and animal species (67 percent of all endangered vertebrate species are threatened by habitat degradation). It is, for now, a more immediate problem on land than in the oceans, where overharvesting is still the main threat to the survival of many fish and other marine species.

There are numerous ways in which the fur trade, with other responsible wildlife use, can help to protect habitats.

- Wildlife use as a sensor to call attention to environmental damage:

At the grassroots level, wildlife use serves as an important environmental sensor. It was sports fishermen, for example, who first brought acid rain to the attention of scientists—when it was noticed that fewer fish were being caught in lakes which had once been productive. Many wildlife biologists and managers depend on hunters, trappers and others who live by the land as their best sources of information. While the plight of endangered animals often sounds alarm bells, it should be remembered that their threatened habitat also supports thousands of less glamorous plant and animal species, many of which are found nowhere else.

- Wildlife use protects habitat—and may be more productive than agriculture in some areas:

The destruction of natural habitat for agriculture is a major threat to wildlife throughout the world. Almost 90 percent of the large mammals are estimated to have already disappeared from Africa, mostly during this century. And the destruction is escalating, pushed on by the growth of human population.

In the second edition of his book, *Animals and Man* (1985), Richard Van Gelder, of the American Museum of Natural History, describes two regions of Kenya where wildlife is still plentiful. In one, elephants, lions, giraffes and other large mammals are strictly protected as an attraction for the tourist industry, which is now that country's second-largest producer (after agriculture) of foreign income. In another, gazelles, hartebeest, impala and other animals are harvested in an orderly way—as on any other ranch—so that their meat may be sold in Nairobi. Here are two clear cases where well-regulated commercial “use” of wildlife has ensured the preservation of their habitat and, hopefully, the long-term survival of many different species.

But then Van Gelder describes a less happy situation: “Fifty miles to the northeast of this ranch is another area I know. Fifteen years ago, I used to see giraffes, gazelles, zebras, ostriches and hartebeest there; today, there are no animals except a few donkeys pulling water carts. The land is divided into small farms, but they are bare and barren, because the area is suffering from one of the periodic droughts that is characteristic of this area. The farms are failing and producing nothing; the people are starving, and the wild animals are no longer present. All has been lost in this place.

"It is still my philosophy that wildlife can be utilized for the benefit of human beings without jeopardizing the existence of the wild species and without destroying their habitat. It is just another form of harvest and human enterprise.

"Some parts of the world produce agricultural products; other parts of the world can use their lands, unsuited for farming, for the production of cash crops from wildlife, be they skins, meat or passive tourism, with which they can purchase the surplus food from other lands. This, to me, is the way of the future and the hope for both humans and animals. But it does require intelligence. . . "

- Wildlife use can help control the impact of existing agriculture on surrounding habitat.

In western Canada (as in many parts of the world), up to 95 percent of the available fresh water is used for agricultural purposes. Agriculture could use the remaining 5 percent as well, to produce more wheat and cattle. But this water now supplies marshes and wetlands that are prime habitat for many wildlife species. Without the income which now comes into the province from hunters, fishermen and trappers, biologists would have difficulty convincing administrators (and taxpayers) to resist the higher productivity promised by agriculture.

- Wildlife use protects habitat from industrial development.

Sometimes wildlife use can prevent habitat destruction from occurring. In the Northwest Territories of Canada, native Indian communities lobbied successfully in the late 1970s to block construction of a gas pipeline, which they feared might disrupt habitat and wildlife through the Mackenzie Valley. Their efforts were successful largely because the communities could show that livelihoods were still highly dependent upon subsistence hunting and furtrapping.

- Wildlife use provides an opportunity to repair damage caused by industrial projects.

In regions disrupted by industrial activity, the possibility of using wildlife may ensure that at least some habitat is restored. The construction of the Bennett hydroelectric project, in the Canadian province of British Columbia, reduced spring flooding downstream and resulted in the drying of marshlands in neighboring Alberta. Efforts are now being made in the Fort Chippewyan and Peace-Athabaska Delta regions to restore some of this prime wildlife habitat. The work is economically and politically viable because it will provide local Indian communities with income from the cultivation of wild rice and muskrat trapping. Other ways the fur trade can help protect habitat include:

- Wildlife use may encourage other resource industries to employ methods which are more compatible with the needs of wildlife.

- Wildlife use can prevent habitat damage from the population cycles of certain species.

- Wildlife use permits "mixed" use of habitat. In a world where wildlife often must survive in close contact with human endeavors, natural controls on wildlife populations may not be adequate or may no longer be present.

3. *Respect for wildlife species.*

Despite worldwide threat of extinction to more than a thousand species and sub-species of vertebrates, one fact stands out strikingly: no species used in the fur trade today is endangered by overexploitation. Nor has this happened by accident. This has been achieved through careful education, controls and legislation, at both national and international levels.

- Protecting wildlife species: National controls—Furs are recognized as a valuable renewable resource and all of the major producing countries have management regimes to ensure that harvesting is conducted at sustainable levels. Exploitation is regulated through a variety of measures: controlled trapping seasons, quotas, licensing, biological monitoring and other techniques.
- Preserving wildlife species: International controls—International trade is now monitored and controlled under the provisions of CITES. The goal is to provide a safety net for national conservation programs by controlling international markets for these products. With literally thousands of plant and animal species threatened in various parts of the world, the difficulty of monitoring and enforcing international controls is evident. As far as the fur trade is concerned, however, the system has been overwhelmingly successful.
- Protecting habitat and wildlife from introduced species—IUCN estimates that almost one-in-five endangered vertebrates are threatened by competition from species which have been introduced, intentionally or otherwise, into their environment.
- Protecting wildlife from “non-target” captures—For the effective management of fur resources, the capture of furbearing species should be quite “selective.” It must be possible to avoid nonfurbearing species, or furbearers which are protected by closed seasons or restricted harvesting quotas. Trapper training manuals explain in detail the techniques which allow specific species to be taken. A quick-kill “Conibear” trap for marten or fisher, for example, can be set on a narrow, inclined log or tree bough, making it inaccessible to overly-curious dogs. A sprig of pine placed over the “set” allows birds which are attracted by the bait to land without triggering the trap.

4. *Respect for individual animals.*

An environmental ethic must also take into account the interests and welfare of the individual animals we use. Recently, certain philosophers and authors have taken this argument to its extreme, suggesting that we have no right to ever confine or kill any animal, even if little suffering is caused. The problem is that a philosophy of never harming or killing other creatures simply cannot be realized.

We may choose, for example, to stop eating meat, but habitat will still be taken for cities and farmland. Animals will still be killed to protect our crops. Similarly, well-controlled fur trapping may actually enhance habitat protection. In fact, many of the industrial and technological processes which supposedly

liberate us from the need to kill animals have proven far more damaging to wildlife and its habitat than hunters ever were. Animal welfare is a more useful concept: i.e., the recognition that our use of animals imposes upon us an obligation to minimize unnecessary suffering.

In the past century, humane societies have contributed to improving conditions for livestock, for animals used in research and product-safety testing and in many other fields. The fur trade has encouraged important advances in humane-trap research and development and research and codes of practice for the care and handling of farmed furbearing animals.

- Humane-trap research and development—Since any method of restraining a wild animal is likely to cause stress, government research in Canada has been directed primarily toward identifying effective quick-killing traps. More than 90 percent of the animals taken for fur in Canada can now be captured in quick-killing traps or sets. Canada has adopted a National Standard for Humane Traps, the first of its kind. Efforts are also being made to establish international standards, since animal populations must be controlled (e.g., to protect crops), even in countries where there is no fur trade.

Research is continuing under the auspices of the Fur Institute of Canada, a national grouping of government, trade, conservation and animal-welfare representatives. The goal is to further refine the effectiveness of quick-killing traps, as well as to investigate various soft-holding devices for the larger predators (e.g., wolf, fox, coyote and lynx) for which no adequate quick-killing trap has yet been developed. This research includes that first attempt to measure the psychological stress experienced by animals when they are restrained in the new live-holding traps. Preliminary results (for foxes) suggest that this stress may not be much higher than that experienced during normal activities in the wild, such as running, hunting or eating.

Other moral considerations: Three additional concerns should be considered when animals are being utilized humanely and at sustainable levels.

- Avoiding “waste.” It might be considered wasteful to kill an animal if only one part (the fur) is to be used. Native Canadian trappers, however, use the main furbearing animals (e.g., muskrat and beaver) for food as well. It has been estimated that the value of this food is often double what they receive for the furs. But without the cash income furs provide, few could afford to remain on the land. Even if meat is not consumed by the trapper and his family, it is not necessarily wasted. Trappers generally return carcasses to the woods as bait. Hunger reigns in the bush through the winter and this meat helps assure the survival of not only many furbearers, but also of birds, mice and other animals. Only the fur has been removed from the environment that produced it. Farmed fur animals are also recycled to produce fertilizers and other products. There is very little waste.

- Fur products are not frivolous items. Well cared for, a good fur coat will last from 10 to 20 years, far longer than most other materials. Unlike cloth and

synthetics, furs can easily be remodeled; their utility is not limited by the whims of fickle fashion. And unlike synthetics, a fur coat is produced from a renewable natural resource—its production doesn't use up scarce materials or burden the environment.

5. *Respect for the diversity of human cultures.*

A large part of the world's population still lives on the land, in small villages, working as farmers, nomadic herders, coastal or inland fishermen and hunters. No development or conservation plan is complete if it ignores the store of knowledge that such people have accumulated about their own environment.

Scientists are stepping back from earlier assumptions that Western models of development can or should be applied everywhere. Experiments have shown that many traditional cropping systems produce high yields, conserve nutrients and moisture and help suppress pests. Native wild herbivores are adapted to make use of natural grazing land without causing deterioration, and in extreme conditions, may be the only species which can do so.

The continued importance of wildlife in many parts of the world has been consistently underestimated. This is unfortunate, for were the true nutritional values and the uses made of wild plants and animals appreciated by governments, they might be more ready to encourage these resources to be managed sustainably and take steps to retain their habitats.

In parts of west and central Africa, up to three-quarters of animal protein in the human diet still comes from wild animals and wild plants are used for food and medicines. Across much of the North—Canada, the Soviet Union and Greenland—Indian and Inuit people still depend upon land and sea mammals for much of their food, as well as for the cash income they need to support a basically subsistence-oriented economy.

Recent anthropological research reveals that many aspects of the traditional beliefs and practices of aboriginal cultures are consistent with modern principles of conservation. This is not surprising. These societies are acutely aware of their dependence upon the environment. There are strong cultural sanctions against taking too many animals or wasting animal gifts (e.g., allowing meat to spoil). Taking more animals than one needs or failing to carry out traditional ritual acts of respect may result in animals refusing to renew their gifts in the future. Hunting cultures, we should remember, may be as valid today as any other way of living. As Alan Cooke points out, native people in northern Canada "gather harvests from land and seas that, through time, will be richer than any oil field."

At a time when radioactive dust circles the planet and cadmium and dioxins have been found in the organs of game animals in the far north, we need all the insight of modern science.

The modern fur trade is based on principles which accord the values now held by the majority of society. A high quality product and responsible conservation are no longer enough. An integral component of any responsible wildlife-use policy must be to ensure that the public is kept well-informed, on an ongoing basis.

THE ROLE OF BIOSPHERE RESERVES AT A TIME OF INCREASING GLOBALIZATION

Bernd von Droste

In the coming years we will most likely see an unparalleled expansion of ecological research at the local, regional and biospheric scales. At the planetary level this is due to the fact that humanity is now perceiving and experiencing a phase of ever-widening globalization—a time of chronic, large-scale, and extremely complex syndromes of interdependence between the global economy and the world environment. What were strictly local problems of air pollution or desertification are now elevated to the scale of entire continents, such as acid precipitation, or to the scale of the globe itself, such as in climatic change.

This trend toward globalization must be seen as a central issue. On one hand it is evidence of concentration of wealth and power within the global exchange economy which gets its impulses from a few centers of increasing influence. On the other hand it reflects a vast international grass-roots effort seeking new forms of self-help and cross-national cooperation which, by their very nature, are decentralized, citizen-oriented and fueled by NGO movements. Globalization is also the key to our current understanding of environmental processes, where we realize more and more that local phenomena are determined by global interactions. In socioeconomics too, we see that changes in the world market price system may have large-scale impacts on land use and resource management, which in turn may have positive or destructive effects on local environments.

There is a need to radically reform ecological research and conservation to reflect this globalization, since the environmental and resource management issues of today cut across traditional ecosystem boundaries, across social and economic systems and across political frontiers.

In the field of conservation and science is the multifunctional system of biosphere reserves. These are an international system of protected areas which are included in the Man and the Biosphere Program (MAB) both for their value in conservation and for providing the scientific knowledge to support sustainable development. The network of biosphere reserves is the foundation of a worldwide system of macroscale conservation and global scientific research. With the advent of globalization, biosphere reserves take on a new dimension which is complementary to their important task of resolving local problems.

Indeed, the International Biosphere Reserve Network deals with man/environment interactions at the micro, meso, and macrolevels. The individual biosphere reserve relates with its local community at the local scale; the

biogeographical cluster biosphere reserve has a regional dimension, and finally the international biosphere reserve network as a whole has significance for global science, for the conservation of global biological diversity and for helping to improve human welfare.

The discrete building block of the international biosphere reserve network is the individual biosphere reserve site, which protects within its core zones a minimally disturbed ecosystem—hopefully allowing species to continue their evolution. The reserve zone also consists of a buffer zone where selected, controlled uses such as traditional land use, recreation and research can take place and human settlement may occur. The transition area—or zone of cooperation—which adjoins the buffer zone is used for demonstrating the application of ecological sciences to sustainable development, which is a top priority for the MAB Program.

The biosphere reserve concept can be adapted to specific cultural and socio-economic environments. The flexibility of the concept is increasingly attractive to policy makers and planners who wish to accommodate conflicting interests of conservation and development, to ensure relevant scientific progress and to develop efficient and cooperative relations with local people.

One major task of biosphere reserves is to stem the loss of biological and genetic diversity. Biosphere reserves should be located and managed in a manner which will help to prevent insularity and fragmentation of individual populations, which increases the probability of species extinction and accelerates the process of ecosystem decay, which in turn can precipitate biotic collapse.

A key subject for conservation research is how to manage the entire global system of biosphere reserves to maintain biological diversity while promoting the cultural identity of local people and safeguarding natural integrity to allow ecological processes to continue. There is a strong relation between sustainable development and conservation of biological diversity, but massive scientific research is required to understand it completely. Such research could focus on how much can we disturb closed canopy forests without upsetting the microclimate, or what determines the presence or absence of a given species. These are, among others, pertinent scientific questions for investigations in biosphere reserves.

Biosphere reserve managers should be concerned with maintaining biological diversity for two reasons: to preserve a unique set of genetic information and to maintain the integrity of a given ecosystem in the longer term. As biological diversity is lost at different levels of biological organization—species, population, communities or ecosystems—there is a decline in resilience and in the possibility for an ecosystem to recuperate from stress. Hence the need to maintain the integrity of entire ecosystems.

Biotic resource management in biosphere reserves requires a comprehensive knowledge of its biological resources. Biological inventories are presently carried out in several biosphere reserves in South America, such as Beni (Bolivia) and Manu (Peru), within the MAB/Smithsonian Biological Diversity Program. This program also gives priority to training. This year about 40 specialists will

receive field training in biosphere reserves at the Smithsonian Institute in Washington. Another of the objectives of this program is to screen biological resources in the tropics for potential economic use.

Biosphere reserves work most successfully when they obtain the full support of local people who participate in their planning and management. Environmental awareness and education programs are key elements in this process. A recent survey of the 266 biosphere reserves which now exist in 70 countries shows that most of them have environmental education programs. Good examples are found at Tayrona (Columbia) and Pilis (Hungary). Furthermore, almost all biosphere reserves have facilities, such as at Berezinsky Zapovednik (Byelorussian SSR), Mt. St. Hilaire (Canada) and Montseny (Spain). However, a similar survey for research programs shows that only a small fraction of these programs correspond to the criteria established for MAB interdisciplinary research. Examples for successful research projects demonstrating sustainable development and cooperation with local people are found, for example, at the Trebon Biosphere Reserve in Czechoslovakia, at the Omayed Biosphere Reserve in Egypt, in the Cevennes Biosphere Reserve in France, at the Mount Kulal Biosphere Reserve in Kenya and in the Sian Ka'an and Mapimi Biosphere Reserves of Mexico. It is important to share this experience throughout the biosphere reserve network.

There are still many tasks ahead for most biosphere reserves. These include:

- Undertaking inventories of biological resources and of forms of traditional uses and technologies;
- Preparation of management plans which reflect the combined objectives of the Action Plan for Biosphere Reserves;
- Training of biosphere reserve managers who need to be "master integrators and motors" of the various cooperative functions of biosphere reserves, which have to be fulfilled locally and internationally;
- Establishment of long-term ecological research (LTER) projects in biosphere reserves. In the US, seven of the NSF-funded LTER sites are already included in the biosphere reserve network;
- Establishment of MAB pilot projects for sustainable development in and around biosphere reserves and,
- Establishment of mechanisms for cooperation with and participation of local people.

The mesoscale of biosphere reserves can be demonstrated by the example of the Carolinian-South Atlantic Biosphere Reserve in the USA, which is a biogeographical cluster biosphere reserve. This type of biosphere reserve is innovative in that it sets up a regional system which groups together disjunct conservation areas and major experimental strategy for a distinct biogeographical province within one biosphere reserve.

The cluster biosphere reserves are established to cover ecological gradients within a given biogeographical province and constitute major interfaces between ecosystems and other zones of high biological diversity. From the conser-

vation biology point of view, biogeographical cluster biosphere reserves can be considered as the best possible insurance against uncertainty and surprise in a time of possible global change. This is because large, disjunct and diverse conservation areas are protected under coordinated management at strategic locations. These different elements of a cluster biosphere reserve should be linked to the extent possible through corridors permitting the movement of biota. Obviously, the management of biogeographical cluster biosphere reserves requires an innovative organizational framework allowing the close cooperation of different landowners and agencies. Such cooperation can greatly improve the quality of conservation and science at the regional level through increased interaction between those who would otherwise work separately.

The macroscale is the highest level of organization for biosphere reserves. Biosphere reserves will ideally cover all 193 terrestrial biogeographical provinces of the world. Today, we are 65 percent of the way in meeting this goal. In their final form they will constitute an unmatched system of macroconservation and global science.

Such a planetary network will be more than just an assembly of individual sites. Indeed, already today we anticipate that biosphere reserves will play a decisive role in global science in the 1990s as a planetary network for observation of global change, and more particularly, for the interpretation of its causes and prediction of its effects. This has particular reference to ICSU's emerging International Biosphere-Geosphere Program, a main objective of which is to understand the processes which govern the evolution of planet Earth on the time scale of years, decades and centuries.

The principal source of data for a study of this macrodimension will be the Earth satellites. The international network of biosphere reserves can provide key locations for research and monitoring, and as validation sites for modelling and remote sensing. Thus, a number of biosphere reserves can provide global observatories in critical, indicator biogeographical zones, such as the limits of northern forests with tundra, the alpine timberlines, the savanna/desert edges and flooded lowlands.

A number of biosphere reserves such as Lugillo in Puerto Rico (which in 1989 will celebrate 100 years of tropical-forest research), Bialowieza in Poland or Repetek in the USSR have some of the longest research records available. They provide excellent potential for long-term monitoring since this research has revealed the "background" fluctuations and ecological cycles upon which the more recent global changes are grafted.

The global network of biosphere reserves constitutes a vast laboratory for ecologists and other scientists. This potential is hardly exploited. The network lends itself to international comparative studies, in biosphere reserves having similar characteristics, to test hypotheses in ecological sciences and to develop a better theoretical basis for understanding the repeatability and comparability of ecological information. Such studies help to make ecology a more predictable—hence a more credible—science.

Four such worldwide comparative studies are under way jointly between MAB and NGO partners, particularly the International Union of Biological Sciences (IUBS). These include:

- Tropical forest biology as a basis of tropical soil fertility;
- Responses of savannas to stress and disturbance;
- Forest regeneration and ecosystem rehabilitation; and,
- The role of ecotones in landscape management.

A fifth theme, on human investment and resource use, will be examined by MAB in more detail as a special effort toward linking ecology and economy.

There is a need to study ecosystems both for comparative research purposes and to exchange experiences on basic biological research and technologies for the preservation of ecological diversity. For example, areas of study may include the design and management of core areas, the compatibility of specific uses in buffer zones and the overall question of how sustainable development relates to biological diversity conservation.

Increasing globalization of ecological and socioeconomic problems suggests that ecological studies and conservation efforts should be looked at and organized at different scales across—and beyond—ecosystems and with more orientation toward societal needs. Both conservation and ecological sciences have to move up in scale without neglecting crucial local tasks and integrate biological diversity conservation in a harmonious way with sustainable development.

The Biosphere Reserve Concept is pioneering such a harmonious approach. It is advocating an ecological ethic of cooperation, and more importantly, of man's partnership with nature.





TROPICAL FORESTS

TROPICAL RAIN FORESTS— GLOBAL RESOURCE OR NATIONAL RESPONSIBILITY?

Alan Grainger

INTRODUCTION

There is widespread concern about the future of the tropical rain forests, but considerable disagreement and uncertainty about how to resolve the problems that face them. This paper suggests ways in which scientific research could help us learn more about this important natural resource and manage it wisely. The central theme is the contrast, conflict and complementarity between the national and international aspects of the tropical rain forests. Is it possible to safeguard these forests and if so, how? Who has the responsibility of doing this—the world, or the countries in which the forests are located? What is the most appropriate international role for tropical rain forest activities, and how does this relate to the individual national roles?

GLOBAL CONCERN AND NATIONAL NEEDS

Forests in the humid tropics are of global importance because of their sheer size. They cover over one billion hectares and account for two-fifths of all the closed forests in the world. Every year about 6 million hectares are cleared for agriculture and a similar area is selectively logged for timber. The tropical rain forests have an ecological importance because they form the habitat for 2 to 5 million species of plants and animals and have an as yet undefined role in the

workings of the global ecosystem which we call the biosphere. They also have an economic importance as the source of 38 percent of all log exports, 14 percent of all sawn wood exports and 61 percent of all plywood exports.

Yet tropical rain forest resources are also very important to the countries in which they are located. Deforestation occurs mainly because people need to clear forest to grow crops in order to feed themselves. Logging is usually not a direct cause of deforestation. Because it is mainly selective and only removes a few trees per hectare, it does not normally remove the forest canopy. Although deforestation is caused directly by the expansion of cultivation, the primary underlying causes are population and economic growth. More people need more land to grow food.

How do we balance our international concern with the national needs of tropical countries? Didn't people in temperate countries clear their own forests in large measure for farmlands? Should we deny those living in the tropics the same right to choose how to use their lands? For that is what we do when we call for a halt to the clearance of forests to protect these marvelous ecosystems for all time; to conserve the gene banks of species of animals and plants which are good for their own sake and have important economic benefits; and to prevent the climate of the world from changing. These are all good reasons in themselves, but they are derived from our own perspective and not from the point of view of those who actually live in these countries, however much we claim to represent the world.

However, there is another kind of concern about these forests and the lands that they cover which may be slightly more justified. This arises out of an understanding that the soils underneath the tropical rain forests are for the most part poor in quality, so that when the forest is cleared and cropped for more than a few years at a time, the soil fertility is depleted and the land exhausted. The real problem of the tropical rain forests is that large areas of forest are being cleared for uses which are not sustainable. Magnificent ecosystems are lost for the sake of a few years of cropping or grazing, after which the lands are often abandoned so that yet more forest has to be cleared to provide more farmland. The way in which these forests and lands are being wasted benefits neither the tropical countries themselves nor the wider global community.

PRIORITIES FOR SCIENTIFIC RESEARCH

Since the loss of tropical rain forests is therefore often in conflict with national needs, one of the main concerns of the international community should be to help tropical countries to study their ecosystems so that they can decide which areas to conserve and to develop land uses which are appropriate in intensity to the capabilities of these ecosystems and the needs of their peoples. Otherwise, the forests and the lands beneath them will continue to wash away.

There are three main priorities for research: investigating the ecosystems themselves and the plants and animals which they contain; studying the human processes involved as a basis for modelling likely trends in forest cover; improv-

ing land-use planning; and mapping the extent of the tropical forests and monitoring the rates of deforestation. The next part of this paper outlines ways by which pure and applied research programmes can be expanded in each of these priority areas.

The main aim of science is to dispel our ignorance about the world in which we live. At the moment, ignorance is the best word which can be used to describe our level of knowledge of the tropical rain forests. We know so little about the species of plants and animals that live in these forests, the way in which ecosystems function and how to manage the forests for timber production in a sustainable way. Only recently has there appeared a glimmer of interest in developing cropping systems which are appropriate to the ecosystems of the humid tropics instead of merely being adapted from temperate agriculture.

The international community must provide far more support for both pure scientific research on tropical ecosystems and applied research to develop sustainable cropping systems for the humid tropics. Because it will take some time to establish sustainable agriculture, unless we expand our pure scientific studies now, much valuable fauna and flora will be lost before we have a chance to study it. All such research must be seen as a partnership between scientists from tropical and temperate countries and have a vigorous training component so that local scientists can grow as rapidly as possible in numbers and skills.

THE STUDY OF HUMAN PROCESSES

A considerable amount of ecological, zoological and botanical research is already being conducted in the tropical rain forests. However, the human processes which lead to deforestation and logging and which directly affect the future of these forests are hardly being investigated at all. What is happening in the humid tropics is probably the greatest land-use transition this century, yet we know very little about what is happening or the scale upon which it is occurring. This is a subject just as deserving of scientific study as the spatial distribution of a plant genus.

The study of the human impact on the tropical rain forests has been the focus of my own research since 1981. Research in Borneo and elsewhere indicates that action in the agricultural sector rather than the forest sector could well be the main factor that will influence future rates of deforestation. On the basis of this research, I developed a computer model to project future trends in deforestation for 43 countries, covering the major part of the humid tropics. Two scenarios were simulated, and they suggest that deforestation rates could fall to between a quarter and a half of their present levels by the year 2020, from 4.4 million to 6.6 million ha per annum respectively in 1980 to 0.9 million to 3.7 million ha per annum in 2020. This assumes that reasonable rates of improvement in agricultural productivity can be attained. These scenarios would lead to a reduction of between 10 and 20 percent in total forest area over that period.

Deforestation is but one of the two major impacts on the tropical rain forests. I therefore built a much larger computer model which includes both de-

forestation and logging. Simulations with this model show that the tropical rain forests are not inexhaustible sources of wood. Timber exports should peak before the year 2010, and by 2020, commercial timber reserves could be only a quarter of what they are today. Exports from Asia, which now supplies 80 percent of all tropical hardwood exports, should decline in the next ten years and by the end of the century will be only a small proportion of current levels. This means that logging will probably become much more extensive in Africa and Latin America. We should therefore begin planning today to anticipate future land-use problems and the need for improved forestry training if an uncontrolled plunder of forests is to be prevented in these two regions.

The model also predicts that intensive forest plantations in the humid tropics, which many thought would take over the timber production burden from the natural forests, will in fact only make a negligible contribution in the foreseeable future. So managing and protecting natural forests is especially important and will require a new programme of both silvicultural research and training so that countries in the humid tropics have sufficient techniques and skilled personnel for the future.

AN EARTH OBSERVATORY

The third research priority is to dispel our ignorance about the global extent of the tropical rain forests and rates of deforestation. There is still considerable uncertainty about the total area of these forests since only about half of it has been surveyed by any form of remote sensing since 1970. Tropical rain forests are but one of two major types of forest in the humid tropics (the other type is the seasonal, tropical, moist, deciduous forest) and we do not even have sufficient information to specify their separate areas. Similarly, current estimates of the annual rate of deforestation are based on actual measurements of deforestation rates for only six out of more than 60 countries in the humid tropics. Without better data it will continue to be difficult for us to convince decision makers of the importance of improving forest management and conservation and developing sustainable agricultures in the tropics.

This year marks the 15th anniversary of the UN Conference on the Environment at Stockholm, which urged that a continuous monitoring system be established to use the best satellite and other remote sensing technology to monitor the tropical forests. This vision has been lost and must be restored. We need a fully equipped Earth Observatory, preferably with its own remote sensing satellite, to continually monitor rates of deforestation and to tell us exactly how much tropical rain forest there is. It will also help us to gain more data about the other major environmental problem affecting our planet: the scourge of desertification which is rampant throughout the drylands of the world. What good is it to observe the other planets if we are content to remain so ignorant about our own?

PUTTING RESEARCH INTO ACTION

The final part of this paper considers how the results of the research proposed above could be put into action to achieve more appropriate and more sustainable uses for these forests.

Biodiversity and Conservation: Biodiversity, which describes the importance of conserving the tropical rain forests for their huge wealth of animal and plant species, is an admirable concept but of very little use until we can map tropical forests by ecological type and species composition. To do that will require the results of detailed ecological, botanical and zoological research together with the detailed maps of the tropical rain forests which would come from the Earth Observatory.

How do we assess our conservation priorities? The most logical approach would be to start with the most valuable areas of rain forest, identified by the research just mentioned, and then estimate which areas would be the most threatened within the next five years. This is where the study and modelling of human processes would come in, for by using appropriate modelling techniques and the data on the current distribution of forest and other land uses on a national, regional or global scale, we could project the likely future trends in forest clearance and therefore find the forests most likely to be under threat and in need of urgent conservation attention.

Once national parks or biosphere reserves have been established, it is then necessary to ensure that there is sufficient staff available to protect and manage them. To make maximum use of the limited personnel we do have, data obtained from the satellite linked to the Earth Observatory would allow local conservation officers to continually monitor the boundaries of national parks and reserves and take quick and effective action when incursions take place.

Controlling Deforestation: How can we bring deforestation under control? Because the tropical rain forests are situated on the sovereign territory of independent nations, it is their responsibility to control the way in which their land use develops. The fact that very often they do not exert this control is not because they do not want to but because they usually lack sufficient skilled personnel and technical knowledge.

The first step toward improving land-use planning will involve much closer cooperation between agriculture and forestry departments in tropical countries. Deforestation is not a forestry problem or an agriculture problem. It is a land-use problem and its ultimate solution depends upon a joint approach by agriculture and forestry departments to improve land-use planning and the sustainability of both forestry and agriculture.

However, land-use planning in the humid tropics is a little different from that in the temperate world, where an area of land can simply be designated for a certain purpose after due consideration of its various capabilities. In the humid tropics, shifting cultivation practices which move in space and time are already widespread, while supposedly permanent agricultures are in fact unstable and

therefore also spread out over time to consume more forest. So even when sustainable intensive cropping systems are developed, it will still be necessary to blend these with existing practices. Change will not occur overnight. That is why we need a new form of dynamic land-use planning that will enable land managers in tropical countries to gain more control over land use and thereby over deforestation also. To develop these new techniques will depend heavily upon the results of the research into human processes mentioned above.

Climatic Change: There is already major international concern about future trends in global climates. Tropical forests are involved because the increase in carbon dioxide which results from their clearance and burning contributes to global warming. Other impacts result from effects on the water cycle and changes in the earth's albedo (or reflectivity) due to deforestation. At the moment, world climatic models have to depend upon very poor data on trends in tropical forest biomass and area. Obtaining more accurate estimates of deforestation rates, even in gross terms, would help to improve the quality of that input. However, we can also look forward to a time when we shall be able to combine our land-use models and the results from our observation with the Earth Observatory to create a fully spatial model of this portion of the earth's albedo and so improve the accuracy of our predictions about future climatic change.

CONCLUSION

It is possible for us to reconcile our global concern about the tropical rain forests with national needs if we can devise international research programmes that are complementary to national action but yet greatly increase our knowledge about these forests and the human impacts upon them. Such global concern should not, however, be aggressive, as is so often the case in the activities of some environmentalist groups, but neither should it be passive. We do not have any right to tell governments of foreign countries how to look after their forests, but we have every right to engage in scientific studies of large area change from outer space and a duty, if requested, to assist the scientists of tropical countries to learn more about their wonderful forests.

There is, however, a need for a new sense of urgency. Dramatic changes are taking place in the tropical rain forests now, and they need to be studied now. Some encouraging events have happened since the last Congress. For example, the International Tropical Timber Organization was established with a mandate to support research to develop sustainable management techniques for the tropical rain forests. However, we badly need a new initiative. The Earth Observatory, which would not only give us valuable new data but also make deforestation visible to millions of people all over the world, could be just such a thing. Time is passing, and for the tropical rain forests the future is closer than we would like to think. We need to act quickly to ensure that these forests have a future at all.

THE FAILURE OF CONSERVATION

F. William Burley

A World Wilderness Congress is supposed to be a happy event, a celebration of life and wild areas and our oneness with nature and a time to review our accomplishments in conserving the wonders of the natural world. So I ask for your indulgence for the next few minutes while I address what I feel has been a failure of conservation in the 1980s. The blame for this failure is on all of us, collectively. Most of my own professional life has been in conservation work, so I'll be the first one to claim at least part of the responsibility for it.

I see three areas in which those of us working in conservation and environmental protection have not done our job very well:

The first area in which we have generally failed is in identifying and agreeing on the most fundamental conservation priorities. Today there are no fewer than 40 groups worldwide who claim to be actively working on identifying priorities either globally or in the major geographic regions. When you also include other efforts focusing on the national or local scale, the number is well over 100. Many who are working on these priorities are here today.

But try to find some consensus among us on how to determine those priorities. The bird conservation people are working hard to determine their top priorities in conserving bird species and threatened populations. The primate specialists are doing likewise. The parks and protected areas specialists have their own lists and methods. We all speak of the importance of centers of endemism and areas of high species diversity, but in the end each group goes its own way. A report is produced, large maps are covered with colorful markers and formal presentations are made to governments and to development agencies.

But those who are making the real land-use decisions and who have the power to designate conservation areas or to move money into other conservation activities are deluged with recommendations—many of which are contradictory.

I can't blame them for being turned off and not taking action, because we conservationists do not yet have our act together. Some of us say training is the answer. Others say institution building is the key. Many of us worry that there is not enough time left—species and forests are being lost too fast—and we had better establish as many parks and other conservation units as possible, right away.

The final answer, of course, is that all these approaches are necessary and integral parts of conservation work on a global scale. But it is no wonder that the bureaucrats do not take action when we cannot agree among ourselves on which approaches are most important, where to apply them and in what order. For ex-

ample, the recent U.S. Strategy on Biological Diversity Conservation contains no fewer than 67 recommendations for action and financial support by the U.S. Government. Yet for various political reasons, no real attempt was made to rank those 67 recommendations or even to make general statements about their relative priorities. So today it is more or less a free-for-all in Washington to capture small parts of the minuscule amount of government funding available for conservation work.

A second area in which we have failed is in making the case for conservation and the importance of conserving tropical forests and biological diversity. Despite all the publicity in the press about the loss of tropical forests and species, most people still do not believe that wildlife and forests are all that important.

This is even more true in developing countries than here or in Europe. We tell people about the origins of food plants, and about the role of wild plants in modern medicine and the importance of managing forests to preserve soils and water supplies. Major research volumes appear, like the impressive one recently by the Prescott-Allens on the use of wildlife and plants in the United States, but apparently all these arguments still are not very convincing to most people.

Only when we try to put dollar figures to some of these issues do people begin to listen. But even then, few government officials can look beyond their present terms of office—they have to see the prospect for immediate payoffs before they will support conservation projects.

A classic example of this failure to make the case for conserving species was a short piece I heard on public radio last Thursday. A physics professor from a university in my home state of Virginia was saying we do not need to worry about all this extinction of wildlife. The biologists tell us that extinction is a normal part of evolution and most species are doomed to extinction anyway. Besides, this professor said, most of the species going extinct today in the tropical forests are only insects, so why worry about them?

When you consider this failure to create public awareness of the issue and our own lack of agreement on how to determine conservation priorities, then it's not at all surprising that the current U.S. legislative earmark of \$2.5 million per year for biological diversity conservation is so small. To keep it in perspective, \$2.5 million is about 1 percent of the amount we Americans spend each year on our dogs and cats.

A third failure we must admit is our inability to clearly make the link between conservation and development. Despite the good efforts of IUCN, World Wildlife Fund and others in developing National Conservation Strategies, despite a week-long conference in Ottawa last year on this very topic, the conservation and development concept has been much more rhetoric than real action.

We must continue to build the system of parks and protected areas as an essential part of conservation, but we will fail miserably in this business if we think primarily in terms of parks and wilderness areas. We are all fond of saying that we must link conservation with development. But nobody knows how to do this very well yet, and we do not have very many good examples.

The whole arsenal of conservation techniques used in this country, Great Britain and Australia has hardly been used at all in the tropical developing countries. Many of them are not useful or applicable outside of temperate zone countries. I am speaking about methods other than land acquisition, such as leases, conservation easements, and a wide range of management agreements that can help achieve our conservation objectives without always having to buy land or lock it up in a park or strict nature reserve.

So far the conservation and development idea is mostly words. It is difficult to find five good conservation and development examples that are working today and have been working for at least five years, in each of the three major geographic regions. Rarely do we have a case in which a major conservation objective has been served, including perhaps the establishment of a core conservation area, while at the same time there being significant local economic development.

The best examples may be some of the MAB Biosphere Reserves. But in my opinion, even the MAB system needs to be broadened considerably and it suffers badly from the image of preservationism in the minds of many government officials. How many examples can we point to where timber harvesting has been planned or coordinated along with, or perish the thought, inside a "conservation" area?

Until we routinely think of doing conservation work in concert with—and as a component of—development, our conservation projects will simply be add-ons, and the conservation community will continue to be looked upon as just another special interest group fighting for a tiny share of the public treasury.

I agree very much with the comments of banker Michael Sweatman that we in the North do not really appreciate the development problems of the Third World. For this reason, we must be very careful with the concept of wilderness itself and with our advocacy of it around the world. To a very real extent, wilderness is a luxury we can afford here in the United States and in a few other countries. But it is anathema and an offensive concept to many persons in the developing countries—persons who must live day to day by exploiting the local forests and who may have no options other than destroying the local resource base.

As the Minister of Public Lands from Botswana asserted earlier at this very conference, if we expect to conserve forests and establish conservation areas in many of these countries, then not only must we help pay for it directly, but we must find new jobs and other sources of income and food for the people who may be displaced.

There is cause, however, for some optimism about conservation. There are three recent developments that, in my opinion, will bring about major changes over the next few years.

One example is the Tropical Forestry Action Plan (TFAP) that is being coordinated by FAO in close cooperation with developing country governments, the development assistance agencies, and a few non-governmental organizations. The TFAP grew out of the Global Possible Conference in Washington in 1984 and out of the work of FAO's Committee on Forest Development in the Tropics.

The Global Action Plan calls for major expenditures of at least \$8 billion over five years to conserve and develop tropical forests. Major emphasis is placed on sustainable exploitation of the forests, on research and on conservation of tropical forest ecosystems.

The work so far has concentrated on outlining global priorities in forestry, on calling attention to the urgency and disastrous consequences of continued forest loss and on mobilizing action at the national level. Over 30 nations are now in the process of reviewing their forest sector, and they are developing national action plans to manage their remaining forests and to replenish or restore much of the forest already lost. Attempts are being made specifically to ensure that the forestry sector is being examined in relation to agriculture and national economic development more generally.

However, the Global Action Plan and the national plans following from it need improvement in several respects. There has not been enough emphasis on involving non-governmental organizations in the process, but steps are being taken now to correct this. The World Resources Institute cosponsored three regional NGO workshops this past year to try to get more national and local NGOs directly involved in the action plan process. Other NGOs are working at the national level in several countries to also ensure local participation in the process.

Further, forest ecosystem conservation needs more emphasis and monitoring in the action plan. However, if all the recommendations in the action plan about managing forests on a truly sustainable basis were to be carried out, many of the remaining tropical forests would be conserved and the biological diversity found in these forests would be less threatened.

The plight of indigenous peoples living in tropical forests is another area that needs more attention in the tropical forestry action plan process. I do not think that anyone knows the best answer on this difficult issue. It is far more complex than simply leaving these people alone—something that will not happen anyway.

Despite these weaknesses, the action plan process has so much potential to slow or stop deforestation that, in my opinion, we should give it our full support. There is no doubt that more funding already is being allocated to forestry by the development assistance agencies—in fact the doubling of development assistance in forestry called for in the action plan will happen in only three years, rather than five as we had expected. The development agencies are coordinating their development assistance better than before, although there still is much room for improvement. Financing continues to flow into some questionable development projects, but that too is changing. The question that remains to haunt many of us, however, is whether all of this response will be commensurate with the scale of the problem.

For that reason, another very encouraging prospect is the whole area of international financing for conservation. Debt forgiveness or debt swapping is only one part of a whole menu of possibilities. Several years ago, Ira Rubinoff and Nicholas Guppy separately proposed saving tropical forests by using innovative

financing schemes to allocate much of the cost of forest conservation to the developed countries. Both of their proposals seemed to the economists to be unrealistic—but perhaps they were only a few years too early with their ideas.

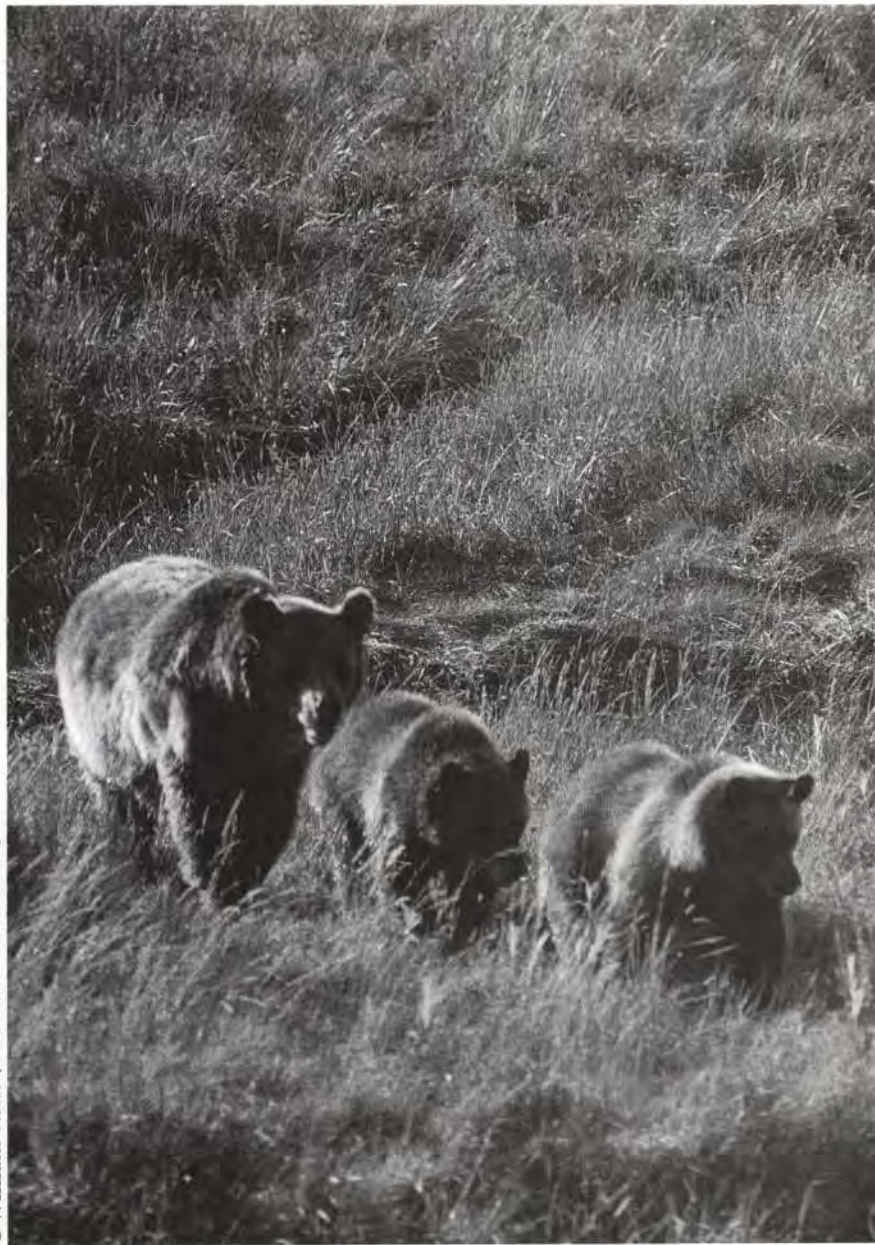
Lastly, another recent development that promises to bring major changes is the crisis that is developing on the international conservation scene—a crisis of organizations—in modern jargon, a real “turf” battle. It revolves around the issues of conservation data and funding for conservation activities. I see this crisis as something positive that will force us all to reexamine our priorities and in some cases, our enormous organizational arrogance. In the process we may just happen to agree on the real conservation priorities and how to go about getting the job done. The identity of the major actors by the time of the next World Wilderness Congress is anyone’s guess.

We had better enjoy wilderness, the tropical forests and biological diversity while we can, because clearly we are losing all of them. Regardless of our heroic actions to change this, it is inevitable that most of the tropical forests as we know them today and much of the world’s biological diversity will be lost in the next 100 years. This fact will not change even if the most optimistic predictions of population growth and habitat loss turn out to be true.

In conclusion, I believe there must be changes in the scale of some of our expenditures. I have already mentioned the amount spent each year on our dogs and cats—it is more than we spend on biological diversity conservation projects. But the comparisons are endless. For example, the states of Texas and Florida together recently spent about \$12 million to officially receive the Pope. Now I am not against the Pope’s travels, but that amount is more than twice the ambitious fund-raising target that was achieved in the recent Costa Rica Parks and Conservation Campaign.

In America especially, I think we need to get our priorities straight. Thanks to our tax laws, we Americans give away more than \$80 billion each year to our favorite charities. About half this amount goes to our churches—more money than goes into all foreign aid or development assistance each year worldwide. It is not surprising that far less than 1 percent of the \$80 billion each year goes into conservation work in the broadest sense. This shows that those of us who are working in conservation simply are not working hard enough.

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NATIONAL CASE STUDIES

*"It is impossible to successfully
resolve environmental prob-
lems in one country, no matter
how large or advanced it is,
without solving the problem in
the whole world."*

—Dr. Roman I. Zlotin
USSR Academy of Sciences



AFRICA

BOTSWANA—STRATEGIES FOR PROGRESS

Patrick K. Balopi

As a matter of priority, Botswana is currently preparing a National Conservation Strategy to deal with all the country's problems of environmental deterioration. Specific proposals which relate to the livestock, wildlife and other sectors will include:

- Range management techniques for farmers on the communal areas and on leasehold and freehold farms;
- Improvement of marketing facilities through which it is hoped distribution will be increased and thus the range be conserved;
- The implementation of relevant sections of the Agricultural Resources Conservation Act;
- Improved infrastructural provision for wildlife in the form of more water sources in their habitat, improved cordon fence alignments and others;
- Better marketing and sustained utilization of wildlife to generate employment in the rural areas;
- Better water-development planning, which is crucial to the survival of livestock, wildlife and man;
- Improved institutional arrangements to facilitate the formulation and implementation of appropriate conservation policies and projects;
- Improved systems of environmental education to enhance community policing of natural resources; and,
- Generation of alternative employment opportunities.

While the Strategy clearly seeks to address a wide range of natural resource management concerns, it also deals specifically with aspects of special environmental interest. Perhaps our most serious problem is that of overgrazing.

This has been a concern which we have tried to address almost since independence 21 years ago. Consequently, our first livestock development project was started in 1973, and the lessons learned from that contributed to the launching of the Tribal Grazing Land Policy in 1975. This policy was a positive attempt on government's part to encourage both individuals and groups with large cattle numbers to move from the communal areas in order to reduce grazing pressures and social inequality. Presently over 48 percent of the 300 or so allocated ranches are in the hands of these groups. However, this program has resulted in the "dual rights" issue, whereby the ranchers continue to have access to the communal areas, particularly after they have overgrazed their ranches. While government is aware of the need for change, it is also aware that this issue affects the constitutional rights of every Motswana regarding access to land. This matter is now under active government consideration.

Reverting to the wider issue of communal area grazing problems, the government of Botswana has recently introduced the National Land Management and Livestock Project. Government monitoring of the Tribal Grazing Land Policy has revealed that assumptions regarding availability of spare land, improvement of productivity and relief in the communal areas were overly optimistic. The National Land Management and Livestock Project has therefore not emphasized the development of new ranches, but has shifted the whole emphasis to management. One of the complaints from ranchers, however, is that lack of financial credit is hampering ranch development and better management which has led to a component being built into the project. These ranches occupy only 4 percent of our land area, nevertheless government has a responsibility toward seeking their proper management.

Though the credit component is large, in reality the main component of the National Land Management and Livestock Project is an attempt to address the communal area grazing problems where 80 percent of the national herd is located. Although this component looks very small in the project document, the people living in these communal areas have to be involved and therefore government has to go through a consultation process. The initial intention is to locate six or seven pilot areas in which the communities involved are prepared to commit themselves to managing their own grazing resources. If this program is to be successful, further consultation will be necessary. We believe this demonstrates a bottom-up approach to planning. In addition, government has commissioned an incentive/disincentive study under the National Land Management and Livestock Project so that it can create a framework for assisting all farmers, especially the communal farmers, to move toward better animal and range productivity.

There are other important thrusts to limit overgrazing that the government has undertaken. The national herd has grown primarily as a result of population growth and wage employment, and not because of outside interventions. In trying to promote distribution so that we can reduce stocking rates to levels compatible with seasonal carrying capacities, we require more abattoir capacity.

It is for this reason that government hopes to build a third abattoir. It is regrettable that pressure is being mounted by our critics against the financing of this project by the African Development Bank on the grounds that the project is harmful to the environment. Government's position is that increased distribution will reduce the incidence of overgrazing, which is presumably also the concern of the critics of existing livestock policies. Secondly, recognizing that the national herd is dependent on the range and that the capability to quantify and monitor range quality is very weak, government under the National Land Management and Livestock Project has commissioned a study to determine how it can provide this capability.

Perhaps the second most important issue is the question of wildlife conservation. In July 1986, my government passed the Wildlife Conservation Policy. This policy recognizes that Botswana has a wildlife resource that has economic, ecological and aesthetic values. Managed properly, wildlife can enable all these qualities to be exploited for human benefit on a sustained yield basis. The size of the resource after the recent drought, as determined from repeated surveys, stands at between one and two million animals. This is substantial. Given the abundance of the resource it has become necessary to adopt a management approach that allows for sustained utilization. Thus the Wildlife Conservation Policy does stress sustained utilization.

The Wildlife Conservation Policy also recognizes the land-use requirements of wildlife. It thus stresses allocation and maintenance of land for either exclusive or dominant use by wildlife. The exclusive use of land by wildlife is in the form of National Parks and equivalent Game Reserves, while the dominant use of land is in the form of Wildlife Management Areas. National Parks and Game Reserves account for 17 percent (over 100,000 square kilometers) of the country and are entirely preservation areas. No consumptive form of wildlife utilization is practiced here. The Wildlife Management Area boundaries, as proposed, now account for approximately 20 percent of the country. Here both consumptive and nonconsumptive utilization of wildlife are accepted. Wildlife and its utilization are regarded in wildlife management areas as the primary forms of land use. Other land uses are only allowed if they cause minimum disturbance to wildlife. Settlements for Remote Area Dwellers, for example, are compatible with wildlife management areas' objectives, whereas large-scale cattle ranching is not.

Wildlife Management Area location has been determined to take into account animal migration routes as well as to act as buffer zones between national parks/game reserves and major settlements and cattle-holding areas. They also will provide extra protection to some habitats and ecosystems which do not fall inside National Parks and Game Reserves. Thus wildlife management areas are regarded as an important land-use form which not only protects the animals but their habitats, while allowing such animals to be utilized on a sustained basis.

The foregoing should not be interpreted to mean all problems facing wildlife conservation have been taken care of. In some cases, fences have been con-

structed cutting across migration routes and obstructing wild animal access to water sources. The Kuke fence, constructed in the 1950s, is one such example and there are others. Lessons learned from the mistakes made in alignment of these fences have been painful and costly, and we are learning constantly. Current land-use planning in Botswana now takes into consideration all aspects related to any proposed use, and these include adoption of mitigatory measures. All fences in wilderness areas now have to take into account the wildlife movement patterns. Where areas have already been cut off by previous fence alignments, water is being provided for wildlife. Most of the boreholes for this purpose are located in the Central Kalahari Game Reserve and it is hoped that they will alleviate the water stresses of animals in the area. It is realized that providing artificial water points for wild animals can also lead to concentration of such animals around such water points and lead to further overgrazing and degradation. Thus, monitoring becomes imperative. Two projects currently being implemented by the Botswana Department of Wildlife and National Parks and funded by the EEC address both aspects.

Drought is another major problem facing wildlife conservation. Prolonged periods of drought reduce food availability and quality. To compensate for this, animals have to roam far and wide and many die from the stresses. Government is currently studying ways and means of reducing such mortalities, and methods such as culling, cropping and increased hunting quotas are now being given serious consideration. Poachers have been apprehended and intensified anti-poaching operations have been mounted.

In regard to our Remote Area Dwellers, of whom the Basarwa constitute a large proportion, my government has recently reviewed the Remote Area Dweller Policy. We are committed to giving such people land rights together with social and political rights in order to remove inequalities. What we cannot do is to prevent these people from adopting a more modern culture.

A fundamental approach in addressing these environmental issues is through the mechanism of land-use planning. This is why the Livestock Project was expanded to include a National Land Management component. There has been criticism that, because it is this livestock-related project that has helped develop our land-use planning capability in the districts with better coordination at the center, we are going to favor livestock. In fact, the contrary has happened. Our land-use planning provides the framework for facilitating all of government's development policies whilst minimizing land-use conflicts. Such policies include Tribal Grazing Land Policy, Wildlife Conservation, Tourism, Arable Development, Remote Area Dweller Programme and the National Settlement Policy. Thus we are moving closer and closer to having our land zoned for specific purposes. We see this as a vital step in preventing encroachment by other users and in focusing people's attention on management by realizing that there is no more land available. The intention then in each zone is to produce a management plan. For example, the Okavango Delta is largely zoned as a Wildlife Management Area. The Ngamiland District Land-Use Planning Unit has therefore

embarked on a Delta management plan. This plan is vital, not so much because we see cattle as a threat to the area, but because other uses such as uncontrolled tourism also pose a real risk to sustaining this unique ecological system.

There are two additional and pertinent points still to be considered. My government is often questioned as to why it does not "use the stick" through legislative regulations, despite the fact that on the whole we do have good and adequate legislation. Botswana is a democratic country and we have a tradition of overcoming problems through consultation. Rightly or wrongly, we have felt that we must try to win commitment to better resource management through education. However, we do realize that things are moving so fast that we are going to have to rethink this strategy and seek better methods of implementing our legislative provisions.

The second point is an underestimation by the international forum on the effects of drought. Such conditions make it difficult to persuade people, particularly at subsistence level, to be environmentally aware in a way that is demanded by the environmental lobby. It is also difficult to disentangle temporary drought effects from longer term desertification effects. Drought is not an excuse, it is simply a reality.

The Botswana government is aware of the criticisms that have been leveled at the World Bank in regard to our National Land Management and Livestock Project. The American government has cited its concerns about this in its efforts to call for improvements to World Bank environmental procedures. We do not wish to get caught up in the need to reform the World Bank. What we want to put on record, though is that through misunderstanding and misinformation, this Botswana project has been singled out quite erroneously as a justification for such reform.

The government of Botswana is and has been aware of its environmental problems well before the orchestration of these international concerns. Pre- and postindependence practices were conservationist in orientation. A series of measures and policies, which I have already mentioned, reflect our own concerns. Further evidence for our independent concern is provided by the growing use of environmental impact assessments that the Botswana government carries out for itself, prior to project development.

Botswana is a sovereign, independent state that is master of its own destiny. We are not being dictated to by the World Bank or any other institution. Government believes that the National Land Management and Livestock Project meets Botswana's requirements and is an environmentally sound project. The World Bank, in this instance, has been sensitive to these requirements. Even if the World Bank is forced to revise its own policies, and if this is done in a manner which does not cause difficulties in meeting the needs of countries such as Botswana, then we will all strive to achieve sustainable development for posterity. The policy proposals which are being made to the bank are policies that Botswana already practices.

Mr. Chairman, I have had to concentrate on our Livestock and Wildlife

issues. There is much international concern. To the government of Botswana, the important issue is the development of our National Conservation Strategy, in which we address all the problems of natural resources degradation in Botswana. The problems that Botswana faces presently are exacerbated by rapid population growth and the continuous drought which we have suffered for the last six years. These problems include soil erosion, overgrazing, desertification, deforestation, water pollution, rural-urban migration, unemployment, inadequate environmental awareness, poor range management techniques and, of course, the problem of livestock and wildlife management. In our quest for the achievement of sustainable development, we have therefore decided on an integrated, holistic approach to dealing with these problems through the preparation of a National Conservation Strategy which is based on a widespread consultation process.

We would like to extend an invitation to those who believe that we are on the wrong track to come to Botswana and to deliberate with us, to look at the people of Botswana's problems, as was done by Senator Robert Kasten. You will find us a warm and open people who take kindly to criticism, but who also believe in fair play and consultation to hear both sides of the story. We have nothing to hide and stand firmly by our approach to conserve our resources. We also appreciate that in the Okavango and the Kalahari we have wilderness areas that are worth sustaining.

KWAZULU—CONSERVATION IN A THIRD WORLD ENVIRONMENT

Nick Steele

Man is no longer at peace with his environment. The symbiosis that once existed—when man was part of the ecological cycle—has broken down. This breach has resulted in an insidious conflict that is reaching frightening proportions. The conflict is most apparent—and most intractable—in the Third World, where a fierce struggle for human survival is being waged with increasing desperation because of rampant human population growth on the one hand and an unsustainable depletion of natural resources on the other.

Rapid population growth is considered the greatest obstacle to economic and social advancement in most countries. From a 1980 total of 4,433 million, the United Nations expects the world population to reach 6,113 million by the year 2000.

Because of the age structure of the world population, a high level of population growth will be sustained well into the next century. A population exceeding 9 billion by 2050 is possible. To put global population growth in perspective, consider the following. In 1980, 75 million people were added to the world's population. In 1990 the annual increase is expected to exceed 90 million, and in the year 2000 it is anticipated that the figure will be over 115 million.

This vast increase in population has already had a dramatic effect on the natural environment. It is an effect that will worsen as more food, shelter and room to live is required in order to meet the demands of the increasing population. The resulting stresses placed on the natural environment have caused the balance of nature to break down. We all witness typical consequences: accelerated soil erosion, aggravated flooding during the rainy season and the drying up of once perennial rivers during the dry season. Other consequences are: increased water and air pollution, loss of crop yield and the loss or even extinction of many wild species. A diminishing quality of life for all is the inevitable result.

This is the situation in KwaZulu. This fragmented region resulted from the defeat of the Zulu nation at the hands of the British in 1879 and the consequential dividing up of the once-mighty Zulu empire into 13 separate chiefdoms. It has all the characteristics and problems of a Third World country. It is overcrowded—at present a population of nearly four million have to eke out an existence in an area of less than 33,000 square kilometers, of which only 23 percent can be considered to be suitable for crop production. The population growth rate presently stands at 3.1 percent, which makes it one of the highest in Africa. Nearly 60 percent of its people are under 20 years of age and so the present population of four million is expected to rise to over six million by the turn of the century.

Against this backdrop is the grim reality that, in many places, the carrying capacity of the land has already been exceeded. This has resulted in increasing desertification and deforestation as populations increase, and as more and more unsuitable land, such as steep hillsides, has been cultivated, more livestock is being kept on the reduced uncultivated land and more forest and natural bush areas have been cleared to make way for cultivation. There has been no alternative but to take more and more from nature in order to survive. As the downward spiral of environmental degradation turns, so the grip of rural poverty tightens.

This is well illustrated at Dlebe in the Mahlabatini district where some women have to spend up to nine and one-half hours covering 19 kilometers in search of one head-load of firewood. This load, if used sparingly, may be enough wood to supply a family's domestic energy needs for four or five days. The alternative is burning precious manure, when it is available, leaving the already exhausted soil deprived of valuable nutrients.

In a situation of steadily decreasing soil fertility, crops become more and more stunted, and consequently, food resources steadily decrease. In areas where there is still some natural vegetation, greater dependence is placed on those few remaining natural resources until they too give way with the heavier demand. In the end, starvation or migration to towns to join the swelling ranks of the underemployed living in squatter areas that surround the cities are the stark alternatives that face many of the rural poor.

One might well ask: In this situation of apparent helplessness, what thoughts can the people of KwaZulu possibly have for conservation? Let the Chief Minister of KwaZulu, The Honourable M.G. Buthelezi, answer that question. When he addressed the World Wilderness Congress in October 1977, he emphasized the importance of wilderness areas and went on to say, "Once we stop being wilderness-oriented, we are likely to feel caged, with a resultant desperation that overcomes all caged animals even if they belong to the species *Homo sapiens*."

The Zulu people have a tradition of understanding nature. Their conservation awareness goes back to the foundations of their society. Because they lived close to nature, they lived in harmony with it and a balance was maintained between man and his environment. But this balance was lost when the white man arrived with his guns, his need for trade and, eventually, his soldiers, farmers and city builders. A new way of life, new priorities and new issues have developed but, in the case of KwaZulu, not at the expense of totally forsaking the values of the past. This commitment to the environment was given tangible expression by the KwaZulu government when the chief minister established a Bureau of Natural Resources in 1981, which reports directly to him.

The necessity of establishing the bureau arose out of a growing awareness that the classical approaches to conservation in nations with Third World characteristics are incapable of achieving their aims. Establishing inviolate wildlife sanctuaries or game reserves in order to preserve animals which had almost become extinct (following the wholesale destruction and wanton slaughter that took place at the hands of professional hunters, farmers and adventurers in the last century and the early part of this one) has little relevance to poverty stricken people preoccupied with survival. Indeed, these island sanctuaries contain a conspicuous but inaccessible wealth of natural resources and they are resented or are even a source of hostility among the people who live in poverty along their borders. Therefore, in order to make conservation relevant to people who have to live at the fragile interface between survival and starvation, the Bureau of Natural Resources is pursuing a conservation philosophy that is centered around three basic principles which Dr. Buthelezi has termed the ABCs of conservation:

- A is for Alternatives;
- B is for Bottom Line; and,
- C is for Communication.

Since rural people usually have no real alternative but to degrade their environment in an attempt to survive, it follows that for conservation to be effective, another alternative must be created. For example, in order to protect forest habitats against the strong demand for firewood, alternative sources of firewood must be found. This can be done by establishing woodlots. In KwaZulu, the Department of Agriculture and Forestry has established more than 100 woodlots. Another example is the use of plants for medicinal purposes. Traditional medicine is based on the use of barks, bulbs, roots and certain animals and reptiles. However, with increasing demand, more and more stress is being placed on available resources. In order to conserve the little that remains, alternative sustainable sources must be found. This is being done by the bureau, in association with various other conservation bodies, by establishing medicinal plant nurseries where endangered plants are grown and from which Inyangas (medicine men) can be supplied and/or assisted in establishing nurseries of their own.

The provision of alternatives is based on the philosophy that when the basic needs of the people are met through the provision of alternative sources of supply, then the restrained use of the remaining natural resources will follow almost as an automatic by-product.

The second principle of conservation in a Third World environment is the Bottom Line. This principle states that conservation cannot be practiced in isolation from the economy of the region in which it is situated. In other words, for people to value conservation they must receive some tangible benefit from it. There must be a bottom-line profit for the local community, otherwise no long-term conservation effort will be sustained.

Pursuing the bottom-line principle, Chief Minister Inkosi Buthelezi proclaimed KwaZulu's first game reserve on 21 October 1983. It is the 29,000 hectare Tembe Elephant Park, situated in Maputaland along the northern boundary of KwaZulu with Mocambique. The park consists of a mosaic of sand forest, woodland, grassland and swampland. The reserve was proclaimed in order to protect the last remaining herds of free-ranging wild elephant in South Africa, the endangered Suni antelope and the unique sand-forest vegetation.

The major significance of the Tembe proclamation does not lie in the fact that endangered species and habitats are being protected, but rather in the reality that the needs of the local people have been considered in determining the objectives of the reserve. The local people have thus not been shut out of the reserve, but instead were guaranteed controlled access to those natural resources that they traditionally obtained from the reserve area. For example, the people are allowed to collect reeds in the reserve for building their houses, provided they obtain a permit and harvesting is done at the appropriate time of the year. A percentage of all revenue earned by the reserve, including that from tourism, will be paid directly into tribal coffers. Income generated in this way will be used to build schools, clinics and other community projects.

The Tembe Elephant Park serves as a model for all of KwaZulu's future conservation areas. As new reserves are proclaimed, so the bureau will concen-

trate on integrating them into the local economy so that people will see that there is a bottom-line profit in it for them.

The principle of communication suggests that the success or failure of conservation in a developing region ultimately depends on the degree of support for, and active participation by, the people of the region. It is therefore vital that efficient two-way communication links be established between those who plan and administer conservation programs and those who have to live with the consequences of that planning and administration. In KwaZulu, the philosophy of "conservation by consensus" is actively pursued through close liaison with the local communities and the tribal authorities. Many tribal authorities have appointed conservation liaison officers who act as a link between the Bureau of Natural Resources and the community they represent. These liaison officers attend all management meetings for game and nature reserves within their wards, where they represent the interests of the local people. In this way, no action that may affect the local community can be implemented without their being aware of it and having an opportunity to influence the decisions taken. In addition, through this communication procedure, the community is able to request assistance and advice on conservation-related matters.

Central to good communication is the creation of an efficient extension service. The Conservation Extension Officer's task is to communicate with local people on a daily basis, visiting schools, clinics and tribal authority offices. They offer in-service ecology courses for teachers, conservation-awareness tours for chiefs and community leaders and conservation outings for schoolchildren. The bureau's extension officers also teach local communities the best methods of protecting and harvesting scarce resources. The relevance of this education has been readily appreciated by many rural communities, so much so that a number of Amakhosi (tribal chiefs) have set aside areas of land as community conservation areas. These areas of land range from small patches of natural forest to large areas of mountain catchment. As the areas vary so do the resources harvested. Forest patches may only yield medicinal plants, while larger areas may yield meat from game animals. All are important to a people who are dependent upon their environment for survival. The community conservation areas, of which there are now eight in KwaZulu, are managed by the tribal authorities with advice and guidance from the Bureau of Natural Resources. The purpose underlying the establishment of these areas is to create an area that is managed according to sound conservation principles and which allows for the resources of the area to be utilized on a sustainable basis. The community conservation areas of KwaZulu bear testimony to the reality that, given the chance, the people of KwaZulu have a strong desire to protect and care for their environment and to live once again in harmony with nature's rules.

Another example of conservation by consensus is the recent move by some tribal authorities to establish tribal game reserves. These reserves will be proclaimed in law and therefore the use of the land for other purposes will not be permitted. The reserves will be run by a management committee, with represen-

tatives from the community, the tribal authorities and the Bureau of Natural Resources. Staff will be trained and supervised by the bureau and will be paid jointly by the bureau and the tribal authority. The proposed tribal game reserves will fulfill all the functions of a traditional game reserve including patrolling, tourism and conservation management.

The battle for survival makes conservation in a Third World environment seem a luxury. But where the leaders of a Third World region have been able to exercise the discipline of standing back in order to view the broader issues involved, there is a realization that sound conservation is an essential weapon in the fight for survival. This is the situation in KwaZulu, where a policy of conservation by consensus is being implemented by the Bureau of Natural Resources. Through this policy of involving the community and gaining their consensus and commitment, conservation is being seen more and more as something that has meaning and tangible benefits and therefore is of relevance and value to the people.

Understanding the relationship between conservation and survival is essential because symbiosis between man and his environment must ultimately be achieved. If not, an increasingly bleak future, especially in the Third World, is the only realistic and infinitely tragic prospect.

Despite the omnipresent depressing realities facing KwaZulu, the underlying message that emerges is one of hope. Adopting a pragmatic approach, coupled with a genuine desire to help people attain their legitimate needs and aspirations, has minimized conflict between environmentalists and local communities. The resulting cooperative effort augurs well for long-term ecological stability in the region.

Wider application of the principles being developed in KwaZulu can help to ensure the survival of the world's remaining wild places and wilderness. After all, wilderness is really a by-product of a healthy environment.



EGYPT—THE RAS MOHAMED— CONSERVATION AND DEVELOPMENT

Hind Sadek

In August 1987, President Hosni Mubarak officially declared Ras Mohamed a National Environmental Park.

Ras Mohamed is located at the southernmost tip of Sinai, with which it shares a rich and varied wilderness of great beauty. The land bridge between Africa and Asia, Sinai was an important trade route throughout history and a crossroad that witnessed endless processions of armies from the times of the great Pharaohs of Egypt to Bonaparte and Allenby. We are told that Allenby himself found time, while battling the Turks during World War I, for bird-watching in the Sinai.

The land itself is barren desert in the north, with majestic mountains in the south and small towns and villages dotting the coastal areas, subsisting primarily on fishing and on trade. The mountains are rich in minerals, especially copper and turquoise, which although never exploited on a large scale, were known and mined since ancient Egyptian times. More recently, of course, oil is being extracted along the western shore of Sinai.

The climate is dry, with occasional low-pressure systems that bring rain from the Mediterranean to the northern parts; dry, easterly storms from the Sahara; and tropical storms from the Red Sea to the south. Daytime temperatures vary between 60 and 120 degrees Fahrenheit in the interior. In the winter, spring and fall a pleasant climate prevails.

Plant life is sparse, a result of both climate and over grazing. In the oases there are both the dome and date palm trees, and in the wadis, acacia trees grow. After the rains, annual plants cover the peninsula with beautiful and delicate flowers that survive during the dry seasons through their deep root systems. This flowering of the Sinai desert usually occurs during the months of February and March.

Insects and other invertebrates are common in large numbers, especially after the rains. Butterflies visit the flowering bushes and plants, and beetles lay their eggs in camel dung balls on which the larvae feed—as did the famed scarab of Ancient Egypt.

The reptiles are well represented by the lizard, whose numbers include the desert monitor, agama and gecko. Snakes are also present, but rare.

Several species of mammal inhabit the Sinai, most of them nocturnal. In the past, excessive hunting unfortunately decimated their numbers, and despite

bans on hunting some species such as the Sinai Leopard, they could not be saved from extinction. In the mountains, however, the ibex have escaped by being agile climbers, and in the wadis the elegant Dorcas gazelle survives and is increasing, thanks to hunting bans. Rodents include the desert hare and the hedgehog, both nocturnal, and a smaller rodent, the gerbil. Carnivores include the wolf, red fox, sand cat, striped hyena and the caracal or desert lynx. None are really dangerous to humans and all are now protected by law.

Birds are prominent in the Sinai, both migratory and resident. Among the resident species are desert, mountain and coast varieties such as the lark (desert), the partridge, eagle owl, raven and rosefinch (mountain), the grey shrike and babbler (wadis), Kentish plovers (coasts), and in the mangroves, important colonies of osprey, reef heron, spoonbill, tern and gull. Birds of prey are everywhere, the most common being the long-legged buzzard, short-toed eagle, Egyptian vulture, griffon vulture and falcon.

Far more numerous are the transient birds, who pass the Sinai by the millions on their way to and from the more hospitable climates of Africa. Herons, egrets and flamingos visit the northern shores and lagoons and sometimes stay to breed. Nearly 500,000 white storks and more than 200,000 eagles pass through every year. Many succumb to exhaustion and dehydration. Quail cross the Mediterranean by the hundreds of thousands.

By far the most numerous inhabitants of the Sinai are the songbirds, which occur there in great numbers and are present most of the year. Among them are wagtails, warblers, larks, shrikes and swallows, for whom Sinai offers a resting place. It is said that to witness the passage of these millions upon millions of birds is one of the most magnificent sights of the natural world.

The peninsula of Ras Mohamed is joined to Sinai by a land bridge of no more than 700 meters. It is surrounded by the waters of the Gulf of Aqaba, the Gulf of Suez and the Red Sea. Its coasts vary between beaches and precipitous, rocky cliffs. The latter, in the east, have acted as natural barriers so that corals and fish have been well protected there from human interference; in the south and west, on the other hand, the coast is more accessible and lends itself to development and to tourism. A shallow, protected gulf in midsection is also teeming with marine life. The Western coast faces the island of Ba'ira, with its vegetation cover of mangrove. Here again, marine life is protected from currents and offers tremendous varieties.

The geomorphological makeup of Ras Mohamed is the result of three geological events of almost equal magnitude: the first shaped its eastern shore, the second created the gulf of water mentioned above and the third caused the separation of Ba'ira from Ras Mohamed by a distance of only 70 meters, which could be joined by a bridge. These events have, of course, greatly influenced the composition and evolution of marine life, as have earthquakes, which are responsible for the formation of water caves in the lowest part of the peninsula.

Ras Mohamed falls within the southeast coast of Egypt and is characterized by a mild climate in the winter, spring and fall, with warm days and cool nights;

the summers, however, enjoy clear blue skies and hot direct sun rays. These sun rays exceed 450 watts from March to September and can be utilized for solar electricity projects. The coasts are exposed to the sea and land breezes. Depressions in the topography offer no obstruction to the northwest winds, which are therefore common to the region. Here, wind velocities, calculated at 3 to 8.5 miles per second, indicate another renewable energy source.

Based on the above, recommendations have been made by the Egyptian government to establish energy-oriented projects there, create a research center for wildlife (possibly on Ba'ira Island) and increase the scenic areas in Ras Mohamed. Outlines have already been drawn up to define the natural, legal and economic guidelines of the Ras Mohamed project, and are aimed at environmental protection and at the maintenance of the existing ecological balance.

SUSTAINABLE DEVELOPMENT: TOURISM

Ras Mohamed and the entire region of South Sinai enjoy natural resources that are rarely combined in any one area, making it a desirable spot for tourism. Controlled and well-managed tourism would create an important economic resource for the nation. Conversely, if not approached correctly the project would yield revenue for a short period of time, until unplanned tourist sprawl begins to pollute and visually diminish its natural beauty, as has happened all too many times before in many parts of the world.

Because of its location and environmental condition, Ras Mohamed offers a variety of interests and activities to tourists, ranging from cultural, historical, scientific, recreational and sporting, among others. Tourism, one of the sustainable development aims of this project, is based primarily on the diversity, beauty and pristine condition of the Ras Mohamed coral reef, one of the most beautiful and probably the richest in the world.

Coral reefs are formed over millennia by living animals—hollow-bodied, flower-like animals, with tentacles crowning the mouth that serve to trap tiny food particles suspended in the water. Corals can only survive close to the surface, as they depend upon algae for their growth. They usually form colonies of thousands of individuals. To form a coral reef takes thousands of years, to destroy it, considerably less. A coral reef broken down below a certain level will regenerate. Tourism, therefore, would be very clear on one point: No removal of corals!

THE REEF AND ITS INHABITANTS

With its intricate pattern of caves, nooks and crannies, the coral reef is the home of a multitude of animals. Undisturbed, it is teeming with life. At Ras Mohamed more than 100 species of coral have been identified, not all of them stony corals. There are also sponges, sea anemones, countless varieties of mollusks, snails, clams, crabs, shrimps, spiny lobster and other crustaceans, as well as the octopuses that lodge in caves.

But of all the inhabitants of the reef, the most spectacular of all sea life are the fish. The richness of the reef offers a home for many different fish, most of

them quite colorful. The most beautiful among them is probably the angel fish, the most common and obvious is the sea goldfish. Other inhabitants of the reef are anemone fish, parrotfish, brick-colored big eye, streaked sea slug, and in the fore reef, the slingjaw or telescope wrasse, grey butterfly fish and the peacock cod (which lives in the coral), the starry moray (a nocturnal dweller) and the hairy scorpion fish (a bottom dweller). Stingrays, sharks and barracudas are also common to these waters, but are not nearly as dangerous as the hammerhead shark, who is most frequently found off Ras Mohamed.

A coral reef is a very specialized and fragile environment. Its destruction by man would be unfortunate, as the reef requires so long to develop. The many life forms inhabiting the reef should all be protected, since each plays its own role in the balance of nature. The removal of one would cause an imbalance in the entire reef ecosystem. A more recent danger to the reef and its inhabitants is major oil spills, which probably represent the greatest threat to this very unique life zone.

The government of Egypt is well aware of the potential of the Ras Mohamed project. The government is also aware that, from the outset, the project has great and immediate earning potential, and that with a sound plan for both tourism and sustainable development, it could assure the nation of a long-lasting and expansive source of income.

The Ras Mohamed project is more than a source of income, however, for it can be a sterling example of international cooperation and progressive nature conservation policy. In order to make this a true transnational park with Egypt leading the partnership and concerned nations participating, the project needs a special initiative which goes beyond basic conservation. Keepers of the unrivaled treasures of human cultural achievement, Egyptians are also the keepers of this most beautiful and unparalleled natural treasure. Indeed, the entire area of Ras Mohamed, Sinai, the Gulfs and the Red Sea should become an environmental park that illustrates one of the world's most exciting and innovative approaches to development and to conservation.

Dr. Atef Ebeid, Minister of Cabinet Affairs and Minister of State for Development of Egypt, has noted the special aspects of Ras Mohamed:

1. It is truly an international natural resource demanding immediate protection and preservation.

2. Throughout its history, Ras Mohamed was protected because it was isolated. This is no longer the case. Oil spills and other debris from the sea are threats to the coral reef that makes Ras Mohamed the magnificent park that it is. Recommendations have been made, therefore, that a park and wildlife refuge be established, with expert and complete management.

3. Construction for visitors within the park should be carefully planned, with minimal on-site facilities to accommodate wildlife observation, swimming, scuba diving, snorkeling and so on. Research will also be considered. All these must be part of a comprehensive master plan.

4. The clean-up of all coastal and upland areas, removal of all trash,

especially in the mangrove channel, will receive the earliest possible attention.

5. Ras Mohamed, the Gulfs and the Red Sea offer some of the best opportunities for ecological, biological and marine research. Considerations, therefore, will be given to the establishment of a marine research center, an aquarium and a field school to be located in South Sinai rather than on the peninsula of Ras Mohamed itself.

6. Ras Mohamed should be viewed as only part of the overall picture of potential development and conservation. Already, visitors are attracted and the establishment of properly regulated tourism and management of parks for the whole area is one of the most important projects of Egypt today.

The Ras Mohamed Environmental Park of Egypt is such an initiative and is a note of hope for conservation and development—perhaps the first of many more.

A new potential project is an environmental education project involving the future citizens of Egypt: its children. The Natural History Museum for Children in Egypt is being established under the chairmanship of Suzanne Mubarak, Egypt's First Lady, and aims to introduce children to the beauty of Egypt's natural world and to the need of protecting it.

Situated in a 14-acre park in Cairo's northeastern suburb, Heliopolis, the museum will invite children to visit integrated environments of Egypt's deserts, seas and its great river. They will examine Egypt's floral, faunal and mineral compositions through a discovery room, hands-on approach, a technique successful in the United States. Visitors to the Natural History Museum for Children in Egypt will explore varieties that are familiar and unfamiliar elements of the natural world, both indoors and outdoors. From the stuffed birds in the museum, to the aviary in the park, to bird-watching in nature, Egyptian children will observe, learn and acquire a more intimate understanding of the natural world. From that understanding will develop, *must* develop, a love of nature and a desire to protect and preserve it. I, for one, know no better way of teaching children to love and protect than by teaching them to know and understand.

Another long-term solution? Perhaps, but we trust that it will work.



EURO-ASIA

SOVIET UNION—NATURE CONSERVATION IN THE USSR

Roman I. Zlotin

Nowadays, the entire world follows the events that are taking place in the Soviet Union. The essence of these events may be expressed in three words: democratization, publicity and *perestroika*—economic restructuring. There is no need to translate them or to explain. Let me hope that there is also a growing interest in my country's vast area, which occupies one-sixth of the world's inhabited lands.

The state of land use in the USSR, with its diverse landscapes and long tradition in the field of conservation, problems and achievements, includes prospects in the matter of conservation of environment and wilderness. The report is based on analysis of the Soviet experience and published materials on regional and global problems of nature conservation, taking into account a number of overseas concepts.

In the USSR there is abundant scientific literature on different aspects of nature conservation. Unfortunately, it is of little use to many of our foreign colleagues as it is published in Russian. Equally, a wide range of Soviet readers, who are interested in nature conservation, are not acquainted with the broad flow of nature conservation information in Western countries. These circumstances, together with problems of a political nature, slow down the exchange of our achievements and the working out of the World Strategy of Nature Conservation. I believe that the future of the worldwide movement for the preservation of the biosphere is in an open exchange of information.

Before turning to the Soviet approaches to nature conservation, I would like to dwell briefly on our fundamental concepts of the ecological situation in the world. The problem of protecting wilderness has become part of a more general problem of environmental conservation. The protection and improvement of the environment should be provided for by the totality of international, national and public measures. It should be directed by rational use, renewal and protection of

natural resources. It should provide for the optimal living conditions of people and it should be able to satisfy the material and spiritual needs of the present and future generations of people. The concept of nature conservation in the process of a rational use of natural resources has become the core of the contemporary attitude to the environment.

Many Soviet scientists believe that the modern world is characterized by a drastic deterioration of the environment as a result of uncontrolled population growth, aggravation of socioeconomic relations and as a result, profound deformations in the nature-society system. We are not yet fully aware of the true scales of nature transformation, but with the continuation of current trends in population growth and in economic production, the pollution of the environment will lead to irreversible transformations of the biosphere and to an ecological global catastrophe.

Estimations of academician I.V. Petryanov-Sokolov show that with the current rates of economic development, the volume of industrial production in the USSR doubles every eight years. With the existing technologies and the rates of growth of the industrial production, its wastes will lead to a catastrophic pollution of the environment and to a regional ecological crisis within several decades—during the life of one generation of people.

Similar problems are also characteristic of many other industrially advanced countries. The problems of loss and pollution of fertile lands in the countries of predominantly agricultural orientation are as acute.

The pollution and destruction of the environment cease to be just a regional problem; it now goes beyond the boundaries of individual states and becomes global. A sad example in this respect is the problem of acid rains, which cross the boundaries of many states. And a sad proof of it is also the tragic accident at the Chernobyl Nuclear Power Plant.

Only One Earth, what Barbara Ward and Rene Dubois called their widely known book, was prepared on the basis of the materials of the UN Conference in 1972. In our days, it is impossible to successfully resolve environmental problems in one country separately, no matter how large or advanced it is, without solving this problem in the whole world. Professor A.V. Yablokov, a Soviet specialist on nature conservation, believes that "the modern world is in greater danger of perishing because of global pollution than because of intensification of class struggle."

In recent decades, different natural hazards have become more pronounced—droughts, floods, earthquakes and others. It is more and more often the case that they happen in those seasons of the year and in those places where they have never been observed before. The intensity and the frequency of such phenomena increase persistently. We are getting used to hearing the phrase, from weather forecasters: "Old-timers do not remember such hot weather and such rains."

We all remember such tragic events of the current year as the catastrophic flood in West Georgia, which has taken many lives, destructive mudflows in Kirgizia and Tajikistan, the unbearable heat in Greece killing thousands of

people and the unprecedented summer floods in Iran with many human casualties. For many years now there is the tragedy of the Sahel desertification that has embraced an extensive area.

The processes of desertification have expanded around the planet, not only in Africa and the Near East. Desertification manifests itself in south Europe and in the southern regions of the USSR. Some frightening trends are under way. In the USSR, between the tenth and eighteenth centuries, an average of five droughts a century were registered. In the nineteenth century there were 10 of them, and at the present time in the desert-steppe zone of the USSR, droughts happen every three or four years.

The cause of these catastrophes is the growing impact of man on the natural environment. So far most natural hazards have been of local character, triggered by the transformation of those regions where they form and from which they spread. But the frequency and the growing area subject to them make us consider them to be the heralds of global catastrophic changes in the state of the biosphere.

The awareness of this danger is rapidly spreading among the Soviet public and is at the center of the Soviet government's attention. An ecological policy is becoming an important component of government activity. Approaches to the state ecological policy are found in the materials in the 27th CPSU Congress, in the June Plenary Session of the Party's Central Committee and in many current publications of the Soviet press. At present, practically every newspaper and every journal publishes materials on nature conservation daily.

Our science is called upon to play an important role in the solution of the urgent problems of environmental conservation. The Academy of Sciences of the USSR is working on two large programs devoted to environmental problems, the national section of the International Geosphere-Biosphere Program, the "Study of Global Change," and the National Program on Biosphere and Ecological Research in the USSR. The president of the academy, academician G.I. Marchuk, heads these programs.

What does the USSR represent in the socioeconomic map of the world and what is its contribution to the world community? I would like to present here some indices (as of the late 1970s) using data given in the Soviet press. The great dimensions of the country determine the proportional distribution of natural resources as compared to their worldwide occurrence.

In the past, the USSR was predominantly a forested country with a predominance of coniferous forests with nearly equal proportions of tundra and desert-steppe ecosystems. Economic utilization of natural resources has caused the ecosystems' cover to undergo great changes. Nowadays, the impact of man is found everywhere. For the most part there are no virgin ecosystems left within the USSR territory. In most biomes no less than one-third of the area is under anthropogenic stress. Only on 25 percent of the territory have natural balances been replaced by anthropogenic ecological complexes. In the main part of the country's area, rather stable, natural and seminatural ecosystems have been preserved in which the composition of plants and animals is close to the original.

Most transformed are the biomes of the south-taiga and broadleaved forests, as well as forest-steppe, steppe and desert biomes in particular. Here the natural ecosystem cover has been replaced by a type of anthropogenic field. In this natural anthropogenic field there arises different man-caused ecological problems and necessary environmental conservation measures are introduced.

The protection of nature in Russia has long-standing traditions. The first legislative acts on nature protection were adopted as far back as the eleventh century in the time of Yaroslav the Wise. In the thirteenth century, Prince Vladimir Volynsky decreed to preserve the territory of Byelovezhskaya Tushcha, which is now a State Reserve. In the fourteenth through seventeenth centuries in the southern borderland of Russia, there existed wide belts of reserved forests (the so-called zaseki) for protecting the southern tribes against nomads. In the same period, in accordance with the decrees of Tsars, populations of game animals such as beaver and sable were protected.

The nature protection decrees of Peter I played an important role in nature preservation. They were of an all-state character and primarily concerned the protection of riverside forests, where felling was prohibited. In the areas of felling timber for industrial purposes, reforestation was carried out. The water of large rivers, especially within city boundaries, was kept pure. The terms of hunting and fishing were strictly observed.

With growth of populations and development of capitalist relations in Russia as well as in other countries, a major attack upon nature began, characterized by a mass felling of forests, plowing of lands, and for the most part, uncontrolled destruction of animal resources. This process brought a wide movement of the Russian intelligentsia to life for nature protection.

Early in the twentieth century, the first societies of nature protection appeared in Petersburg and Kharkov. Reserves began to be created for protecting rare species of plants and animals, first by private capital and then as state establishments. Such were the Kronotsky Reserve (1882) in Kamchatka, Askaniya-Nova (1898) in Ukraine, and Lagodekh (1903) in the Caucasus. In 1916 the efforts of the Russian scientific community bore fruit and the first governmental act was approved. It accorded the organization of reserves for the purpose of conserving samples of nature. With the act, representatives of fauna and flora became an important national concern. The first state reserves established were the Lagodekh in 1912 in East Georgia and the Barguzin in the Baikal Region in 1916.

In the years of Soviet power, the ideas of nature conservation have further developed. The Soviet Government under the leadership of V.I. Lenin worked out about 100 documents on the rational use of natural resources and nature conservation. The decrees "About Land," "About Forests," "About Hunting" and "About Protection of Nature Monuments" were adopted in 1917 to 1921. Each laid down the socialist principles of nature protection. The All-Russian Committee on the Protection of Nature was established, which worked out a strict regime for the reserved areas' protection and delineated the first reserve areas.

The public has always played a significant role in the field of nature

conservation in the USSR. In 1924 the All-Russian Society of Nature Protection was created, which is the largest public organization in our country dealing with conservation. In 1955, the Academy of Sciences of the USSR set up the Commission on Nature Conservation. It worked out comprehensive methods and measures for the protection of nature, coordinated the activity of scientists and established contacts with international organizations.

The USSR takes part in international cooperation in the field of nature conservation primarily through the International Union for the Conservation of Nature (IUCN), as well as in special commissions of the United Nations. A number of bilateral agreements on the protection of wilderness also have been made with the USA, Japan and other countries. A special environmental program was created, which unites the efforts of the countries—members of the CMEA.

In the USSR all natural resources are owned by the State, which helps apply legislative standards in the matters of the use of natural resources and preservation of environmental quality. The Soviet Constitution defines the duties of the State and of every citizen in the area of nature conservation. From 1968 to 1980 the Supreme Council of the USSR approved fundamentals of the legislation on land resources, forests, animals and the atmosphere. Corresponding laws were also passed in all the Union Republics of the USSR.

Working out the main orientation of the economic and social development of the country, the CPSU Central Committee and the Council of Ministers of the USSR constantly pay attention to the improvement, rational use and conservation of the earth and its resources—air, water basins, the plant and animal worlds. The possibilities presented by the state centralization in respect to nature conservation are so far not fully used. About 2 percent of the gross national product is assigned for the preservation of the environmental quality. This is not a small amount, but the several billion rubles allotted for this purpose is not highly effective. The reason is the dispersion of the state authorities concerned with the conservation and control of nature. Nine State Committees and seven ministries are responsible for the conservation of individual kinds of natural resources. They are, at the same time, the consumers of these resources.

Restructuring the management of nature conservation and the use of natural resources is being considered. The Soviet Government soon will make a decision about the creation of the All-Union and of Republican State Committees on the Conservation of Nature and Rational Use of Natural Resources. This will give a new impetus to the matter of nature conservation in the USSR. The great dimensions of the country, the diversity of landscapes and natural resources, as well as their irregular distribution create a complex nature conservation situation with many problems in the USSR. In the attempt to overcome these problems, about which our mass media speak much and openly, the state is taking many practical steps.

In the field of science, principles of economic and extraeconomic evaluation of natural resources are being worked out. On this basis, approaches are created and priorities set for the optimization of the use of natural resources. An

obligatory consideration is the local account of natural conditions and natural resources. Much attention is being paid to the monitoring of a network of ecosystems and protected areas to determine effects of an intensive economic use. An important aspect is the determination of the factors and mechanisms influencing sustainability of ecosystems and particular elements of the environment under anthropogenic pressure.

An integrated geo-ecological prediction of possible consequences is the basis upon which we create a choice of optimal strategies to balance the use of natural resources with the need to preserve the quality of the environment and gene pool. In organizing the use of nature, scientific principles are introduced into the design of economic activity. The interests of different economic sectors are coordinated with the need to protect the health of people and wilderness. Here I would like to dwell, in short, on the organization of protected areas, since only this form of conservation provides for the saving of all the diversity of living nature and wilderness.

Between 30 and 40 percent of the area of our country has ecosystems whose state is close to the natural one. In the opinion of Professor A. V. Yablokov, which I fully share, about one-third of the area of all large physiographical regions should be preserved in a natural state. This is an indispensable condition for the preservation of the gene pool and is necessary for the living matter to be able to maintain its functions which regulate planetary homeostasis.

Here I mean not only nature reserves, in which any economic or recreational activity is prohibited, but all the other categories of protected areas as well. In the USSR, there are also preserves and protected forests (where some kinds of economic activity are allowed), national parks and nature monuments. At present, all these categories of lands occupy approximately 8 percent of the country's area; their area and the number are increasing.

There are more than 140 reserves in the USSR, occupying about 0.5 percent of the total area. It is in reserves alone that about half of all species of vertebrates and higher plants are protected. The entire system of protected areas provides for the preservation of the gene pool of the greater part of biota, including many rare species listed in the Red Book of the USSR.

In the field of technology, introduction and application of ecologically pure and economically profitable industrial and agricultural technologies are the main problems facing nature conservation. Waste-free technologies should become an imperative of industrial production, while in agriculture these must be ecological forms of the production of biomass.

There are four necessary conditions that determine the potential of rational use of natural resources, conservation of environmental quality and preservation of wilderness in the USSR:

1. To plan the national strategy for preserving the environment and wilderness, on the basis of an ecological theory which accounts for the dynamics of socioeconomic development of natural-economic regions and new technologies in the utilization of natural resources.

2. To see that all the existing rules and standards of nature use are observed.

3. To train all members of the society to be ecologically conscious.

4. To broaden the scientifically substantiated network of protected natural areas in order to preserve the entire diversity of ecosystems and their gene pools.

These tasks seem to be quite realistic, but are reliant on the condition that the development of our society and of the whole of mankind is peaceful, that the universal disarmament is successfully implemented and that the huge capital used for covering military expenses is diverted to the conservation of the environment.

USSR

Total area, % to the world land	16%
Population, % to the world population	6%
Closed forests, % to world area	31%
Woodstock in forests, % to the world stock	26%
Surface of forest cover, % to the total area	33%
Woodstock per person, cubic meters/person	310
Agricultural land, % to the world	14%
Agricultural land, % to the total area of the USSR	27%
Arable land	38%
Meadows and pasture	55%
Haying land	7%
Areas of irrigated lands, % to the world	6%
Mineral fertilizers, kg/ha	78%
Arable land per person, ha/person	0.86%
Cattle, % to the world	9%
Annual river runoff, % to the world	6%
Runoff used in economy, % to the world	12%
Unrecoverable water resources, % to the world losses	9%
Water reservoirs area, % to the world	20%
Total area of nature conservation territories in USSR	57%
The same, % to the world	14%
Number of species of vascular plants, % number of species in world	20%
Species of mammals	7%
Species of birds	8%
Species of reptiles	2%
Species of amphibians	2%

ITALY—THE VAL GRANDE— A WILDERNESS AREA

Bianca Vetrino

At the close of the 3rd World Wilderness Congress in 1983, a motion was approved inviting the Italian government and the government of the Piedmont Region to class the district of Val Grande, along with its minor valleys, as a "Wilderness Area."

Ever since, the Piedmont Regional Government has endeavored to achieve the longed-for result of complete protection of the Val Grande. To be able to understand the procedure adopted, it is necessary to offer a brief explanation of Italy's administrative structure and particularly the role of regions with regard to the central government.

The Piedmont region is one of the 20 Italian Regions. This type of territory is an administrative structure with a limited legislative power, as provided for by our Constitution. Every regional law must be submitted to governmental control and must conform to and be coordinated with the state's general laws.

The Piedmont Region is located in the northwestern part of the Italian peninsula and covers an overall surface of 2,538,000 hectares (25,380 sq. km). The region's capital, Turin, with its 1,100,000 inhabitants, has an economy based chiefly on industrial activities and is the site of the largest car manufacturer in Italy, the Fiat Co. From a morphological and environmental standpoint, the Piedmont Region is marked by three different characters: a mountain area (the Alps Chain), the hills and the plain. Thanks to these features, Piedmont is not only an important industrial district, but also an economically prominent agricultural region, especially in rice-growing and wine production. As to its more specific natural aspects, Piedmont is gifted with a great variety of environments, from glaciers to mountain forests, from woods of broad-leaved trees to lakes and water courses coming down from the Alps.

Because of this variety of environments, it has been possible in Piedmont to establish a system of protected areas of widely diverse and different dimensions, from the few hectares of some natural reserves to the 70,000 hectares of the Gran Paradiso National Park. I realize that such surfaces may appear trifling in a country like the United States of America, rich in great natural spaces. It is important to notice, however, that in a situation like Italy's or in Europe at large, the intense demography and the high population substantially modify the frame of reference, so any environmental defense policy must aim at the preservation of those limited but still natural spaces located among areas of high human concentration and activities.

In 1975, the regional government approved a special law and launched policy for the protection of the natural environments still present in its territory.

Twelve years after the introduction of this policy, 33 parks and natural reserves have been founded in aggregate. The program of the regional government is to establish, by 1990, 15 other protected areas. These areas, because of the environmental and territorial variety I have previously mentioned, have quite variable features (such as mountain areas, marshes, archaeological sites, natural monuments, rivers, historical and artistic areas). The zones deserving great attention from the administrators include chiefly that of Val Grande which, of all the possible districts to be protected, is the only one that possesses the features of wilderness.

The regional government, taking into account the pressures from the participants in the 3rd World Wilderness Congress as well as from the national naturalistic associations, has endeavored to protect completely the Val Grande area. It is an area that some people define as a "return-wilderness" area because in fact, this district has been inhabited and used for agricultural activities and was the scene of an intense deforestation in the nineteenth century. The increasing abandonment of the zone by the shepherds and the lower economic benefit of shepherding in comparison with other activities, has made the Val Grande slowly assume the characteristics of a wilderness area.

The procedure established to activate protection had to take into account a particular situation of both judicial and land-use concern in the district. In fact, the heart of the Val Grande is already now constituted as a natural reserve for a park and an oriented natural reserve for another classification. These forms of protection have been in force since 1971 and were provided for by the national government. Bordering these two natural reserves is an area owned by the Piedmont Region and therefore a public property. This is an exceptional fact in Italy, for about 95 percent of the territories designed for parks or natural reserves are privately owned. This seemingly favorable situation represents, however, a limit to the possibilities of intervention by the regional government. In fact, thanks to the definite provision of a national law, the responsibility for the natural reserves rests with the state, and the Piedmont Region cannot make any decision on the matter or legislate to impose safeguard rules. For the region-owned portion, on the other hand, the responsibility can be both of the state and the region, and national government is always entitled to intervene with its own regulations.

In order to overcome juridical difficulties, the Piedmont Region's government has proposed to the national government—namely the Environment Department—to establish a national park in the Val Grande, thereby taking a substantial first step toward the realization of the first wilderness area in Italy. Submitted April 8, 1987 the proposal located the borders of the area to be protected, covering a surface area of approximately 7,000 hectares. Though not very wide, the zone would have the characteristics of wilderness, making up a territorial whole we could define as complete and not directly influenced by man and his activities. It is possible to think of enlarging this proposed National Park by adding surrounding land, although this land could not be considered wilderness.

The proposal of the regional government discourages the construction of new hydroelectric power plants and has started a process with the national government that we hope may rapidly lead to the foundation of the National Park. This represents a full answer to all of those who have fought and still fight for the fullest protection of the Val Grande.

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ASIA

NEPAL—THE ANNAPURNA PROJECT

Hemanta R. Mishra

It is an unfortunate paradox that in the past, development planners of protected areas have often ignored the crucial link between nature conservation and economic development. Developers, too, viewed nature conservation as a hindrance to socioeconomic growth. But with increase in the rate of deforestation, soil erosion, and loss of productivity in the Himalayas, it has now been realized that the relationship between nature conservation and economic development is not antagonistic but symbiotic. Poverty and lack of appropriate technology have been identified as the root cause of environmental woes in the Himalayas.

The Annapurna Conservation Area Project (ACAP) is Nepal's latest innovation, integrating ecology with economics to halt the slide of environmental deterioration. It is governed by the needs for an ecosystem approach to maintain long-term integrity of the natural system while accommodating increased human usage including the tourism phenomenon. The important mission of the project, ventured jointly by the King Mahendra Trust for Nature Conservation and the World Wildlife Fund, is aimed at striking a balance between nature conservation, tourism and human needs.

In the center of the capital city of Kathmandu, there is an ancient man-made monument, the temple of the Goddess Annapurna, which in the local vernacular means "The Provider of Grains." Almost 100 kilometers northwest as the crow flies, in the heart of the Kingdom of Nepal, lies yet another edifice with the same name, created not by man but God—the Annapurna mountains. These mountains with snow-clad peaks that feed the river systems provide food grains and are a perennial source of water. Without water the civilization and agricultural development in river valleys, particularly the Indo-Gangetic plain, would not have been possible. These water resources also have led to much-needed electric plants and irrigation facilities for economic development in the latter half of the twentieth century. Similar to the American Thanksgiving,

every year after harvest thousands of Nepalese pilgrims pay homage in Kathmandu to Goddess Annapurna. They offer rice, wheat, corn and other cereals as a Nepalese way of paying homage to the Provider.

In contrast to this man-made temple, the natural monuments of Annapurna attract a new breed of pilgrims: the twentieth century tourists armed with American dollars, British pounds, German marks and Japanese yen. While the temple has been sustaining the worshippers for more than four centuries, it is uncertain if the mountains can sustain another decade of human intrusion. The Annapurna range is a part of the fragile Himalayan Mountains, an ecosystem with its self-defense mechanism developed through the evolutionary process spread over millions of years. Patches of dense forest protected the steep slopes from direct impact of torrential rain. Rich and mushy green cover facilitated the absorption and delayed discharge in the form of springs and streams. Fresh soil and water resources of the Himalayas have acted as a nutrient bank for basic economic activities of agriculture and animal husbandry. Agriculture, trade and commerce flourished in the Annapurna basin for hundreds of years as human population density remained stable, with a minimum impact on the natural system as a whole.

The advent of tourism and the so-called rural development schemes, coupled with the increase in human population, triggered a process of environmental deterioration. An area that has remained virtually untouched and unchanged for centuries is now faced with a plethora of ecological hazards created by human interference in the last two decades. The pressure on nature in the Annapurna region is more profound than in other areas, such as Langtang and Sagarmatha (Everest). Each year more than 25,000 tourists—nearly five times more than those that visit the Everest region—spend an average of 10 days in the area. There are more than 130 trekking lodges and tea shops along the Annapurna trail alone. This has resulted in destruction of forest land creating a shortage of fuelwood and fodder. Tourism has become a major economic factor in Nepal and is deeply embedded in the overall socioeconomic development strategy. It is Nepal's biggest industry and the topmost spinner of foreign exchange, as far as the government is concerned. While the villagers of the area are worried about the loss of forest land, they do not refrain from demanding more roads, better housing facilities, drinking water, electricity and other paraphernalia of the modern age. Roads, agriculture and horticulture extension programs have been introduced.

Elementary human concerns for maximizing economic returns are not only restricted to the people of the Annapurna region. Yet, there are few regions where nature conservation is more vital to sustain the economic gains. The harsh realities in Nepal illustrate that it would be naive to assume that the issues of conservation can be isolated from the issues of economic development. Conservation essentially means creating an environment wherein wisdom is applied in order to create change for the benefit of humankind. It calls for an approach that regards man as a focal point for any conservation endeavor, right from the initial stages of planning.

It was precisely for this reason that after a tour of the area in the spring of 1985, His Majesty King Birendra Bir Bikram Shah Dev issued directives for the implementation of meaningful conservation measures. The royal directives clearly stipulate the need to strike a realistic balance between tourism, economic development and nature conservation in the Annapurna region. In essence, the Nepal Sovereign said that in the long run, tourism cannot survive without nature conservation. The trampling of the environment is like killing the goose that lays golden eggs.

In May 1985, the newly established King Mahendra Trust for Nature Conservation (KMTNC), took on the challenging task of implementing the directives of the nature-loving King of Nepal. The directors, under the stewardship of His Royal Highness Prince Gyanendra Bir Bikram Shah, decided to look for new and practical ways to integrate sustainable use of resources by the local populace, recreational trekking by outsiders and the national imperative to preserve the outstanding ecosystem of the Annapurna area.

By June 1985, with financial assistance from the World Wildlife Fund, a feasibility study was launched. The findings of this nine-month-long study germinated the Annapurna Conservation Area Project, which is an experimental model that involves public and private sectors—international, regional and local—centering on the theme "Conservation for Development."

THE SETTING

The natural systems in the Kingdom of Nepal range from the dense and steaming tropical monsoon forests in the southern terai, to subtropical and temperate forests in the midland regions, to the alpine pastures and forests in the high Himalayas, to the tundra-type temperature and barren land mass in the trans-Himalayan region. The biological diversities are best reflected in a wide variety of flora and fauna found in Nepal. To date, over 5,400 species of vascular plants (including 240 endemic to Nepal), 130 species of mammals, over 800 species of birds, 117 species of fish and innumerable varieties of other lesser creatures have been recorded here. A majority of these species and land types are found in the Annapurna Conservation Area.

Geography has dictated the presence in the conservation area of both the Oriental species of southern Asia and the Palearctic type of the Northern hemisphere. Wild animals of the area include some of the world's rare and endangered species such as the snow leopard, the musk deer, the red panda and many of Nepal's brilliantly plumed pheasants. In the botanical world, it supports lush patches of rhododendron and coniferous forests that contain several species of orchids and many of Nepal's 700 medicinal plants.

The area is internationally well known for its formidable peaks—a mountaineer's dream come true. In addition to some of the world's tallest mountains, the area also features the earth's deepest valley, between the Kali Gandaki, that lies in Dhaulagiri, and the Annapurna ranges. The Kali Gandaki meanders through these narrow gorges, forming rich river valleys that contain

fossil ammonites dating to the valley's geologic origins in the Tethys Sea, 60 million years ago.

The United Nations has classified Nepal as one of the least developed countries. The population is currently 16.6 million and is increasing at an alarming rate of 2.6 percent. Thus, the population which had taken 60 years to double may now take less than 27 years to redouble. Nearly 40 percent of the population is less than 15 years of age. The density is 472 persons per square kilometer of cultivable land. More than 90 percent of the people are subsistence farmers who depend on depleted forest for fuel, fodder and water.

The fertility rate is one of the highest in the world, as it is most common for women to have five to seven children. Family-planning programs have been quite useful, yet only 17 percent of families practice birth control. Infant mortality is 133 per 1,000 live births and life expectancy is 44 years. Adequate health care is unavailable for most Nepalese—there is one doctor for every 32,000 persons and one hospital bed for every 5,000.

Despite government efforts to provide free education to all children, the literacy rate is a mere 23 percent. Only half of the eligible primary school-aged children enroll, even though education is free.

With the exception of tourism, industries are underdeveloped. They employ about 60,000 people and contribute only 4 percent of the Gross Domestic Product. Government has laid heavy emphasis on cottage industries, yet their average turnover is merely \$150 per annum. The per capita income of \$160 per annum is one of the lowest in the world. Nearly 65 percent of the 1.3 million rural labor force is either unemployed or underemployed.

In spite of these hardships, outsiders regard the people of Nepal as hardworking, friendly and tolerant. The Kingdom's Tibeto-Burman and Indo-Aryan ethnic groups form a mosaic of rich and diverse cultures that flourish to this day.

The Annapurna Conservation Area encompasses 2,600 sq. km. of undulating mountainous terrain. It harbors permanent human settlement with a population of more than 40,000 stretched over five administrative districts. Although all ethnic groups are found in the area, Gurungs, Magars and the Thakalis are dominant. Traditionally, men from the former two have served in the British and Indian Army. In contrast, the Thakalis have been traders, operating border business in Tibet and India. Incomes, levels of education and other socioeconomic indicators in the Annapurna region are slightly higher than the national average. Nevertheless, most of the people, who are poor rural farmers, depend entirely upon the land and upon nature for their livelihood.

THE SITUATION

Ecological issues in the Annapurna are not much different from those in other Himalayan and Hindu-Kush regions. The exception perhaps lies in magnitude of the problem. No other area is subjected to such a tremendous direct influx or impact of overseas visitors. Twenty years ago there was not a single tourist lodge along the Annapurna Trail. Now there are over 130 such lodges. Areas that

contained patches of untouched virgin forest have been cleared within the last 10 years. New settlements to service tourists have cropped up along the trail right up to the Annapurna base camp.

Deforestation has increased with the increase in use of fuel-wood by tourist lodges. Selling wood has become a lucrative income generator. Deforested areas abound even in remote and core parts of the area. Toilet paper and litter are common sights even in spots of religious and cultural importance.

Because of public demand and lobbying by the elected lawmakers, a motorable road is being built along the southern periphery of the Conservation Area. A jeepable road has been completed through part of the once remote and enchanting Manang Valley which shelters cave-dwelling saints and sages.

Large hydroelectric plants are planned for the Kali-Gandaki river. Foreign-aided rural development projects have recommended introduction of exotic livestock with no consideration for the carrying capacity of pasture land. Rational forest management on a sustained yield basis is nonexistent. Poaching as a way to make cash has also been reported.

A lack of conservation awareness and conservation education programs have also contributed to the plight of natural systems. But it is clear that people will not want to preserve and protect an environment they do not appreciate or understand. Furthermore, it is doubtful if the poor rural population, preoccupied as it is with the problem of immediate needs for food, fuel and fodder, would care about intellectual discourses that proclaim long-term benefits from nature conservation. It has also often been emphasized that no conservation program can succeed without active involvement of the local people and without implementing programs that bring direct benefit to them.

In the past, few attempts have been made to integrate economic and social development activities for communities as part of conservation techniques. Conservation programs in the Himalayas have often failed because they focused mainly on an arbitrary enforcement of regulation. Efforts have not been targeted at the grass root economic and social factors that cause the villagers to illegally collect products from protected areas. Experiences have shown that income-generating alternatives must be provided to the villagers if we have to eliminate the need for them to engage in activities that adversely affect the environment. In short, the task is to strike a balance between the immediate requirements of the rural population and the long-term needs for nature conservation.

THE ANNAPURNA CONSERVATION AREA CONCEPT

The ideals of the ACAP are reflected in the statement of His Royal Highness Prince Gyanendra, the Chairman of the King Mahendra Trust, to mark the 25th anniversary of the World Wildlife Fund. He declared that the project "departs from the conventional approach and envisages a multi-dimensional strategy and maximum people participation, which stresses conservation for people and conservation to improve the quality of human life." Basically, ACAP recognizes the following concepts.

In the past, designations such as National Parks to National Recreational Areas had been proposed for the Annapurna region. In view of the complexities of issues involved, particularly the high human density and usage, a nine-month field study was authorized to find out what would be the most appropriate designation for the area. Without in any way diminishing the concepts and needs for national parks and wildlife reserves, the "Conservation Area" concept is an innovative exercise that will link conservation directly with human needs.

More flexible than a national park, it allows local villagers to continue to gather wood, graze animals and even hunt. The project design is based on multiple land-use concepts and the traditional methods of resource utilization. Programs include the formation of an effective system of zoning, with each zone having its own sets of management prescriptions.

ROLE OF NON-GOVERNMENTAL ORGANIZATIONS

Management of protected areas traditionally falls under the purview of government departments. But the question is can the governments in poor, developing countries with limited financial resources continue doing so? Even in the economically developed countries with large government budgets, non-governmental organizations represent a parallel alternative for implementing nature conservation programs. Unrestricted by cumbersome bureaucratic procedures, private institutions have the advantage to experiment with new ideas. On the other hand, non-government institutions cannot match the long-term commitments and legislative power of government institutions. Recognizing this fact, the Annapurna Conservation Area seeks the assistance of both the government and non-government institutions. A proposal designed to amend the existing National Parks and Wildlife Conservation Act is paving the way for declaration of "Conservation Areas." This new proposal to amend the ACT of 1973 provides for new incentives to institutions like the King Mahendra Trust to manage such conservation areas through active participation of the people.

THE KING MAHENDRA TRUST FOR NATURE CONSERVATION

Fifteen years of experience in the field of National Parks and Wildlife Conservation in Nepal have revealed that efforts of government alone are not enough in an impoverished country like Nepal. The realization sparked the idea of a conservation trust. A number of experts were consulted, from organizations such as the Smithsonian Institution, World Wildlife Fund, IUCN and the International Institute for Environment and Development (IIED). By the end of 1982 the seeds finally germinated when the elected legislature passed the King Mahendra Trust for Nature Conservation Act. The trust is named after the late, revered monarch of Nepal, without whose foresight areas such as the Royal Chitwan National Park and the Sukla Phanta Wildlife Reserve would have been converted into agricultural land 20 years ago.

The trust is an autonomous, nonprofit institution established for the

sole purpose of conserving natural resources to improve human life. It is an action-oriented organization that aims at achieving a balance between basic human needs and the needs of conservation.

A unique feature of the trust is that the governing board of trustees comprises not only Nepalese, but personalities of note from abroad. It is Nepal's only non-government organization to have been created by a special and separate act of the Rastriya Panchayat (National Assembly). The gracious consent of His Majesty King Birendra Bir Bikram Shah Dev to be its patron, and the nomination of His Royal Highness Gyanendra Bir Bikram Shah as the first chairman, has been a source of great encouragement to all of us who believe firmly and irrevocably in conservation for development.

The goals of the trust have been broadly defined in the act. This includes bringing about attitudinal changes in the masses through conservation education and by implementing programs that involve participation of the local people. It works in close collaboration with His Majesty's Government and foreign donor agencies. The trust supports field projects that the government or others are unable to finance or execute, including research and development of alternative sources of energy besides fuelwood, implementation of an effective conservation education and publicity campaign, applied ecological research and captive propagation of endangered species. Above all, its target is to launch programs that support the ethics of conservation for sustainable development as outlined in the World Conservation Strategy.

The King Mahendra Trust is a novel concept for a developing country like Nepal. Its success has an immense demonstration value for other Third World nations. As a body adhering to the basic principles of an NGO, some of its characteristics are bound to be unorthodox. However, the motive behind the creation of the Trust is to ensure that conservation programs are pragmatic and in harmony with Nepal's overall development aspirations.

Despite increasing conservation consciousness, no non-governmental organization has undertaken responsibility to manage protected areas of such global implications as the Annapurna Basin. Thus, the incentives for the King Mahendra Trust are not only to set a pilot project for Nepal, but also to set an example for the rest of the Third World.

MAXIMIZE BENEFITS TO THE LOCAL PEOPLE

Pragmatists have often remarked that money and personal benefits constitute the best motivations for humans. ACAP, for example, insists that the local inhabitants must reap maximum benefits from tourism.

Tourism surveys conducted by the King Mahendra Trust indicated that less than 10 cents of each tourist dollar is spent in the area. Most of it is not even retained in Nepal. Visitors on luxurious trips using high-tariff trekking agencies contribute less to the local economy than individual travellers who use the local lodges and tea shops. Of the 130 trekking lodges, 96 percent are operated by owners themselves who have, in most cases, merely expanded their homes to

accommodate tourists. Interestingly, 82 percent of these people say they are planning more to improve their facilities—a clear indication of their faith in the burgeoning trekking tourism. As evidence of the tremendous growth in lodge construction, 68 percent of the owners say they built their lodges in the last five years.

Almost all of the lodges use firewood for cooking and a significant 48 percent of them say they bought their firewood. This demonstrates an improvement in the spending power of the local people. Significantly, 60 percent say they would be willing to cook on kerosene or other alternative energy if it is available and cheaper than firewood.

Easy accessibility is an attraction of the Annapurna region for trekkers and mountaineers. It is, therefore, clear that firewood consumption and impact on nature will continue until alternatives are provided.

One of the mandated responsibilities of ACAP has been to advise the local people to improve the quality of lodges and to help them standardize the pricing pattern. In addition, it has proposed a user fee that would be ploughed back to the area for conservation and development. His Majesty's government charges fees for trekking permits. But like most government agencies, the revenue goes to the central government treasury. This system discourages any entrepreneurial local management. A questionnaire survey of visitors indicated that 61 percent would be willing to pay between (U.S.) \$5 to \$10 more, on top of the government fees, if the money would be ploughed back to the area for protection and improvement of the environment.

A modest increase in the quality of facilities and services of lodges and consequent price rise may meet with little resistance. It can be assumed that low-budget trekking lodges will continue to thrive regardless of improvement and in spite of the not uncommon fear that this place will turn into the Alps.

The money raised will be pumped back to the Annapurna Conservation Area. This in itself is a radical and novel concept—non-governmental agencies with ability to apply funds from entry fees to a reserve toward conservation development of the area.

PEOPLE PARTICIPATION

One of the important aims of the Annapurna Conservation Area Project is to incorporate the local people's participation in the development and management of the area. If living resource conservation for sustainable development as outlined in the World Conservation Strategy is to be achieved, it must involve the local people, along with their traditional values, as an integral part of any conservation strategy.

Historical evidence testifies to the fact that the administration and protection of the forests in the mountains of Nepal proved effective wherever local control existed, because the interests of the villagers were clearly tied to schemes of rational and sustainable use of forest resources. The Forest Nationalization Act of 1957 brought major changes as centralized government control was ex-

erted in forest protection and management. Consequently, the sense of belonging between the people and forest resources that had developed over generations was eventually lost. This triggered heavy damages by a free-for-all exploitation of the forests of Nepal. Even stricter forestry laws introduced in the 1960s and the 1970s had no effect as the local communities lost a sense of affiliation and involvement in forest management plans.

Ironically, by the 1980s, the government realized the need to revert back to the traditional system. Community forestry programs were again recognized as an effective means of protecting and managing forest resources. The ACAP recognizes the importance of traditional conservation practices. By setting up a chain of Panchayat (village) Conservation Committees, the ACAP aims to empower and involve the local communities in protection, law enforcement, management and use of forest resources on a sustainable yield basis, in addition to other nature conservation activities in the Annapurna region.

PROJECT ACTIVITIES

ESTABLISHMENT OF FIELD HEADQUARTERS

The size of the Annapurna Conservation Area, with its high human population, dictates a phase-by-phase approach. The first phase of the activities has been concentrated in one district and in an area where conservation action programs are deemed urgent.

Following a nine-month, in-depth survey, implementation schemes commenced in December 1986. Headquarters were set up at Ghandruk village, en route to the highly disturbed Annapurna Sanctuary. The core area of the Ghandruk basin is considered the "nerve center" of the first phase of operation. It is located along the popular and most disturbed trekking route. A day's walk to the east is the village of Ghorepani, a typical tourist village, along the old trade route to Tibet. Two days to the south is Pokhara, the administrative headquarters of the Western Development Region of Nepal. Located at an altitude of 1,950 meters, the population of Ghandruk village is about 4,000. The activities described below represent pilot efforts to integrate conservation with human needs.

FUELWOOD CONSERVATION

Water Heaters: Tourism being a major factor contributing to high consumption of fuelwood, with their demands for cooking, hot showers and campfires, it was decided to introduce energy efficient wood-burning technologies as one way to minimize wood consumption. Field tests were conducted for displacement water heaters with circulation coils. This system heats water while preparing a normal meal. It would make better utilization of cooking fires, as heating water alone consumes an excessive amount of firewood. A staff of the ACAP and two local tradesmen were engaged full time in installing these systems. Presently, eight prototype water heaters have been installed and are being monitored. Lodge owners and villagers have shown keen interest in these systems. This system is expected to generate additional income by charging tourists extra for hot baths.

Kerosene Depot: A kerosene depot has been set up at Chhomrong, the last permanent village before the Annapurna Sanctuary. A local management committee has been formed and a concessionaire has been selling kerosene since March 1987. Provisions have been made for renting stoves and containers at the site. A depot management committee has fixed the price of kerosene at Rs. 11.00 (50 cents U.S.) per litre. Presently all trekking groups and 12 lodges beyond Kinko Cave cook with kerosene and the scheme is expected to save over 1,600 kgs of wood per day.

SOLAR TECHNOLOGY

A prototype model of a low-cost solar water heater was designed and is in the process of being installed in Ghandruk. The conventional solar water heaters produced in Kathmandu are found to be too expensive and inappropriate as they were designed for a mild climate. This prototype was built using much of local materials and improvisation. This prototype can be built and installed by the local tradesmen themselves.

FOREST MANAGEMENT

Forest Management Committee: The Project recognizes the knowledge of the local people and their views on methods of resource utilization. Before the Forest Nationalization Act (1957), Ghandruk Panchayat had a very effective rotational system for woodcutting and livestock grazing. They had developed and formulated their own regulations that enabled them to appoint a number of forest guards to penalize offenders. Revenues collected were spent on community programs such as trail construction or even religious festivities.

In the beginning of March 1987, ACAP organized a public meeting in Ghandruk, where the concepts and planned activities of the project were explained. The local people were in favor of reestablishing forest management committees similar to the ones they had. A 23-member forest management committee was formed with at least two representatives from each of the nine villages. This committee has formulated a set of rules to define where, when and what species of firewood to collect. It is active and has already penalized seven people for cutting excessive amounts of wood. Once this type of local committee is fully operative, ACAP will supplement their traditional wisdom with technical advice, and financial and legal support.

Four nurseries have been established in Ghandruk and Chhomrong, and 70,000 seedlings were distributed during this monsoon. A third forest nursery for raising high-altitude species has been established in Ghorepani.

Near Ghandruk, an area has been fenced and planted with more than 7,000 fodder and firewood saplings. The plantation on six hectares has been chosen as a demonstration plot for raising both fodder and firewood trees.

CONSERVATION EDUCATION AND PUBLIC AWARENESS

The heart of the program is to enhance environmental consciousness through conservation education and public awareness campaigns. In order to avoid misunderstandings and injudicious expectation, public meetings in the villages were held to explain the aims and objectives of ACAP. The most promising development has been the formation of the Forest Management Committee, described above, and a Lodge Management Committee, which consists of selected lodge owners and an ACAP staff person who also oversees the use of kerosene.

At the behest of the ACAP, the lodge owners agreed to form a cartel. At a public meeting held in Chhomrong, 47 owners gathered to form a Lodge Management Committee. This committee has fixed a standard for services and prices for food and board in the area. Most of the lodges in the core area are temporary in nature, with bamboo structures. They decided to improve the existing structure to offer better facilities for visitors. ACAP outlined the basic necessities for a lodge in order to qualify for cartel membership. The cartel has the authority to penalize or dismantle lodges not complying with the basic standards. Lodge owners can apply to the ACAP for loans up to NC Rs. 5,000 (approximately U.S. \$250) for improvement of lodges, and particularly to build latrines and rubbish pits.

Environmental education is an important component of ACAP. The extension unit has developed courses in environmental education for the Ghandruk High School and the children have begun course work on practical aspects of environmental conservation.

Presently, activities include examples of vegetable plots, forest nurseries, latrine construction and drawing and organizing essay competitions. ACAP staff imparts environmental instruction once a week to the eighth-, ninth- and tenth-grade classes.

On the occasion of Nepali New Year 2044 (April 14, 1987), the ACAP launched a campaign to clean up the villages. The teachers and students of the high school, ACAP staff and others, including village leaders, took part in this campaign.

A slide program has been put together and presented in the open school ground in the evenings. This has proven to be a popular and an effective means of conveying conservation messages. So far this program has been organized in four of the villages, but plans to show it to other villages are under way.

The importance of the women's role in the development process is universally acknowledged. However, village women in general do not participate in the decision-making process. A female extension worker has been hired to develop suitable programs to involve women in project activities. She undertakes home visits as part of the informal community programs to create environmental awareness. One of her tasks is to develop a mechanism for women to participate in reforestation, agriculture, sanitation and other activities of the project.

In collaboration with Tribhuvan University, renovation is under way of the Prithvi Narayan Campus Museum to house the new ACAP Information Centre. This will house a photographic display on natural and cultural features of the area. Three foreign volunteers have contributed their expertise in setting up exhibits of birds and butterflies found in the area. Minor repair work on the museum and construction of facilities for visitors is being undertaken.

The village around Ghandruk, where the project headquarters are situated, has a population of approximately 7,000 and receives an average of 15,000 tourists each year. The nearest hospital is in Pokhara, about two days' walk away. Villagers have repeatedly requested the government authorities for a health clinic. ACAP has proposed the establishment of a community-supported health centre in Ghandruk. One health instructor has been hired for one and a half years to train local health workers and to run the clinic until the trainees themselves can handle it. After this period, the clinic will be run totally by the village health workers under the guidance of a Village Health Committee. The villagers have raised an endowment fund of RS 100,000 (U.S. \$5,000). ACAP will provide matching funds at a ratio of 2.1 rupee for every rupee the villagers collect. It is expected that the clinic will operate from the interest accrued on the endowment fund.

At the request of some of the villagers of Ghandruk, ACAP initiated a drinking-water project. A local committee was formed to carry out the construction work. The villagers provided labor for half the total cost of the project. ACAP provided funds to purchase pipes, cement and other materials. Successful completion of this project has inspired requests for similar support from other villages.

Sanitation problems are encountered along all popular tourist trails. Ranging from indiscriminate disposal of waste to crude toilets located directly over rivers and streams. ACAP has initiated sanitation programs by constructing two vent-dry pits and two composting toilets.

Over 60 percent of the households in Ghandruk do not have a toilet. A survey carried out by the ACAP extension unit showed that the majority of the residents expressed a desire to install appropriate sanitation systems in their homes. This project, it is hoped, will continue to encourage and assist in toilet building in the project area. Local tradesmen were trained in constructing composting and dry-vent toilets in the village. This project has proven to be particularly popular with lodge owners.

At the request of the village Panchayat, ACAP oversaw the repair and maintenance of suspension and wooden bridges. The local people provided free unskilled labor, while the ACAP paid for the services of skilled technicians.

RESEARCH AND SURVEYS

The study of wildlife habitat in the Nar Phu Valley in the Manang district is being continued by a zoologist from Tribhuvan University. These areas are included in the second phase of the Annapurna Conservation Project. Findings indicate that the Nar Phu Valley has a good population of blue sheep and snow

leopard. However, wildlife is being threatened by overgrazing by livestock and hunting by people from outside the valley, although tourists are not yet permitted to visit this area. The Ministry of Agriculture has a pasture development project and the Livestock Development Board is considering setting up a yak farm in the area. The study will provide baseline data to integrate wildlife management with other development activities.

Feasibility studies of three rivulets for micro-hydro projects have been complete with assistance from Butwal Technical Institute. The findings indicate power generation from several sites in the ACAP area is possible. Site survey for a headquarters building at Ghandruk has been prepared.

Soil surveys have been conducted at several locations for plantation and nursery development at Ghandruk and Chhomrong in collaboration with soil scientists from the Research and Survey wing of the Department of Forestry. A report on soil conditions and choice of species for reforestation programs has been prepared. Two British ornithologists conducted a bird survey of the Modi Khola, a major river valley in the special management zone of ACAP. Arrangements are being made to publish their findings as a guide to birds and mammals of the Annapurna Conservation Area.

Multilanguage posters in English, Nepali, Japanese and French were designed and posted at strategic places for the benefit of tourists. The posters outlined some of the environmental pressure on the Annapurna area and how the visitors can help reduce them. ACAP has also produced an informative brochure for distribution and sale to tourists. It explains the uniqueness of the aims and objectives of resource conservation in Annapurna and includes guidelines on how to minimize the damage on nature.

TRAINING

Four persons from the project area received two months' practical training in nursery management at the British-aided Agricultural Centre at Lumle. One trainee from Ghandruk spent two months at the Department of Watershed Management and Soil Conservation of His Majesty's Government while four local semiskilled tradesmen received on-the-job training to improve their skills in plumbing, carpentry and masonry works. Two of the project staff recruited from the region will attend a degree course in protected area management in New Zealand. The Overseas Development Agency of the British Government has provided ACAP with one fellowship for practical course work in conservation education in the United Kingdom.

A training program specially designed for lodge operators was held in Chhomrong in July this year. There were 65 participants from 47 lodges in the week-long program conducted jointly by the Department of Tourism and the ACAP. This training was the first of its kind to be held outside Kathmandu and has proven to be effective, as indicated by the lodge owners' reactions.

At first it was difficult to convince the local people that ACAP is an integrated development project. They feared that the area will turn into another

national park with restrictive government regulations. Villagers demanded ultimate benefits from the project. But as the pilot projects described above commenced, they began to show interest in conservation. By necessity, the project activities are kept flexible to allow individuals and communities to adapt to new ideas. The effectiveness of the programs is being monitored in consultation with the local people. Some changes and adjustments in the priorities as set forth originally have been necessary.

PARTNERS IN CONSERVATION

The World Wildlife Fund-USA has been Nepal's key partner in the conservation of the Annapurna area. A preliminary study and surveys financed through a grant from the WWF were conducted by Nepali and American experts. The chairman of the World Wildlife Fund/Conservation Foundation, Russell Train, is also a member of the Governing Board of Trustees of the King Mahendra Trust for Nature Conservation. The bulk of the financial resources required by the King Mahendra Trust for the Annapurna has been provided by the World Wildlife Fund. In addition, a number of experts from the WWF have visited the area and provided technical advice. Besides the WWF, the ACAP has received supports from a few other resources both local and international.

The King Mahendra United Kingdom Trust for Nature Conservation has provided funds and expertise for the conservation education programs. The British government has provided grants for training ACAP staff. Similarly, the idea and funds to operate the kerosene depot have been provided by the German Alpine Club. An Australian NGO, AREA, in collaboration with the ACAP, has undertaken reforestation projects in Ghorepani and helped in the production of water heaters. The government of New Zealand has provided training and fellowships to develop a cadre of managerial manpower. The government of the People's Republic of China has provided two micro-generators for electricity.

Within Nepal, the Tribhuvan University provided facilities for an information centre in Pokhara. Various agencies of His Majesty's Government have provided support. The Ministry of Tourism has given the ACAP a building at Kuldighar.

In addition to these, various individuals, both Nepali and non-Nepalis, including a Japanese taxi driver, have donated their time and expertise. The support-mobilizing efforts have been quite useful in getting new ideas on ways and means of generating international support. At times it fitted the predictions made by the Brundtland Commission that international assistance has not only been inadequate, but too often reflects the priorities of the donor rather than the needs of the receiver. Nevertheless, the ACAP has also been an experience in the integration of different kinds of international cooperation for the attainment of a specific goal in a specific area.

CONCLUSION

It has been recognized that large-scale poverty coupled with lack of technol-

ogy is the root cause of environmental problems in the Himalayas. Thus, conservation programs should not be dictated by actions that discard economic growth, but by plans that are capable of diverting attention toward rational use of nature resources. In the past, international organizations with nature protection bias have often ignored this fact, as they have isolated the issues of economic development from those of environmental conservation. Recently, the World Conservation Strategy and the Brundtland Commission have recognized that it is impossible to separate these issues.

The harrowing account of happenings in Africa has tragically illustrated how ecology and economics are interlinked. The Annapurna Conservation Area Project is an experiment of a concept that seeks to demonstrate that good ecology is good economics, and vice versa. If over-development, over-consumption and waste are the problems of developed countries, then poverty, hunger, apathy and lack of economic infrastructures are the seeds that breed environmental woes in the underdeveloped nations. It has been pointed out that people who are ill-fed, in ill-health and have no shelter or jobs cannot understand paternalistic concerns for conservation of their environment. When the source of their next meal is a major worry, lofty principles of nature conservation for sustainable development have little relevance to them. The programs of the Annapurna Conservation Area are governed by the needs for an ecosystem approach to maintain long-term integrity of the natural systems, while accommodating increased human usage, including tourism.

Today, most conservation programs in the Third World are financed by either tax payers or tax-free money. While the former comes in the form of government inputs (either national or through bilateral foreign aid), the latter has been funnelled through numerous NGOs in Europe and North America, which receive tax deductible donations from concerned citizens.

But neither bilateral aid through governments, nor private contributions through non-governmental organizations, have attempted to ensure that nature conservation programs are self-supportive and economically viable for poor, developing countries. To the contrary, in the last two decades, these contributions have made Third World nations become not less, but more dependent upon international charity—a fact implied in the report of the World Commission on Environment and Development. The ACAP incentive of the King Mahendra Trust is an exercise that seeks to demonstrate how a nationally-established protected area serves as a catalyst for socioeconomic development through a system of imposing and recycling a user fee for visitors from the rich and developed countries.

Half a century ago, Aldo Leopold stressed the need to understand the relationship between the human environment and wilderness areas within the context of ecosystem interdependence. Though Leopold's ideas were concerned with wildlife conservation in the United States, his wise words have universal application even five decades later in the Annapurna region of Nepal. As the catchment of one of the major river systems in the Himalayas, the Annapurna

basin is not only of aesthetic value for foreign tourists, but it is vital to the conservation of soil, water and resources for the people of Nepal. Thus, as has been emphasized by others, there is a clearer need to understand the human dimension of conservation programs, particularly the human and nonhuman dichotomy. It calls for recognition and understanding of the interaction between nature and humans who use and exploit natural resources. Problems once perceived as biological in nature are now known to be economic, social and cultural in nature as well as in implications. Conservation issues in the Annapurna area tend to verify these predictions. Thus the ACAP is an endeavor to bring about awareness through people's participation. It is an exercise that attempts to ensure that the fruits of conservation go directly to the local inhabitants. No program, however ambitious or well planned, can succeed unless it identifies with and seeks the support and cooperation of those who are to be the real beneficiaries.

The Annapurna Conservation Area Project addresses the problem of maintaining a crucial link between economic development and environmental conservation. It recognizes that protection of critical habitat and sustenance of species diversity cannot be achieved without the betterment of economic conditions of the poor villagers who inhabit the mountains of the Third World countries. Unlike the national parks and wildlife reserves, the ACAP regards humans (rather than any particular species of wild animals or plants) as the focal point of every conservation effort right from the beginning. After all, as aptly stated by the Chairman of the King Mahendra Trust for Nature Conservation, His Royal Highness Prince Gyanendra Bir Bikram Shah, "What is conservation—if not for people? It must be viewed only as a means, the end being the improvement of the quality of our very existence."

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It would not have been possible for us to attend the 4th World Wilderness Congress without the gracious consent and encouragement from His Royal Highness Prince Gyanendra Bir Bikram Shah, Chairman of the King Mahendra Trust for Nature Conservation.

INDIA—THE CONSERVATION MOVEMENT

Dilnavaz Variava

Respect for nature—and the active protection of the environment—have ancient roots in India. The royal edicts of the emperor Ashoka, dating back to the third century B.C., provide lists of wild species to be strictly preserved and injunctions on the protection of forests. They are often quoted as one of the earliest known examples of wildlife protection legislation. The Mogul Emperors—kings and nobles of more recent centuries—protected areas primarily for their personal sport and pleasure, and some of these are amongst our richest wildlife refuges today.

Religious scriptures of Hindus, Buddhists and Jains enjoin respect for all forms of life. In practical terms, religious sentiments have resulted in specific cases of protection through community efforts throughout the length and breadth of the country, for which this generation must be deeply grateful. Sacred forests which were set aside for various deities preserve small islands of rich genetic diversity in areas that are otherwise barren or cultivated. Even when no trees remained in the areas surrounding such sacred forests, their sanctity remained inviolate. The Bisnois of Rajasthan, whose religion is based on 29 principles for the conservation of animals and plants, once sacrificed their lives to protect their trees from the axemen of their king. Even in times of drought, blackbuck have been known to feed undisturbed on their standing crop. The rich bird sanctuaries of Ranganthitoo Vedanthangal and Kokkerebellur in south India owe their survival to the strict protection afforded them by local populations. Tribals in every part of the country have lived in harmony with nature, strictly regulating the exploitation of forests through elaborate social and political systems.

In the past century there has been a systematic breaking down of traditional norms of environmental protection. This has been partly due to the increasing pressures of an exploding population and the breaking down of religious and social taboos. The real root of today's problems, however, goes back to British rule when forests were taken away from the village communities, who used and protected them, to be systematically exploited for commercial purposes to meet imperial needs. Unfortunately, the postindependence government in India continued to treat forests primarily as a source of state income. Village communities stood by helplessly as the resources of their well-being slipped away.

Occasionally, in the face of some cataclysmic policy or project such as a dam, which would destroy the very foundations of their sustenance by uprooting prosperous village communities from river valleys and casting them onto barren

hillsides, local resistance would develop but would usually be crushed through state action. In rare cases, without being able to halt such projects, large-scale agitations by affected populations forced concessions from the government. A case in point is the widespread agitation by farmers in the state of Maharashtra against successive dams which resulted in this being the only state government to concede, through legislation, to the demand that displaced persons be allotted land in the areas benefited by the projects. All these agitations were on economic rather than environmental grounds.

An environmental, or rather wildlife, conservation movement of the type known in the western world was first launched in India by the Bombay Natural History Society at its Golden Jubilee in 1933. This organization, founded in 1883 by sportsmen and naturalists, contributed a great deal to the initial documentation of India's flora and fauna. In later years, it played a quiet but useful role in protecting endangered species of wildlife, lobbying for the creation of sanctuaries and in framing wildlife protection legislation. The World Wildlife Fund, launched in 1970, played an important role in publicizing wildlife conservation, primarily among the educated elite. Both these organizations could occasionally obtain governmental action largely because of the personal interest and commitment to conservation of two of India's prime ministers who held office for 34 out of the 40 years of India's independence—Pandit Jawaharlal Nehru and Indira Gandhi. In the absence of any grass-roots contacts, however, both these organizations and many other local environmental groups which sprang up in different parts of the country were forced to restrict their interventions to appeals to the central and state governments, and were helpless when such appeals were ineffective.

From the mid-1970s a truly exciting trend has emerged with the explicit and successful linkage of environmental, social and economic perspectives. This has sprung from groups engaged in local development and economic issues which have perceived and integrated environmental imperatives in their campaigns. A landmark was the Chipko Andolan—the now-famous Hug-the-Trees movement—born in the foothills of the Himalayas in 1973. An unprecedented flood of the Alaknanda River in 1970 left a trail of death and destruction among the peaceful inhabitants of the valley. It also left, however, a new awareness of the tragic consequences of the past deforestation of their hillslopes, primarily by government-approved contractors. In March 1973, when representatives of a sports factory reached Gopeshwar village to cut 10 ash trees, the villagers courteously asked them not to do so. But, when they persisted, the villagers went to the forests and hugged the trees, forcing the axemen to retreat empty-handed. A few days later they went to another village, 80 kilometers away—and the men from Gopeshwar travelled those 80 kilometers to again foil their attempt. Finally, the contractors chose a day when they knew that the men were away to cut trees at the village Reni. Another landmark in the conservation movement occurred when the village women stood in the path of the contractors, singing that the forest was their mother's home, which they would protect with all their might.

Women bear the heaviest burden of environmental degradation in India, often walking many wearying miles to fetch fuelwood and fodder. They have traditionally borne this ever-increasing burden helplessly. Traditionally, they have no say in community matters. Now, in a few cases, women have come to the forefront in a movement that concerns them deeply. In village after village in the Gathwal area, women were pleading for Chandi Prasad Bhatt to visit them and help them reforest their lands. Bhatt is the father of the Chipko movement, who, with young volunteers, has been spreading awareness of forest conservation and organizing ecodevelopment and reforestation camps. The women then set up regulatory mechanisms for equitable and ecologically sound use of the firewood and fodder that becomes available.

Like their Chipko sisters of Reni village, the women of Khirakot also found the courage to face a powerful mining contractor who was making their land barren through soapstone mining. The women of Khirakot caught hold of the implements of the miners and would not let them dig. They raised money from every household and sent their men off to file a court case. Finally the lease was cancelled. The women of Khirakot are also from a hill district not far from where the Chipko movement started. It should be noted that the proportion of women on the work force is particularly high in mountainous regions and in some tribal regions. This has perhaps given them the confidence to take initiatives that the more economically oppressed women of the plains have not yet been able to take. It is, however, a significant beginning and a possible new direction for the environmental conservation movement in India.

Elsewhere, though women have not played a leading role, the Chipko movement has inspired similar conservation action. In Karnataka State in southern India, the Appiko movement is successfully challenging unscientific felling by the forest department. Throughout the country, groups which once confined their tasks to rural upliftment of health, education, or economic development are turning toward the issues of protecting existing forests and affirmative reforestation of barren areas. The survival rate of trees in community reforestation programs has been as high as 90 to 95 percent, whereas in government sponsored projects they are generally much lower—sometimes as low as 10 percent.

Another important factor from the environmental perspective is that community movements often underscore the need for preserving the natural diversity upon which the community depends for a variety of its needs. Government programs are often only too willing to promote high-yielding monocultures of eucalyptus, teak and other commercial species for meeting urban and industrial needs, regardless of either ecological imperatives or the welfare of local communities.

If the Chipko movement is a pointer to the new and most welcome direction of integrating environmental and economic issues through grass-roots movement by affected communities, the Silent Valley campaign provides a landmark of a new awareness among intellectuals of the dangers of blind allegiance to models of development based on large, high-technology projects.

India has made amazing strides in self-sufficiency in food grains in the last two decades. It has also been one of the world's leading builders of dams in its postindependence era. Pandit Jawaharlal Nehru, free India's first prime minister, called these large projects the "temples of modern India." Although there were agitations for better rehabilitation terms for affected populations, or occasional protests by wildlifers when they were likely to submerge a national park or sanctuary, their sanctity remained unquestioned in the public mind until the Silent Valley controversy rocked the foundation of a proposed hydroelectric dam in the state of Kerala. In my involvement in Bombay as Honorable Coordinator of the Save the Silent Valley Committee, I was able to gain a unique understanding of this important campaign.

THE SILENT VALLEY CASE STUDY

Protected over millennia by its virtual inaccessibility, this 8,950 hectare valley of tropical, wet evergreen forests forms part of a magnificent block of almost 40,000 hectares of contiguous forest. The Silent Valley itself is one of the few areas in India to have been almost free of human habitation and intervention. It provides a home for endangered species like the tiger, the niligiri langur, the giant squirrel and for one of the only two viable populations of the lion-tailed macaque—one of the world's most endangered primates. In its dense vegetation are found wild relatives of pepper, cardamon, tobacco, black gram and other commercially valuable species. It is a genetic resource essential for the survival and development of their cultivated counterparts and many medicinal plants are found there which could provide the basis for modern life-saving drugs.

Unfortunately, it was identified as far back as 1929 as an ideal, almost textbook, location for a dam site. As so often happens, environmentalists woke up to the existence of this area—and to the devastating effects of the proposed hydroelectric project—at a stage when the project had already been cleared by the Planning Commission for implementation. In fact, preliminary work on the project had already started in 1973, but in 1976 to 1977, a government-sponsored task force for the Protection of the Western Ghats, headed by Mr. Zafar Futehally, recommended that the project be dropped. Fearing, however, that the odds against this happening were too great, it added a series of safeguards if the project were to be implemented.

Ironically it was the Kerala State Electricity Board, concerned by the contents of this report, which drew the attention of environmentalists by lobbying public opinion through the press. It gave this logic in the intense campaigning that followed:

1. That the hydroelectric project, situated in one of Kerala's poorest regions, was an economic necessity for Kerala. It would generate 500 million units of energy, irrigate 10,000 hectares of land and provide employment for 3,000 people during its construction phase.

2. That the Kerala State would have a power deficit by 1985 without it.

3. That every single political party in Kerala had joined forces to demand

from the then Prime Minister Shri Mararji Desai the implementation of the hydroelectric project. (In fact, no political party in Kerala dared ask for the abandonment of this avidly awaited project!)

4. That the project had been cleared by Prime Minister, Shri Morarji Desai, on the state government enacting legislation for implementing the safeguards listed in the Task Force report.

5. That the ecological damage by the project was negligible—and the area itself was of little ecological interest.

6. That the Kerala High Court had cleared the project for implementation.

"MAN VERSUS MONKEY"— THE ELECTRICITY BOARD'S CASE

With many lucrative contracts for timber felling and construction at stake, the Kerala State Electricity Board (KSEB) and its unions mounted an "environmental education" campaign of its own by:

1. Projecting unknown college professors as "eminent scientists" and getting them to produce a number of books and scores of articles for the local press denigrating the ecological value of the Silent Valley. The objective was to create an impression that "scientific opinion was divided" on the value of this forest.

2. Taking legislators and journalists to the dam site, already denuded of trees, to show them how ecologically poor the Silent Valley was.

3. Dubbing eminent scientists and environmentalists who called for the dropping of the project as stooges of the developed countries, or cranks who were more concerned about the welfare of monkeys than of men.

4. Assiduously lobbying officials, especially Keralites, who occupied key positions in the central government (including the chairman of the Central Water Commission, an authority concerned with the implementation of hydroelectric projects throughout the country) and providing them with distorted information about the biological wealth of the area and the ecological impact of the dam.

5. Whipping up the sentiments of the local population so that environmentalists who went there ran the risk of physical assault if they advocated dropping the project.

"MAN AND MONKEY"—THE ENVIRONMENTALISTS' CASE

Environmentalists, on their part, mounted an unprecedented national campaign to create public pressure to stop the project. Starting in 1977, when a few naturalists in Kerala visited the area after reading the KSEB-sponsored barrage in the newspaper, the campaign gained national momentum by 1979 with "Save the Silent Valley" groups springing up in different parts of the country. The key elements of this campaign were the following:

1. The seeds of public debate on the wisdom of the project were planted by a group of intellectuals in Kerala through newspaper articles and speeches. Among these were scientists, poets, economists, and political activists opposed to the project.

2. The executive committee of the Kerala Shastra Sahitya Parishad (KSSP)—an organization committed to taking scientific and socially relevant concepts to the people of Kerala—was inspired, primarily by the persuasions of one of its members, Professor M.K. Prasad, to undertake a technoeconomic, sociopolitical assessment of the implications of the Silent Valley project. The report, produced by its multidisciplinary task force consisting of a biologist, an electrical engineer, an economist and an agricultural scientist-cum-economist, provided a turning point in the Silent Valley campaign and a landmark in inter-disciplinary cooperation on environmental issues.

3. The cogent analysis in the KSSP report provided environmental activists with important data, namely that: the energy contribution of the Silent Valley project was really marginal in the context of Kerala's power requirements; alternative sources for augmenting power existed; ground water provided an effective and economical source for irrigation; and, far more employment could be generated in this economically backward region through medium- and small-scale industries than through this one major hydroelectric project. More importantly, it convinced the 60-member executive committee of the KSSP to take up the fight to save the Silent Valley.

4. The KSSP's 7,000 members—teachers, doctors, engineers, lawyers, scientists, agriculturists, trade union workers and others—fostered public debate on the Silent Valley issue throughout Kerala. The youth, especially the college-going youth, were convinced. KSSP members focused on the effects of deforestation through their unique annual *Jatha*. This is a 37-day marathon march from one end of Kerala to the other using traditional cultural media such as dance, drama, poetry and music. The *Jatha* covers 300 to 400 villages along its 6,000 kilometer route.

5. A court case, though eventually lost, brought an invaluable stay on KSEB operations, thereby providing time for the educational campaign to have full effect.

6. International and national organizations like the IUCN, WWF, Bombay Natural History Society, Indian National Science Academy, Friends of the Trees and other organizations throughout the country adopted resolutions and lobbied through letters to the central and state governments.

7. Save Silent Valley committees, which sprang up in different parts of the country, lent considerable support to the movement in Kerala. One of the most active was the Save Silent Valley Committee in Bombay which worked closely with groups in Kerala. Some of the tasks it undertook were:

- Persuading eminent scientists and environmentalists to make public statements regarding the importance of preserving the Silent Valley;
 - Persuading members of the government-sponsored task force on the Western Ghats to publicly state that they had been mistaken in recommending the so-called "safeguards" which had been misused by the protagonists of the project;
 - Feeding the national press with information against the dam, which was
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particularly important once the local press in Kerala was muzzled by vested interests;

- Working jointly with activists in Kerala to get the most eminent scientists like Dr. Salim Ali and others to persuade key decision makers to save Silent Valley—or at least to keep options open until all other power generating alternatives in Kerala had been exhausted.

Key decision makers became one of the most valuable forces in dropping the project. Dr. M.S. Swaminathan, who was then Secretary of Agriculture, prepared a report highlighting the genetic wealth of the area and the desirability of postponing the project until this resource could be studied and tapped. E.M.S. Namboodripad, secretary of the powerful (especially in Kerala) Communist Party of India, left the matter open for debate within the party, having been convinced that the proposed hydroelectric project was not an unmitigated blessing for the people of the area.

India's foremost naturalist, Dr. Salim Ali, played a major role in convincing Indira Gandhi, who again became prime minister in 1980, to ask the state government to halt further work until the central and state governments could explore the implications of the proposed hydroelectric projects and the alternatives that were available. A committee with representatives of the state and central governments was set up by her, under the chairmanship of Professor M.G.K. Menon (then Secretary of the Department of Science and Technology) to look into the ecological implications of the project.

THE OUTCOME

In November 1983 the Silent Valley hydroelectric project was officially declared to have been shelved. Steps have been initiated since then to create the Silent Valley National Park. In the conservation field, no battle is ever final. The Silent Valley may again one day resound with controversy. A campaign involving three successive prime ministers (Morarji Desai, Charan Singh and Indira Gandhi) led to the most heated public conservation debate among intellectuals throughout the country. Perhaps the most heartening indicator that the environment education campaign had succeeded was the absence of public outcry when the project was dropped. In the Palghat district, where the project was to have been located and where environmental activists once faced the possibility of physical assault, the people asked KSSP activists to organize a felicitation for the prime minister for her wise decision to drop the project.

LESSONS OF THE SILENT VALLEY CAMPAIGN

While it is difficult, even at this stage, to precisely pinpoint all the factors which contributed to the shelving of the Silent Valley hydroelectric project at the eleventh hour and in the face of formidable odds, some factors may bear consideration in similar campaigns elsewhere:

THE CAMPAIGN THEME

A major requirement of such a campaign is a constant sensitivity to what is the most appropriate message, to whom it should be addressed and by whom. Lion-tailed macaques were useful in obtaining support from international and national conservation bodies, but counterproductive at the local level. The genetic treasure house concept was effective for both decision makers and the general public. The Silent Valley name was deeply evocative, and if such an advantage does not exist in other cases, it would be useful to search for some element that could create it.

Above all, however, the environmental education effort must start with an effort to understand the needs of the local people and project how the proposed conservation movement is directly beneficial to them.

THE MEDIUM

Since the dropping of the project involved convincing many different levels in the decision-making process, different media had to be used:

At the prime minister's level, letters from such an eminent naturalist as Dr. Salim Ali, a report prepared by Dr. M.S. Swaminathan and representations from reputed international conservation bodies carried weight.

At the popular level, the use of the press created national interest in the fate of the Silent Valley and the KSSP's annual *Jatha* took the issue of deforestation to the countryside. During an unprecedented drought in 1983, the KSSP organized a special 12-day *Jatha* covering all districts in Kerala which still had forests. Signatures were collected from 200,000 people asking the government of Kerala to have a moratorium on all development projects in forested areas and to stop all clear felling, especially on steep slopes.

The decision not to use a particular medium is often as important as the decision to use it. At the state level, representation from international conservation bodies, with headquarters in Western countries, would have been counterproductive and were not used because of the prevailing communist ethos in this state.

A 35-mm film, on which much labor was expended, was never released for screening to millions of people through the film division because, by the time it was ready, the campaign had moved into a phase of behind-the-scenes diplomacy rather than public outcry.

In the final stages of the campaign, when key officials in the central government were looking into alternatives and trying to find a possible solution, I had a four-hour discussion with the initially hostile chairman of the Central Water Commission, himself a Keralite. It was agreed that the best strategy would be to call a halt to the public controversy so that positions would not harden further and so that the central and state governments could work on resolving the problem in the right atmosphere. There was accordingly an immediate de-escalation of the press campaign by both sides.

METHODS AND STRATEGIES

Some of the following strategies paid dividends and may be useful elsewhere:

Have a multidisciplinary report so that the benefits of the project itself can be questioned on economic grounds;

Lead the supposed beneficiaries of development projects to look at and question the benefits which the project promises to bestow. Without this, it is difficult for economically deprived people to sympathize with environmental positions which require them to sacrifice even small short-term gains in the interest of sustainable development;

Ask for a postponement of the project until other alternatives have been explored, rather than demand a dropping of the project. This can generate public support and provide a face-saving escape from the project;

Expend the necessary time and energy to muster data in order to convince key decision makers. Government officials who do not have a vested interest in a project, either in potential income or prestige, can be most helpful. Those who have open minds should not be blamed if the pro-project lobby does a better job of communicating with them than environmentalists do;

Have maximum organizational flexibility in campaigning. The established conservation bodies, with their multitiered organizational structures, were less effective in responding to the demands of rapidly evolving situations. An ad-hoc group, like the Save Silent Valley Committee (Bombay), strongly focused on a single environmental issue. With no hierarchical structure and no requirement to perpetuate itself once the campaign was over, it could draw together interested members from various organizations and pool their valuable contacts and expertise;

Coordinate strategy formulation and decentralization in action for powerful campaigning. Although Silent Valley groups had sprung up spontaneously and independently in different parts of the country, a division of functions emerged. Groups in Kerala created public awareness in their respective areas, the Friends of Trees unit in Kerala pursued the court case, the Society for Environmental Education in Kerala worked largely with children's groups. The Save Silent Valley committee in Trivandrum, capital city of Kerala, provided a meeting point for important activists from different walks of life and from different political parties;

Undertake public education—through the press and through direct contact with organizations and the activists in whom they have confidence—to make decisions politically acceptable. Though the prime minister's personal interest is invaluable, it does not provide a simple solution for a politically complex or sensitive issue.

The ability of public opinion to stop a dam and the protracted public debate on the merits of implementing major projects at the cost of environmental factors have provided an impetus to anti-dam campaigns in other parts of the country.

The Bedthi project in Karnataka was dropped when rich local farmers, supported by economists and intellectuals, successfully sought and argued the case in a public debate sponsored by the state government. In other cases, the struggles against major dams are continuing.

The destruction of valuable ecosystems and the displacement of thousands of people, many of whom live in tribes whose culture, religion and very survival is closely interwoven with the forests, have formed the focus of these debates. Interestingly, it is once again not the national environmental groups like the World Wildlife Fund and the Bombay Natural History Society that are in the forefront of raising public awareness. It is local leaders who have worked for many years on the development issues connected with these communities who are now combining environmental, economic, and humanitarian arguments in the struggle to ensure that local communities are not destroyed by projects which will benefit distant urban groups. Thus, Mr. Chandi Prasad Bhatt of the Chipko movement is campaigning against the Vishnuprayag dam which will submerge the Valley of the Flowers. Dr. Baba Amte, who has worked on health and leprosy issues amongst the tribals of Gadchiroli district in Mahatashtra, is leading them in the struggle against the proposed Bhopalpatnam and Imchampalli dams. The Koel Karl Jana Sangathan, consisting of the headmen of all the affected villages, is fighting to secure suitable rehabilitation schemes that will look after the needs—economic, social, and cultural—of the tribals of Koel Karl. And, four social service organizations in Gujarat are in the forefront of the struggle against the mammoth Narmada project being implemented without sensitive, egalitarian and comprehensive handling of the rehabilitation of oustees!

The message of hope that the 1970s and 1980s have provided to the conservation movement on India is that grassroots organizations in many parts of the country, without even having heard of the World Conservation Strategy, are affirming the tenets of sustainable development and forging crucial links between development and environment issues.

The dissemination and sharing of experience are vital for this movement to gain strength. A significant contribution in this direction has been made by the two citizens' reports on the state of India's environment, published by the Center for Science and Environment.

THE INDIAN ELEPHANT

R. Sukumar

Worshipped and hunted, carrier of human burdens and killer of human life, companions of kings and commons, war machine and peace ambassador, the sheer contrast and splendor of the association between elephants and people in Asia is unequalled by any other interaction between animal and man in the world.

During prehistoric times the elephant was viewed by hunter-gatherers probably only as a source of meat, ivory, hide and bones. But this perception must have changed once man realized the potential of using such a large and powerful beast as his servant. The earliest records of domestication are engravings on seals during the Indus valley civilization, from the third millenium B.C. This ancient relationship between elephant and man provided a strong motivation for the development of a science of elephants.

Ancient literature such as the *Rig-Veda* (twentieth to fifteenth century B.C.), the *Upanishads* (ninth to sixth century B.C.), the *Gaja-sastra* (sixth to fifth century B.C.), and the *Tamil Sangam* literature record details of elephant distribution, life and habits, (though mixed with mythology, imagination, and exaggeration) with instructions on their capture and training, maintenance and treatment of diseases. The *Gaja-sastra* is probably the world's first such monograph on the elephant and its author, Papakapya, the first elephant scientist.

The domestication of elephants certainly meant their reduction in the wild but there seems to have been knowledge of prudent capture even in early times. Kautilya's *Arthashastra* (circa 300 B.C.), a treatise on state administration, urged setting apart tracts of forest on the periphery of the kingdom as elephant sanctuaries. These sanctuaries were to be patrolled by guards and anyone who killed an elephant there was to be given the death penalty. Among the instructions given for capture of elephants, the treatise prohibited the capture of elephant calves, elephants with small tusks, tuskless males, diseased elephants and female elephants with young or suckling calves. It further recommended that a 20-year-old elephant should be caught. This practically meant that only adult male elephants with tusks could be captured. This was the most scientific and prudent way of harvesting the wild elephant population given the fact that domestication was inevitable.

The period after Christ saw a steady decline in elephant numbers over the Indian subcontinent. We know that elephant captures were not always prudent. Entire herds were often captured in stockades by the keddah method. With the enormous pressure on elephants and their habitats over many centuries from the human population, it is perhaps surprising that the elephant has survived to this day. The cultural and religious traditions certainly played some part in their

conservation. The elephant is worshipped in the form of Ganesha, the God of Learning. Religious taboos against the killing of elephants is widespread over most of the Indian subcontinent, except in parts of the northeast. Sport hunting of the elephant was not known until the eighteenth century of British India. By contrast, another large mammal, the American bison, was almost completely wiped out within a century due to hunting.

Today, elephants survive in four major regions of the Indian subcontinent—about 500 of them in the northwest, 9,000 to 12,000 in the northeast, 1,600 in central and 6,000 to 7,000 in south India. We face the challenge of conserving elephants scattered in numerous populations, small and large, surrounded by human societies whose traditions are changing with the assault of modern civilization. To me, the elephant in India symbolizes a conservation culture which represents the meeting point of rich traditional values, evolved over centuries, and modern conservation needs responded to with scientific good sense. I shall now refer to a study I carried out on the ecology of the wild elephant and its interaction with people in southern India with a view to providing a scientific basis for their conservation. The study was sponsored by the World Wide Fund for Nature, through the Asian Elephant specialist group of the IUCN.

In southern India the elephant is found in a wide variety of habitats ranging from dry thorn jungle through deciduous forest to wet evergreen forest. The 1,000-square kilometer area in which I studied elephants had a good representation of this diversity. One of the basic questions on elephant ecology I studied was how elephants utilized this diversity of habitats to obtain their food requirements on a seasonal time scale. Elephants were identified based on morphological characteristics. Data from resightings of such elephants indicated minimum home range sizes of 100 to 300 square kilometers for elephant family herds and adult bulls. The seasonal spatial distribution patterns and observations of feeding demonstrate that elephants utilize different habitat types with a view to optimizing their consumption of food and water. During the dry season (January to April), elephants typically congregated at high densities of up to five elephants per square kilometer in river valleys or swampy grasslands. With the onset of rains (May to August), they dispersed over a wider area, mainly into deciduous forests with tall grass. Later, during the second rainy season (September to December), they moved out of tall-grass hill forests into lower elevation short-grass open jungle.

Elephants are both grazers and browsers. Though they consumed a large number of plant species, more than 80 percent of their diet consisted of only 25 species from the botanical taxa *Gramineae* (grasses), *Cyperaceae* (sedges), *Leguminosae*, *Palmae* and *Malvales*. Feeding was predominantly on browse (69 percent) during the dry season while grazing on tall grasses (54 percent) increased with the onset of rains. Consumption of tall grasses again decreased during the second wet season. The movement pattern and feeding preferences were related to the changing nutritive content, particularly protein, in food plants. During the dry season the protein content of tall grasses is less than 4 percent, which is

insufficient for maintenance. Hence, elephants clearly prefer browse plants which have 8 to 20 percent protein. The new flush promoted by the rains has 8 to 10 percent protein; hence its increased consumption during this season. When the grasses mature they become fibrous and unpalatable, with a drop in protein value, and elephants now switch over from tall grasses to short grasses and browse.

The lesson for conservation is that elephants need a diversity of habitats to optimally satisfy their food and other requirements. During the dry season they need habitats with browse forage, such as leguminous plants of tall grasses in swampy grasslands. They need river valleys for water. Riparian forests and evergreen forests also afford them shelter from fires which are frequent in the dry forests. Deciduous forests are utilized for their tall grasses mainly during the rainy season. Thus, the highest densities of elephants under natural conditions can be maintained in regions with a mosaic of habitats. Human use of the habitat through selective timber felling or extraction of certain forest produce need not be incompatible with the elephant's use of the habitat, since elephants adapt well to secondary vegetation. However, the systematic destruction of certain habitats such as river valleys for dams or for cultivation does not augur well for the elephant.

Elephants may encounter cultivation in the course of their natural seasonal movements. Since many cultivated crops—cereals, millet, oil palm, coconut—are analogous to the wild grasses and palms, elephants are likely to consume these crops as any other wild plant. Crop raiding by elephants is a serious conservation problem. A detailed monitoring of crop damage in several villages revealed some interesting implications for controlling this problem.

Crop raiding was most frequent during the second wet season, when a large proportion of land was cultivated for the staple crop finger millet (*Eleusine coracana*). During this period there was also abundant forage in the natural habitat. There was no correlation between the frequency of raiding in villages with the quality of the natural habitat around them. These observations suggest that elephants would raid crops irrespective of the availability of sufficient food in the wild. The ultimate cause of crop raiding is the higher palatability and nutritive value, in particular protein, sodium and calcium, of cultivated crops compared to the analogous wild plants.

One significant observation was that adult male elephants showed a far higher propensity to raid crops than did the female-led family herds. An adult bull raided crops on average of six times more frequently than did an elephant belonging to a family group. Consequently, adult bulls derived about 9 percent of their quantitative food requirement from cultivation compared to less than 2 percent for family herds. Male elephants also joined together to form larger "bachelor bull groups" in order to raid crops more effectively. Not only did an adult bull raid more frequently, it also damaged more quantity of crops per raid (being larger in body size) and also the more economically valuable crops such as coconut than did an elephant belonging to a family herd. The cumulative

effect of this meant that the average annual damage to crops was about \$500 per bull and only \$25 per elephant belonging to a family herd.

Another unfortunate consequence of the interaction between elephants and people is the killing of people by elephants. In southern India about 30 to 50 people are killed each year, while in other regions of India another 70 to 100 people fall victim to elephants. Records of manslaughter showed that a significant 45 percent of instances occurred within cultivation areas and the rest within the forest. Adult male elephants were responsible for almost all killings within cultivation areas and for 80 percent of overall killings. I must add here that 77 percent of people killed were adult men. The tendency for male elephants to show more aggressive behavior leading to manslaughter could have its origin in their more intensive interaction with people within cultivation. This behavioral difference between male and female elephants in raiding crops and in killing people has important implications for management.

Elephants are also at the receiving end, since between 100 and 150 male tuskers are shot every year in southern India by poachers for their valuable ivory. Unlike the African elephant, female Asian elephants do not possess tusks.

This human/elephant interaction has direct consequences for the elephant population. To understand the dynamics of the population, I obtained its age structure by aging elephants from their shoulder heights measured by a photographic method, estimated its fertility and mortality rates, and incorporated these into a matrix model to simulate demographic trends using a computer. The age structure shows a strongly female-based sex ratio; the adult ratio was one male for every five females. Female elephants first give birth at 17 to 18 years and continue to do so every 4.7 years on average until about 60 years. Three sets of mortality rates for male and female elephants were considered—a low mortality schedule representing the minimum rates expected, a medium mortality schedule incorporating the rates estimated to be currently operating in the population and a high mortality schedule which could be reached during periods of stress such as drought or increased poaching.

Computer simulations revealed the following trends: The elephant population seemed relatively stable at present. It had the potential to increase at not more than 2 percent per year in the long term. However, the disparate sex ratio would further widen due to the high male mortality from poaching. To a certain extent a disparate sex ratio would not affect the fertility of the population in a polygamous society, since an adult male can mate with many females. At some value of a disparate ratio there would certainly, however, be a decline in fertility. Too few males also means a reduction in genetic diversity and problems associated with inbreeding, especially in small elephant populations. It has been suggested by conservation geneticists that a minimum population size of 500 breeding or adult individuals is necessary to maintain the long-term evolutionary potential of the population. This may mean a total population of about 1,500 to 2,000 elephants. If elephants exist at an average density of 0.5 elephants per square kilometer this also means that the minimum viable area is 3,000 to 4,000

,square kilometers. This study certainly suggests that an adult ratio of one male to five female elephants in a large population can still maintain a relatively high birth rate, and hence, demographic vigor of the population. At present no clear answer is available to determine a safe level of a skewed sex ratio in elephant populations.

In managing elephant populations, advantage can be taken of the fact that some males can be harvested, especially from a large population, without any detriment to the population's demographic vigour. This would substantially reduce damage to crops and save human lives. This should not be taken as a justification for poaching; there are legal and ethical issues involved in the wasteful slaughter for ivory. However, since there is a tradition in Asia of capturing elephants for domestication, selective captures of notorious crop-raiding bulls could be permitted.

The elephants' depredations will have to be minimized if its conservation is to be accepted by people in modern rural society. Trenching around cultivation has largely failed to keep away elephants. One product of technology, the high-voltage electric fence, holds promise of containing elephants. A typical design used against elephants gives a 5,000-volt current in pulses of very short duration, say 1/3,000 second every second, and is not harmful to animals. Intelligent elephants have, however, used their tusks, nonconductors, to break an electrified wire and enter cultivation!

The grand symbols of Indian culture are derived from nature—mountains (the Himalayas), rivers (the Ganga), trees (the peepal or fig), animals (the elephant) and only an occasional human edifice (the Taj Mahal). Sages retired to the solitude of the Himalayas in order to promote lofty ideas. Bathing in the Ganga symbolized a spiritual cleansing. The modern protest by peasants against deforestation in the Himalayas or the physical cleaning of the polluted Ganga are manifestations of these deep-rooted traditions. The Buddha attained enlightenment under the peepal tree; today, we still find a revered peepal in every village. In many regions the only remnants of undisturbed forests are the sacred groves dedicated to deities. The elephant has shared with people war and peace, joys and tribulations, pomp and neglect. It is still a powerful symbol around which the conservation of India's natural heritage can be organized.



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CHINA—WILDLIFE CONSERVATION

Liu Guangyun

Upon receiving the Worldwide Conservation Leadership Award on behalf of the Ministry of Forestry, People's Republic of China:

China, with vast area, complicated topography and varied climate, is rich in wild fauna and flora. Some of them, such as giant pandas, golden monkeys, white-lipped deer, brown-eyed pheasants, black-necked cranes, Chinese alligators, dawn redwood and *Cathaya argyrophylla* can only be found in China. In order to protect and reasonably use the resources of these wild fauna and flora, the Chinese government has done a lot of work, establishing management organizations at different levels, making laws and regulations, providing lists of wild fauna and flora to be protected and strengthening scientific research.

Saving endangered species is one of our important works. In 1981 we found seven crested ibises still surviving in the wild. After several years of strict protection, its population has been increased to more than thirty. With artificial breeding, we have bred more than 1,000 Chinese alligators. In 1983, the bamboo died on a large scale in areas where giant pandas live. In order to save giant pandas, our government allocated special funds. Altogether we took 86 dying giant pandas, of which 62 survived, thus decreasing the loss and achieving good results. We are now working with the World Wildlife Fund (WWF) to make a comprehensive inventory for the giant pandas and make protection and management plans for the future. We have introduced Pere David deer and wild horses, which were extinct in the wild in China. We have established a breeding center in Jiangsu Province and Beijing for the deer and Xinjiang Autonomous Region for the horses. We hope to recover their wild populations in China.

Nature reserves are our important base for protecting the natural environment and wild fauna and flora. By the end of 1986, we established 333 different types of nature reserves with a total area of 19,330,000 hectares, amounting to 2 percent of our land. Facts show that our nature reserves have played an important role in protecting the natural environment and resources, especially in protecting and saving endangered species.

It is imperative to have international cooperation to protect wild fauna and flora. We have joined cities, signed treaties to protect migratory birds with Japan and Australia, and have nature conservation protocol with the United States. We work closely with the WWF, the International Union for the Conservation of Nature and Natural Resources (IUCN) and the International Crane Foundation. Many foreign scientists have come to China to work for the protection of wildlife

and scientific research on wildlife resources and make contributions to our work. I would like to take this opportunity to express to them our sincere thanks.

China is a developing country. Although we have made some achievements in nature conservation, there is a long way to go. We want to cooperate closely with other countries, organizations and individuals and to make greater contributions to world nature conservation.



The Worldwide Conservation Leadership Award
presented to
the Ministry of Forestry, Peoples Republic of China

For excellence and international leadership in:

- efforts to preserve the panda and its wilderness habitat
- establishing national forestry education and research system
- conservation of natural resources through population planning
- implementing creative solutions such as the use of birds for the control of damaging insects

presented this 12 day of September, 1987, on the occasion of the 4 World Wilderness Congress, by the International Wilderness Leadership Foundation

Dr. John Handoo
Dean, College of Forestry
Wildlife and Range Sciences
University of Idaho

Dr. Ian C. Playler
Vice Chairman
Wilderness Leadership School

Vance G. Martin
President
International Wilderness Leadership Foundation



AUSTRALIA

THE AUSTRALIAN GOVERNMENT AND CONSERVATION

Patrick J. Galvin

Australia has been involved in earlier World Wilderness Congresses and is proud to have hosted the 2nd Congress at Cairns and to have participated actively in Inverness and Findhorn.

At the time of the 3rd World Wilderness Congress in Scotland, the Hawke Labor Government had been in office only seven months. The government's election platform included a strong commitment to conservation and environment protection. The then Federal Minister for the Environment, the Honorable Barry Cohen, in addressing the congress, described the steps the government had followed to prevent the building of a dam in the Western Tasmania World Heritage Area. He reminded the congress that the first legislative action of the new government, on its election, was to introduce to the Parliament a bill to make provision for "the protection and conservation of those places . . . that are of such outstanding universal value that they are recognized as part of the cultural or natural heritage of the world." That legislation, calling up the World Heritage Convention, stopped the building of the Franklin Dam.

Four-and-a-half years later the Hawke government has been reelected for its third term. Throughout this recent election campaign the government's commitment to conservation and to the protection of the environment was a significant issue.

Following are some remarks of the prime minister in opening the election campaign:

"The task of protecting the environment imposes a heavy responsibility on the whole community. For Australians, that responsibility is a particularly important one since we have the good fortune to live in a country of unsurpassed environmental magnificence.

"However, protecting the environment also requires us to find a delicate balance with legitimate economic interests. The Hawke government can point with pride to the progress Australia has made in recent years in striking that balance and in securing our environmental heritage.

"The matchless beauty of our land has a value beyond dollars and cents. That's why we stopped the Franklin Dam. That's why we have made mining illegal in Kakadu. It's why we are protecting the special forests in Tasmania. And that's why we will save the Daintree."

It is this recognition of the responsibility of the present generation of Australians for the welfare and quality of life of our successors, and of the world at large, that forms the basis for all the federal government's policies and actions on conservation. This approach, of course, is in line with the philosophy of the World Conservation Strategy. Australia was one of the first countries to accept the World Conservation Strategy and to develop a National Conservation Strategy.

Yet the Australian Constitution makes no mention of environment or conservation. It was drafted in the 1890s and reflects the perspectives of those times. Decisions on land use, forest management, wildlife conservation and pollution control are primarily the responsibility of each state.

Wherever possible, the federal government has sought to cooperate with state and territorial governments in developing conservation policies and addressing priority conservation issues. However, there have been issues of national and international concern where the federal government has found it necessary to intervene and to use the powers granted to it by the Constitution. These include: trade and commerce, external affairs and the power to legislate in its own territories. In this action it has had the support of the courts.

Australia has a land area of about 7.7 million square kilometers (roughly the same area as mainland United States, excepting Alaska). It spans more than 30 degrees of latitude, from the tropics to the edge of the Southern Ocean. It is, for the most part, a flat, arid continent—one-third of the total land mass has a mean annual rainfall below 250 mm (10 inches). The human population is about 16 million (less than that of New York State). More than 85 percent of Australians live in about 10 cities on the coastal fringe of the continent, leaving the inland very sparsely inhabited, though by no means unaffected by human habitation.

Australia has the distinction of being the only country in the world to occupy a whole continent. It contains a great variety of environments, ranging from a vast arid inland to complex rain forests, large sand islands, ancient coastal landforms, enormous coral reefs, and small areas of Alpine heaths and snowfields.

The scientific importance of the Australian landscape and its flora and fauna is well recognized. The Australian government accepts the obligation to conserve this natural heritage.

During the more than 40,000 years of Aboriginal occupation, human activities established an equilibrium with the environment. While Aboriginal land-

use practices left their mark on the vegetation—especially through the use of fire—there is no doubt that these practices were sustainable in the long term. The same cannot be said for those who followed.

In 1988 Australia will celebrate 200 years of European settlement. It is an important time to reflect not only on our achievements but also on our mistakes. Massive forest clearing, overgrazing, introduction of weeds and pests, poor irrigation practices and the overuse of artificial fertilizers have occurred. All seemed good ways of maximizing yields and profits at the time, but the consequences have been devastating.

At the time of European settlement about 10 percent of the continent was covered with closed forest. This area has been progressively reduced to about half that amount. It has been estimated that three-quarters of the rain forest has disappeared.

The conservation of Australia's remaining native forests is the major issue of serious conflict between conservation and development interests in Australia today.

The responsibility for use and management of forests in Australia rests with the state governments. However, international trade and commerce are matters for the federal government. A federal decision, for example, whether to issue a license for the export of wood chips may well be the determining factor in the development of the timber industry at regional or local levels. There is obvious potential here for conflict.

In the past few years there has been a succession of widely publicized conflicts—at both government and community levels—over the clearfelling of native hardwood forests to produce wood chips for overseas markets. Clearfelling, especially when followed by burning, is hardly consistent with conservation of natural communities, especially that of native fauna.

The most significant of these events has occurred recently in Tasmania. The federal government had made clear its opposition to forestry operations in areas containing nationally and internationally important conservation values. In December 1986, it indicated its intention to stop logging in parts of the Lemnathyme and Southern Forests adjacent to the Tasmanian World Heritage Area and consequently initiated legislation to establish a Commission of Inquiry to examine whether the values in the Lemnathyme and Southern Forests are themselves of World Heritage Value.

On September 3, 1987 the government was successful in obtaining a temporary High Court injunction to prevent logging in these forests pending hearing of a High Court challenge by the Tasmanian government to the legislation establishing the inquiry. The Tasmanian government, which initially refused to appear before the inquiry, has now agreed to do so.

Only a small proportion of Australia's remaining forests are rain forests. Australia's rain forests are relics of an ancient environment which is believed to have once covered most of the supercontinent of Gondwanaland. The tropical rain forests of northern Queensland are of particular scientific interest. Conser-

vationists and the federal government are determined that logging in these rain forests must cease if destruction of their scientific values is to be avoided. The decline of rain forests throughout the world adds to the urgency.

In recognition of the importance of Australian rain forests, the federal government last year established a National Rain Forest Conservation Program and agreed to provide funding of \$22.25 million over three financial years. The program is being implemented in cooperation with the states and the territories. It includes survey and research, the acquisition of privately owned rain forests for inclusion in parks, plantation establishment to provide alternative sources of timber and studies of the tourism potential of rain forests. Components of the program are already being successfully undertaken.

A major objective of the program was to establish cooperative arrangements with the Queensland government for the conservation of tropical rain forests in Northern Queensland. Unfortunately, that state government did not choose to enter into acceptable arrangements. In particular it refused to cease logging.

In June 1987 the prime minister announced the federal government's determination to protect the outstanding values of this region. He said, "The Queensland Government must be made to recognize the need to change its management practices with regard to irreplaceable environmental heritage." He announced that the federal government had decided to proceed immediately toward nomination of the wet tropics of North-East Queensland to the World Heritage list.

World Heritage listing will enable the government to prevent further rain forest logging in the wet tropics. Recognizing that this action will affect the livelihood of timber workers—at least in the short term—the government has agreed to make substantial funding available for industry readjustment.

In determining the boundaries of the area to be nominated, the government has undertaken an extensive program of community participation and consultation. During this consultation, the minister has visited most areas in the region. Of course the reaction of those who clearly will lose their present employment is not a particularly happy one. The most recent visit to a town called Ravenshoe resulted in some violence. Nevertheless, the government is determined to go ahead.

Neither in the case of logging in the Lemonthyme, nor in conservation of the wet tropics, has the federal government been able to achieve its objectives with state government cooperation. However, we have now come to a good working arrangement with Tasmania to manage the Western Tasmania World Heritage Area.

In the years since the last Congress, the federal government has cooperated with the Tasmanian government to restructure parts of the Tasmanian economy affected by the loss of the dam project and to develop management arrangements for the Tasmanian World Heritage Area. In January 1985 agreement was reached between the federal and state governments on the establishment of a ministerial council to advise on policy, management and financial matters relating to the

area. The council itself is advised by a consultative committee which includes representatives of tourism, research, conservation, bushwalking and local government to enable the users of the area to have a say in the decision-making process. Once virtually unknown outside Tasmania, the Franklin River and the Tasmanian World Heritage Area are now popular destinations for conservationists, scientists, wilderness adventurers and tourists from all over the world.

Despite the differences over the North Queensland Rain Forests, good cooperation has been achieved with the Queensland government in the management of the Great Barrier Reef. Legislation to establish the Great Barrier Reef Marine Park was enacted in 1975. In 1979 a ministerial council was established to coordinate the policies of the federal and Queensland governments in relation to the Marine Park. Formal arrangements have been made for public involvement in its management, and a Great Barrier Reef Consultative Committee provides advice to the government and to the management authority.

The scientific and recreational qualities of Marine Park are well known, and in recognition of these qualities the whole area, comprising federal waters and some Queensland Islands, has been inscribed on the World Heritage List.

One of Australia's most serious national conservation problems—the environmental degradation of Australia's largest and most important river catchment, the Murray-Darling Basin—has evolved slowly over many years and involves four states.

The Murray River forms the border between New South Wales and Victoria and flows into the sea in South Australia. The Darling River flows from southern Queensland to join the Murray near the South Australian border. These two rivers and their tributaries have a combined length of 3,780 km (one-and-a-half times the length of the Colorado River). The basin covers nearly one million square kilometers (about 15 percent of the continent) and has a population of 1.6 million people. Throughout much of Australia's history, the Murray-Darling Basin has been one of its most important agricultural and pastoral areas. Although it still produces over half the nation's agricultural output, much of the area is now severely degraded by soil erosion, dry-land salinization, poor river-water quality and rising groundwater tables.

In November 1985, the federal government and the governments of New South Wales, Victoria, and South Australia agreed to cooperate in planning and management for the use of water, land, and environmental resources in the Basin. A strategy for integrated management of these resources is being prepared and a Murray-Darling Basin Commission, representing the four governments, is to be established by legislation of all four parliaments involved, and will oversee future management of the Basin.

The federal government recognizes the special relationship between the Aboriginal people and their land. Large tracts of Australia, especially in the Northern Territory, are owned by Aborigines. The federal government has successfully sought the cooperation of Aboriginal people in conserving and managing lands which contain some of Australia's most outstanding natural

environments. Uluru National Park in central Australia, which contains the world famous Ayers Rock (or Uluru) and the Olgas (Katatjuta), has enormous religious and cultural significance for the traditional inhabitants. In October 1985, the Aboriginal people's traditional ownership of Uluru was legally confirmed in a ceremony at the Rock in which the governor-general handed over a deed of title to the Katatjuta Aboriginal Land Trust. On the same day, the Katatjuta Trust leased the area back to the director of the Australian National Parks and Wildlife Service for management as a national park.

Kakadu National Park, established in the magnificent tropical floodplain and escarpment country of the Alligator Rivers Region in the Northern Territory and featured in the film *Crocodile Dundee*, is also partly owned by Aboriginal traditional owners. In 1975, following discoveries of uranium deposits in the area, a government inquiry was set up to consider the future of the entire region, including the ecological and wilderness values, traditional ownership claims, commercial fishing, mining, pastoral activities and interests of the Northern Territory government. The inquiry recommended the establishment of a major national park in the region to include the entire catchment area of the South Alligator River. The federal government intends that Kakadu National Park will eventually meet that specification.

The original Kakadu National Park was proclaimed in 1979 and inscribed on the World Heritage List two years later. An adjacent area (Stage Two) was proclaimed in 1984. In September 1986, the government decided to acquire the Gimbat and Goodparla pastoral leases, which contain the headwaters of the South Alligator River, for further extension of the park.

Last year the government nominated Kakadu Stage Two for the World Heritage List. The World Heritage Committee deferred consideration of the nomination, at the request of the Australian government, after a legal challenge was initiated by mining interests. The case was decided in the government's favor by the Full Bench of the Federal Court earlier this week, enabling the government to proceed with the nomination.

Land rights over substantial areas of Kakadu National Park have been granted to an Aboriginal Land Trust and leased back to the director of the Australian National Parks and Wildlife Service on the condition that the Aboriginal people be trained, employed, and otherwise involved in management, development and planning of the park. The government has pursued this policy actively and with considerable success.

The choice of priority between conservation of living natural resources and exploitation of rich mineral deposits in the Kakadu region has been an important political issue in Australia. There are proven uranium deposits in addition to the present Ranger and Nabalark mines, and much of the region is said to be highly prospective for gold, platinum, and other metals. The federal government's uranium policy precludes further uranium mines, but there are strong economic pressures to extract other mineral resources.

The government decided in December 1986 to declare as a Conservation

Zone one-third of the Gimbat and Goodparla pastoral leases and to allow mineral exploration, in that zone only, under strict environmental guidelines for a period of five years. The act provides for a conservation zone to be declared for the protection and conservation of wildlife and natural features of the area until a decision is made whether or not to declare the area a park or reserve. The government's intention is that ultimately as much of the conservation zone as possible will be incorporated in the park. Only mining prospects of major economic significance—not merely economic viability—will be allowed to proceed, and then only provided that strict environmental guidelines are met.

The government is determined that the wilderness value of Kakadu will be protected against the effects of minerals activity and maintained for nature conservation and for the large number of tourists from all over the world who visit the Northern Territory. In May 1987, the Parliament enacted legislation to prohibit exploration and mining in the area declared as Kakadu National Park.

Protection of wilderness has been a significant part of almost all of the federal government initiatives. By wilderness, I mean loosely those areas of substantially unmodified native plant and animal communities and the landscapes they inhabit that are sufficiently large to make it practicable to maintain them in their natural condition in perpetuity.

The Tasmanian World Heritage Area, Kakadu National Park, and the Wet Tropics of North-East Queensland contain major wilderness areas, by any definition. Some attention is being given to better defining wilderness values and identifying areas suitable for wilderness preservation. The Australian Labor Party, which holds government in Canberra and in four of the six states, is committed to encourage and promote the preservation of Australia's wilderness areas under appropriate legislation.

Bearing that in mind, and with the constant prodding from the community and especially the conservation movement, I believe that the future for wilderness conservation in Australia looks very bright.

Action to protect forests, the Wet Tropics, World Heritage Areas and the important Murray-Darling Basin are major and significant political issues. The government's conservation agenda also includes a National Soil Conservation Program, a National Tree Program, protection and management of native fauna and flora, measures to combat environmental contamination and, of course, public education and awareness programs.

The government values the international aspects of its conservation and environment protection policies. Its participation in UNEP, IUCN, CITES, the South Pacific Regional Environment Program and other international activities is active and interested. We have shown special interest in the support and promotion of the World Heritage Convention. So far, some six sites are included on the World Heritage List. The government has nominated Uluru and is moving to nominate the Queensland Wet Tropics Region.

Much of this has been achieved through a growing acceptance by Australian citizens of conservation values. There can now be no doubt that environmental

awareness and concern have reached a high level. Recent surveys and analysis of election results demonstrate this clearly.

Recognizing that conservation is a matter for the whole community, the government has made considerable efforts to involve community interests and to strengthen the voluntary conservation movement.

Federal government grants are made to these bodies in recognition of their important role in raising environmental awareness in the community and contributing to the development of effective environmental policies.

During a record four years as environment minister, Barry Cohen met with the 20 or 30 representatives of the major federal and state conservation groups two or three times a year to discuss with them whatever matters they wished to raise and to inform them of government thinking on conservation issues. The prime minister has met with representatives of conservation groups to discuss contentious issues. The newly-appointed minister, Senator Graham Richardson, has already gone out into the community to meet and listen to many groups of people affected by government policies. He intends to continue the regular process of consultation with the voluntary conservation movement. Government conservation and environmental protection policy has been enriched and certainly better informed by the process of community involvement and participation.

At the 1986 IUCN conference on implementing the World Conservation Strategy in Ottawa, it was clear the Australia had made comparatively good progress in implementing the strategy. I do not believe we could have achieved this without the very positive contribution of the conservation movement.

There is now considerable intellectual support for the view that Australia's economic development should be pursued through careful integration of development and conservation policies. Among the public at large there is increasing commitment to ensure that no development takes place without its environmental implications being thoroughly understood and weighed against its economic benefits. A network of legislative and administrative environmental impact assessment processes is well developed.

Despite this, I would not wish to leave you with the impression that in Australia we have found it easy to put into practice the principle of conserving living natural resources for sustainable development. In our experience this has been, and will continue to be, a difficult and challenging assignment.

I fail to be convinced that development and conservation are natural bedfellows. They can be brought together in appropriate circumstances with deliberate effort, but we have found that it is not always possible to accommodate environment and conservation in the same place. In some cases the conservation stakes are so high that economic development cannot be permitted. The government took that view when it decided to stop the Franklin Dam, when it legislated to ban mining in the Kakadu National Park and when it moved to preserve the Wet Tropics of Queensland.

In many cases we do not fully understand what constitutes a sustainable

level of use of our living natural resources. How many trees can be safely removed without destroying a forest? How much vegetation can be cleared without causing the soil to blow away? The dilemma of governments is that they cannot afford—economically or politically—to suspend all development until they have the final answers to these questions. But nor can they afford to ignore long-term conservation needs simply because Australia is not—at this time—a major environmental disaster area.

Although the Australian environment may be unique, most of our conservation problems—both in their technical and political dimensions—are also found elsewhere. Therefore, we must also attempt to contribute to conservation on a wider scale. We can share the lessons we have learned from our own experience concerning two essentials for progress: positive leadership from a committed government, and the support and participation of an environmentally conscious public. Through our participation in the World Wilderness Congress and at other international venues I hope we can both share and learn.

Secondly, like any country, we can apply sound principles of conservation to the management of the part of the world's living natural resources with which we have been entrusted. In our case it is quite a large part. I hope I have emphasized the seriousness with which we accept this responsibility.

We in Australia are lucky to have a large, well-informed and committed conservation movement which, in cooperation with government, has been successful in raising the level of public awareness and understanding of conservation issues. We are also lucky to have governments prepared to adopt policies which will preserve resources for long-term survival, even at the expense of short-term wealth. Prime Minister Hawke has said, "We have never believed that the only values in life—in the life of our nation, in the life of our families—are the ones with the dollar tag upon them.

"The environment can only be destroyed once. But when it is protected and preserved, the benefits are permanent and will be appreciated for generations to come."





THE AMERICAS

BRAZIL— CONSERVATION POLICY

José Pedro de Oliveira Costa

To describe Brazilian conservation is a difficult task, as there are an enormous amount of problems. I will try to give you a slight idea of what the country and our 8.5 million square kilometers of territory was like before the arrival of the Europeans.

We're more or less divided into two deep tropical forests: the Amazon forest, which takes half of the Brazilian territory and is shared with other South American countries, and on the eastern border of Brazil we had what we call the Atlantic forest, mostly on Brazilian territory, with a little bit of it in Paraguay and Argentina close to the Iguacu Falls border. Between these two forests there was an area covered with two types of savanna vegetation: one called caatinga, which is very dry and almost unfit for human habitation; and another called cerrado, which receives more rainfall and is better suited for habitation.

The caatinga would originally represent 15 percent of the Brazilian territory, and the cerrado savannas would correspond to 20 percent of the territory, the Atlantic forest 10 percent and the Amazon 50 percent of the Brazilian territory. The last 5 percent would correspond to the Pantanal zone, a freshwater marsh in the middle of the South American continent between Brazil, Bolivia and Paraguay. The Pantanal area has the largest concentration of wild fauna of all South America. It is a very important place for wilderness conservation, having a high concentration of birds, mammals, and reptiles, and an enormous population of crocodiles.

In early years we also had a huge Indian population. Some experts estimate a population of over a million, while others speak of around five million Indians

in the Brazilian territory at the beginning of our colonization. They lived there for at least 30,000 years with a balanced way of life. They did use nature and they cut forests, but in such a way and with such a technology that they did not damage the environmental equilibrium. They produced wonderful pottery and superb feathered artifacts that are still considered the greatest expression of Brazilian art. It's said that when Columbus arrived in America he was so impressed by the tropical forests that he thought he had reached paradise. Columbus left us several writings about the everlasting summer of the tropical forests, the perfumed flowers and the wonderful birds of the Garden of Paradise. Amerigo Vespucci, when he passed by the Brazilian coast, also described this region as a paradise. Even the name Amazon comes from the medieval myth of the women warriors who protected the sacred garden.

The first Christian name of Brazil was The Land of Saint Cross, but with the rise of mercantilism during the Renaissance, the name was soon changed to Brazil, the name of the wood which was exploited in our country. Brazilwood was used as a red dye for clothing and was the first product to be exploited in our country.

After almost 500 years of colonization in Brazil the Atlantic forest has been reduced from covering 10 percent of our original territory to covering 0.2 percent. It is the area where the most of our endangered species are found. We have at least six species of primates in danger in the remainder of the Atlantic forest, among them the Muriqui, the largest monkey in the Americas. We have two wonderful species of parrots and dozens of other species ranging from mammals to butterflies, all of them endangered. Guaira Falls, as magnificent as the Iguacu Falls on the Paraguayan border, was transformed into an enormous dam for electrical energy during the military regime. Our mangroves, which are responsible for the production of the marine life in the tropical region, have been mostly destroyed for the construction of ports and cities and by oil spills. The Caatinga region is undergoing fast and thorough desertification. The Pantanal area, where the greatest portion of fauna exist, has been assaulted by people hunting crocodiles for their skins. We know that at least one million crocodiles are killed each year. Although the greatest portion of the Amazon has been destroyed, it has still been better preserved than any other ecosystem in Brazil. Currently, around one million hectares of the Amazon forest are being destroyed each year. Mercury is being used by gold miners in the Amazon and in the Pantanal to separate gold from sand in the riverbeds. With the uncontrolled contamination of the Pantanal and the Amazon, the Indian population is being decimated. We are living in the Wild West of the nineteenth-century United States, and the only difference is that this time the filmmakers are on the side of the Indians and are making films to try and protect them.

The current social and economic situation in Brazil is that half of our population of 140 million live in a reasonable condition, some of them in a very privileged condition even compared to those living in the developed nations. The other half, however, are living a subhuman, subsistence lifestyle. They are not

eating enough, they do not consume enough calories. They are not receiving enough education, when they are educated at all. The political decision of the government is that we need to develop in order to feed all these people. Development means that we need exportation, we need dollars, we need industrialization, we need to modernize the country. At the moment, Brazil is a food-exporting country especially of soya beans, meat and several other goods. The decision has been made to put more land in production to feed the people and to export. Brazil has a \$120 billion debt which was not assured through a decision of the people, but mostly by a military government that was not elected. More than \$10 billion of this debt is to be paid as interest per year to the international monetary system. The problems are huge and the solution so far has been to occupy more areas, to destroy more of the Amazon forest and to sell whatever products of the forest could be sold, regardless of the serious possibility of desertification and all of the problems that come with it.

At the time the debt was made, the World Bank was financing development based on a Western definition of progress. Roads were being built and destruction was taking place. Now we are trying to find solutions to all of these problems and discussing what we should do about our \$120 billion debt. There's a possibility of negotiating that and transforming part of the debt to conservation, as recently happened in Bolivia, which is a very welcome thought. Population control will be necessary in order to stabilize the economy, but this has still not been completely adopted by our government as policy. We need to preserve the productivity of our soil, we need to prevent desertification, we need to preserve our endangered species and those traditional people will be endangered if we continue this way. The kind of development that Brazil needs is not the kind that can be translated into numbers on a piece of paper. We are not interested in this kind of development. The type of development we need is food for the people, education and medical care for our population. Destruction that appears as numbers on a sheet of paper is different from the concept I have of development. We have already destroyed a lot of the Atlantic forest to plant coffee in the last century. We sterilized great parts of the soil of our country and we are still destroying and sterilizing a great part of the Amazon forest. We need a kind of sustained development, as do other underdeveloped countries, to develop in such a way that the country will maintain the capacity of production.

To illustrate my story I will relate my own experience when I got back to Brazil after living in Berkeley, California for two years. I was in charge of implementing an ecological reserve in the Atlantic Forest, in a place called Juriea that still has a large amount of primitive forest and other associated ecosystems. I went there in 1979 when the biggest challenge we faced was land speculation. We were trying to preserve a beautiful place that real estate companies wanted to turn into a beach resort. We found several endangered species in the area, and we also found that the people who lived in the poor soil areas were feeding on the rare animals. How could we deal with an endangered species that people were still eating? One of these animals is the Murigin, a slow monkey that's very easy

to catch. These people needed to eat, they needed to feed their children, and they didn't know anything about endangered species and were just using all of their available resources to feed themselves. So we have to find alternative ways to approach endangered species preservation, get information to the people and give them an alternative to feed their families. This we did with reasonable success.

One year later, the federal government decided that this area was one of the least populated areas of Brazil and decided that two atomic plants should be built there. So we had to deal with the idea of having two atomic plants within the boundaries of our ecological station, and in spite of all these problems we have just decided to stay there. After five years of economic problems and other setbacks, the government has decided not to build the atomic plants after all. Last year our ecological station was made official. A bill was signed and 82,000 hectares of the Atlantic Forest have been officially designated as an ecological station. That doesn't mean that the fight is over. We still have to get the money to buy the land for the government. We still have to make improvements, we need guards to protect the area, but we are creating a reserve. We have already established an NGO that's in charge of taking care of the area.

The current situation is still tenuous. The military wanted to build the atomic plant to have control of the atomic system. All countries in South America wish to have such power and control. This is where all the money is being spent. We need a democratic government, we need to get rid of the dictatorship. I believe that the only way to prevent destruction is to have the people making the decisions. I do believe that the conservation of nature is the way of doing what is necessary for the people now and in the future.

I apologize for all of this bad news. Help and support is needed for the conservation of the land of Brazil, and to reinforce our hope for our fight. I also have some good news. We are having great support from the press in Brazil, which is very important for nature conservation. The other news I have for you is that we have created two new private foundations for environmental conservation in the past two years. These new foundations will support and contribute to the work being done by our other foundation which is now 20 years old. More than 100 NGOs are being created every three to four years, and at the moment I would say that there are about 400 NGOs in Brazil. We are having big demonstrations in our cities. I live in Sao Paulo, a metropolitan area of around 15 million people who are becoming concerned about the environment. Last year a representative of NGOs was elected to the national congress. This congress is responsible for writing our new constitution and there is a proposal for a whole chapter on the environment. In this chapter it is stated that the government is responsible for the preservation of all the species of animals native to Brazil.

Throughout South America the story is the same: destruction of our forests, destruction of our ecosystems. We need to face this reality so that we may find a strategy: we need plans, we need scientific effort. The tropical climate and environment calls for a different approach and different technology from the temperate climates. We need the help of anyone who can support us technically,

financially, or politically. Any kind of support will be important. We already have very good help from the World Wildlife Fund and it is very important that we have the support of the American public. For example, the World Bank has, due to different pressures, offered several hundred million dollars for the preservation of nature in Brazil and we are going to take it. That will change our possibilities of treating our problems. We need environmental education, we need to reinforce the protection of our national parks and we need to create new national parks. We also need a good use for developed areas. We believe we are entering a new era of treating the conservation problems of the world. It is a long and hard fight but we will succeed by all working together.

ECUADOR— THE PROMISE AND PROBLEMS OF WILDERNESS IN THE THIRD WORLD

Yolanda Kakabadse

A couple of months ago a tribal group of the Amazonian region of Ecuador killed a priest and a nun who intended to land in their territory on a friendly mission. The news of this episode was spread all over the world and became an important topic of discussion. We all speculated on the motives.

What led this tribe of only 50 or less individuals to kill two innocent people? Among the many answers, we can be certain that one of them was the defense of their territory, their integrity, their wilderness.

Those indigenous peoples that still remain within the wild lands of South America are slowly but aggressively being pushed away from their lands. The reasons? Mainly economic ones. As long as the exploitation of the natural resources within wild areas means business, there will be little that we can do to stop the process.

International commerce between developed and developing nations has no pity on local resources. There is a foreign debt and local economic pressures that have to be met, and decision makers from the public and the private sectors fall

into the vicious circle of intensifying the exploitation of natural resources to increase the national income.

Such is the case in Ecuador and its neighbor countries when we talk about shrimp production for the international market, versus the conservation of the mangroves; or timber, versus tropical forests that are being destroyed at an incredible speed; or flower plantations that have put aside local agricultural products and practices.

I believe it is important to emphasize that there is a definite relationship between a country's financial obligations—foreign debt—and its capacity to preserve its natural resources and wild lands. More so, when we consider the lack of awareness on the part of the majority of the population about the advantages or disadvantages of conservation.

What does conservation really mean in most of our countries? Let's go back a couple of decades. Conservation programs and national parks systems were created as a result of well-planned and successful international lobbying originated in the North. It started in the North, and rightly so, because most of its wild lands had been destroyed by human action and many species had already disappeared. The sense of loss and the sense of responsibility for the future made the Northern countries design and implement conservation programs and transfer them to the Southern countries that still had abundant wild areas at hand. Third World countries felt that there was no problem in introducing these conservation programs in their development plans, but felt no urgency to implement them. We still don't. The reasons? On the one hand we haven't suffered the absence of resources; on the other hand there are other national priorities.

The budget assigned for these departments are usually too low. Motivated personnel soon feel defeated and the local population does not understand their goals.

Decision makers consider wild areas as potential alternatives for large investments if natural resources are abundant, or for colonization programs if they aren't.

The general public does not have a definite attitude toward those areas as long as their personal or group interests are not affected. Some groups of the population consider that the benefits of the wild areas are a luxury for the privileged classes who, in addition to what they already have, want to own large territories for their personal enjoyment.

Indigenous people do not believe in conservation programs, whether they be presented by national or foreign organizations, official or private. In the last centuries and in the name of progress, their natural areas and resources have been taken from their hands and have been unmercifully disposed of.

Then, there is the smallest group: the NGOs, formed by environmentalists, scientists and common people, young and old, poor and rich, men and women, who are striving to put things right by:

- Working on legislation to update obsolete laws and regulations;

- Working on pesticides to stop—at least in Ecuador—the corruption of some industries that produce only for export to the Third World;
- Working with the conservation authorities so as not to let them be defeated by the influence of decision makers;
- Promoting applied research among scientists and scientific institutions to identify local alternatives;
- Dealing with indigenous groups that lose faith and hope as the years pass by;
- Negotiating with individuals of the industrial sector to have them change their attitudes toward society;
- Implementing public awareness and educational programs to modify our behavior before it is too late;
- Dealing with officials of bilateral and multilateral agencies, proving that we can do it ourselves; and,
- Promoting institutional building among the other countries of the region so as to strengthen our work.

It is not easy. All these efforts require faith, time, effort, money and international support. Conservation programs, though, have some exceptions, for example those in the Caribbean region and the Galapagos Islands, which are highly profitable largely due to high visibility and tourism. This evidence forces us to conclude that unless conservation projects turn out to be financially successful, they will not be seriously considered by Third World authorities at the moment.

Our actions in conservation must consider the following challenges and meet them effectively with action:

- There is an urgent need to educate and raise awareness among all sectors: decision makers, children, university students and the general public;
- We must look for economically sound alternatives for the people who are presently depending on an irrational use of the natural resources;
- The current situation of the tropical rain forests of the world is a global problem, therefore solutions must also be global;
- The debtor-lender relationship, when focusing on conservation, has proven to be ineffective. We must start or continue to look for solutions that invoke North and South, specifically through NGO cooperation; and,
- Proposals and their implementation will only be feasible if they become an authentic and global partnership.

There are only two paths for the near future. Total destruction of the remaining resources—basically the tropical forests—implies a massive loss of biological and genetic diversity and endangers the survival of the human species. More difficult, but of critical importance is an intensive and immediate action to prevent this destruction.

CONSERVATION BY TRADITIONAL CULTURES IN THE TROPICS

Arturo Gómez-Pompa and Andrea Kaus

It has been said that the main problem in conservation in the tropics has been the activities of native people whose populations have grown to such high density that they have destroyed their soil resources, deforested their lands, overgrazed their pastures and overused their agricultural lands. It is not uncommon to read and hear that shifting agriculture is the main problem for biological conservation in the tropics, a claim made by a few speakers even at the World Wilderness Congress.

The wrong but pervasive concept that the tropical forests represent a poor and difficult environment for the development of complex human societies has been used as a basis for denying the high degree of sociopolitical complexity reached by civilizations in the tropics. This denial led to the acceptance of such sites as merely ritual centers of shifting cultivators coexisting with magnificent forests. The same superficial concept asserted the emptiness of the tropical regions, the low value of their forest resources and the low agricultural potential of the tropical soils. One well-known example of this view is the common belief that the old and magnificent Classic Maya civilization had a major collapse because of a failure in the proper management of the environment.

This conception of tropical forest environments has strongly colored modern approaches to their use by directing attention away from their potential as any kind of renewable, sustainable resource and promoting instead a troubled and erroneous dichotomization between pristine conservation on the one hand and totally unthought-out use on the other. The result has been the over-exploitation of the forest resources, mismanagement of soils and neglect of the human groups who have lived there in the past and live there presently.

Under this belief our society has directed its efforts to preserve pieces of "wild lands" without people and without the influence of people in parks and related protected areas. This approach has been followed by many temperate countries with some success, but the same approach in the tropics has been difficult to implement.

The common conceptual framework behind these efforts lies in the belief that preservation of pristine environments without human interference is the best way to preserve biological diversity, and also helps to reconstruct environments similar to those before the impact of humans. This concept is heavily charged with emotion and its followers are mainly urbanites educated in modern universities, who lack a link with the land and its resources or consideration of

the traditional cultures which inhabited the land before them. Such modern perceptions of preservation forget our past and jump over a long history of human occupancy back into prehuman "pristine" lands.

In contrast with this, there is the need to promote economic development. The "unused" pristine areas often provide the only unreclaimed space (agricultural frontier) available to accommodate landless farmers and open new agricultural and pasture lands. The dilemma of conservation versus development is one of the most important problems facing the underdeveloped world today. It seems to us that these opposing views toward resource management have been overstressed and misunderstood from a historical perspective.

HUMAN IMPACT ON "PRISTINE" ENVIRONMENTS

What we want to preserve today is the result of a complex set of changes that have occurred through time. Climates have changed drastically in the last 20,000 years, as have soils and the biological diversity of ecosystems. Humans especially have had a strong impact in many ecosystems far beyond our present understanding. Fires, deforestation and agriculture have occurred all over the world through historical times. The fact that history is better known outside the tropics does not necessarily mean that equivalent changes have not occurred in the tropics.

Human impact in the tropical areas needs to be studied from an objective approach to understand past and present influences on the structure and composition of tropical ecosystems, and consequently, the human role in the conservation of biological diversity. In order to do that, more knowledge of present-day ancient cultures that subsist in the tropical world is needed to learn their successes and failures, thereby increasing our understanding of the failures and successes of their ancestors.

In the Americas during pre-Hispanic times many cultures lived in the diverse environments of the continent from Canada to Tierra del Fuego. These indigenous groups lived efficiently from the land and its resources in various ways. They were efficient hunters, gatherers, fishermen, agriculturalists and forest managers. They practiced shifting as well as sedentary agriculture, and they managed their wildlife and fisheries. The "pristine" unused environments of the conquerors were the subsistence fields of the natives.

In the tropics we have the longest history of sedentary human occupancy. Very few places in the tropics exist where it can be assured that there are no evidences of human occupancy or human influence in the past. The recently discovered stone-walled forest gardens in the Maya area, the pet kot, were previously confused with climax forests.

Many of the tropical "pristine" forests of today are the result of the last cycle of abandonment by humans. In the history of humankind there have been many cycles of occupancy and use-perturbation, with corresponding cycles of abandonment. Some abandonment cycles are planned and others are unplanned. The best-known planned cycle is that of shifting agriculture, varying from two to five

years of use and from three to 20 or more years of fallow. One very well-known cycle of unplanned abandonment occurred during the European conquest of the Americas, when war and disease reduced the population in some areas down to 20 percent of previous levels.

Many tropical "pristine" forests in America are remnants of managed forests abandoned for nearly 500 years with scattered periodical perturbations, both natural (cyclones, fires) and human (timber mining). In the last 20 to 40 years the greatest known disturbance of the tropical forests of Mexico has occurred. The reasons for this frightening perturbation of today's tropical forests are well known, and with the advent of machines and chemicals, the rate of deforestation has increased immensely. As a result, the forests are entering into a very dangerous stage of perturbation (for its extension and intensity) without anyone's knowledge of when the next abandonment will occur. It is of utmost importance, then, to try to understand what the minimum requirements in ecological and biological diversity are at the present time that may ensure a good recovery in the future, or which may be used if our society decides wisely to restore the lost forest ecosystems.

MAYA SILVICULTURE

In order to answer that question it is necessary to understand what the Maya culture did in order to maintain a high population density in the lowland tropics without diminishing the biological diversity potential of the area. This particular ancient culture, which is a case study on this subject, is suitable for this purpose because there exists very good evidence of the management techniques used in the past that enabled the Maya to conserve the biological diversity we are unsuccessfully trying to preserve today.

In contrast with what is commonly believed, the Maya had a very complex system of natural resource management in which conservation of biological diversity seemed to be a common denominator.

Table 1
Maya Subsistence Systems

Present-Day Maya	Ancient Maya
Milpa	Raised Fields
Kitchen Gardens	Terraces
Ka'aanche'	Silviculture
Orchards	Milpa Forest Gardens (Pet Kotoob)
Plantations	Wildlife Management
Hunting and Gathering	Aquaculture
Livestock/Small Animal Husbandry	Water Management
Irrigation Agriculture	Intensive Animal Husbandry
Forest Mining	Biological Conservation
Fishing	

These complex systems allowed them to attain population densities of 500 people per square kilometer in contrast with present densities of five people per square kilometer. A great variety of subsistence systems available to the Old Maya have been discovered rather recently and include a great diversity of agricultural systems and silvicultural techniques. Several books and articles have been written on this subject and new information is continuously appearing in the literature.

From the biological conservation point of view, the most important subsistence system is the one related to the management of forests and trees. The Old Maya have been blamed for the deforestation of their lands that triggered an ecological disaster, a theory which has then been used as an explanation for the Classic Maya collapse in the ninth century. Recent evidence challenges this assertion.

The concept of "virgin" forest has been challenged for a long time, as several scientists in the past have noted the impact of humans on the vegetation of the tropics. It has been mentioned that the abundance of palms, fruit and other trees in the native vegetation is evidence of past human intervention. In 1937 the American botanist Lundell explored the vegetation of the Peten in Guatemala and found a great abundance of fruit trees in the Maya ruins, which suggested that they may have been planted by the Old Maya. In addition, he later pointed out in 1939 that tree species of economic importance found on the ruins were also species commonly planted by the modern Maya.

More recently, Puleston suggested that the "ramon" tree, *Brosimum alicastrum*, with its edible seeds, may have played a role in the subsistence of the Old Maya. Today these seeds are still used as a substitute for corn or are mixed with it. An important controversy is currently going on over the role of this species in Maya subsistence. The fact is that the present-day Maya, as well as other cultures such as the Huastec and Totonac, still protect and cultivate this tree in their home gardens and have many uses for it.

In addition to this species, the present-day Maya have a great variety of trees that they plant and protect for their own use in kitchen gardens and other similar agroforestry systems. Some of the important species used by the Maya for their tropical fruit and other products include *Artocarpus*, *Bactris gasipaes*, *Diospyros digyna* and others. All of these species are assumed to have been present in the native flora, and the most important species were selected through time for different purposes. Such is the case of the ciruelos (*Spondias spp.* and *Ziziphus sp.*), from which the Maya of one locality recognize 22 varieties. For a complete reference of species use and management in tropical areas write the Fund for Conservation Projects of Young Scientists and Students in Developing Countries, UC Mexus, University of California, Riverside, CA, USA 92521.

What is most intriguing is the fact that many of these species are very abundant in different natural ecosystems of the region and other tropical lowland regions of Mexico and Central America. Many of them are dominant in a number of communities. This extraordinary coincidence of abundance of

useful trees in mature ecosystems is a central question in the understanding of the success or failure of the Maya through time. In addition, these facts may be of great importance in the design of strategies for the conservation of biological diversity in regions with high population densities. The problem, then, is how can the abundance of useful, dominant trees in the old, mature forests of the Maya area be explained? Five different hypotheses can be formulated:

1. Deforestation hypothesis—The Old Maya destroyed most of their forests and thereby caused their own collapse. The natural regeneration process occurred after their collapse in all the deforested areas. In this regeneration process some useful species that were scattered in the area gained an advantage and have dominated the vegetation until the present.

2. Natural hypothesis—The trees were abundant in the area before any human occupancy and the Maya and their predecessors were lucky to find such a rich environment.

3. Accident hypothesis—The trees were there before human arrival but were not necessarily abundant nor dominant, and through their activities humans have by accident created ecological niches (such as those of the archaeological sites) that favor these species.

4. Man-made hypothesis—The species were present in the area but were not necessarily abundant nor dominant, and humans over time selected, protected and cultivated the most useful ones. These actions explain their abundance and dominance in the forest today.

5. Mixed hypothesis—The species were there in the area in some abundance, and humans improved and maintained that abundance and by accident created niches that favored the useful species.

From the available evidences we have found sufficient data in the present-day activities of the modern Maya to support the man-made and mixed hypotheses. From these a silvicultural system for the Old Maya based on the knowledge and techniques used by the present-day Maya has been proposed.

Table 2
Silvicultural Techniques of the Maya
(Gómez-Pompa 1987:6)

Cenotes

Introduction of useful trees

Dooryard Gardens

Germination of seeds in *caanches*

Tree planting

Selection of wild useful trees at beginning

"Natural" Forest Ecosystems

Conservation of forest patches

Selection of useful trees

Introduction of useful trees

Pet Kot

- Selection of forested sites
- Selection and protection of useful wild trees
- Introduction of useful trees

Raised Fields

- Trees in borders of fields
- Tree plantations (cacao?)

Shifting Agriculture

- Selection and protection of trees
- Coppice of selected species in slash
- Tree planting before fallow

Tolche

- Different sizes and forms of forested belt

Tree Plantations

- Fruit trees
- Cacao plantations with legume trees

Other

- Living fences
- Trees in urban and religious centers
- Sacred groves
- Trees in terraces?

These techniques that integrate the Maya silviculture are not all practiced in any one area by the present-day Maya, but all occur in the region. Given past internal communication, political complexity and general levels of empirical knowledge in the Maya area, these techniques were likely to have been integrated at times in the past. They help to explain the presence of useful "natural" forests (forest gardens) in the zone and their possible role in Maya subsistence.

In order to accomplish this hypothetical system of silviculture, there must have been a good biological diversity conservation strategy involving a plan of resource management that ranged from intensive crop cultivation in the ancient irrigated chinampa fields to the creation of artificial forests and with less use the conservation of "pristine" ecosystems. In between, they had many agricultural, agro-silvicultural and silvicultural systems in which the maintenance of biological diversity was the rule. This is probably why, in spite of the fact that the Maya area was densely populated and intensively used in the past, there is no evidence of mass extinctions of species, nor any evidence that species diversity or richness was diminished by the actions of the inhabitants. The proof of this can be found in the richly endemic flora of the Maya area. The secondary succession forest composition, as well, provides evidence of tree species manipulation which maintains a high degree of diversity and usefulness. The regeneration of the ecosystems of the Maya area after successive abandonments was possible only because of the existence of insitu seed banks in managed and "natural" ecosystems, and because of land uses that did not cause irreversible damage to the soils.

In an ongoing literature survey we have been doing in other tropical regions of the world, we have found several examples of similar situations to that of the Maya area. Many communities of the mature primary vegetation are dominated by species of trees that are well known to the local people for their uses. Examples of conscious manipulation of these tree species exists as does evidence of inadvertent manipulation through the combination of cultural practices with ecologically sound measures. For example, trees protected for religious reasons and taboos are unconsciously given competitive advantage in the forest. Other tree species, such as some fire-resistant palms, are better able to survive or coexist with human activities. Even negative manipulation by avoidance of certain toxic tree species (such as *Rhus*) may explain their abundance.

To illustrate what has been found, we have produced a list of some of the tree species reported as dominant in the natural communities of different areas of the tropics which are also reported to be useful or managed by the local cultures. The results so far have been very encouraging, as a strong association exists between the abundance of trees and the uses and management practices such as planting, protecting, and sparing (during forest clearing) of these tree species. Cultural groups which report using and managing these species include: Ashanti, Bokata, Bora, Boruca, Enga, Guaymi, Huastec, Ibo, Jicaque, Kayapo, Maring, Nuaulu, Maya, Talamanca, Terraba, Totonacan, Waika and Zenu.

It is clear that the conservation of the biological diversity of the tropics should have the highest priority. It is also clear that a great many of the areas occupied by the tropical forest ecosystems of today were occupied by traditional cultures for millennia. Many tropical forests are, in fact, managed forests by local cultures, both past and present, and it is to everyone's advantage to learn more about the forests and the people who inhabit them.

Even though the number of managed tree species known by modern science is very low if compared with the tree flora of the region, we have to understand that each culture has its own interests and its own uses for the trees. The more we know about cultures, the more we learn about their value to the trees. As a result, the of managed trees is longer. This important issue has been overlooked by the majority of researchers, modern resource managers and conservationists.

The biological diversity we want to conserve today has been influenced by generations of inhabitants. Even with our modern scientific knowledge, we should be humble enough to learn from the knowledge developed over these many generations by traditional cultures in the tropics. Research on this subject has implications for formulating alternative conservation plans in development schemes. Man-made forests with high diversity can play an important role in the conservation of biological diversity. They offer niches for a great diversity of plant and animal life and also act as biological buffers between the agro-ecosystems and the natural "pristine" ecosystems, while still providing tangible benefits for local people. We must then realize the importance of human experience in the design of the ecosystems of the past, learning from their successes and failures in order to design the ecosystems of the future.

CANADA—THE NEW FRONTIER IN CONSERVATION

Thomas McMillan

The challenge for humankind is to ensure that we heed the wise counsel of Madame Gro Harlem Brundtland and the World Commission on Environment and Development toward "our common future." Otherwise, the world itself will be history. Certainly, what future we and our children might be able to look forward to will be as grim as it will be short.

Fortunately, the WCED is already having an impact on world thinking and, even more important, on our actions. The choice of themes for the 4th World Wilderness Congress—conservation, the need for a global inventory of wilderness areas, the development of conservation strategies and international banking and the debt crisis in the Third World—reflects the growing recognition that environmental and economic decisions must be integrated if the human family is to survive beyond the twentieth century.

The subject of Third World debt might, even a few years ago, have seemed an unlikely subject for environmentalists. Now, however, it is automatically considered as legitimate a topic as the plight of tropical rain forests. Indeed, the world is beginning to recognize that the latter cannot be adequately considered without the former. As the Nobel laureate Dr. George Wald has said, the current state of the Third World debt load is equivalent to modern-day "peonage." The abject poverty and the heavy debt load it breeds drives Third World nations into environmentally disastrous decisions that compound the economic crisis in which they find themselves. If the vicious circle is not cut, neither their economy nor their environment will last. For the Third World, poverty is pollution and pollution is poverty.

But we in the industrialized nations have no cause for feeling superior. We are not only destroying the environment in which we live, we are, wittingly or unwittingly, encouraging others to destroy theirs as well. Only recently, for example, has Canada's multimillion dollar foreign assistance program required environmental assessments for development projects it funds in the Third World. In the past, we have been a party to some of the most obscene violations of the environment ever committed in that part of the planet—all in the name of altruism. We have helped give the Good Samaritan a bad name! If, in the words of the late Richard St. Barbe Baker, the planet is being "skinned alive," we, like other industrialized countries, are largely responsible for the offense.

It is as though humankind's ultimate purpose in life is to exploit every natural resource until nothing remains of it. Having decimated one species, the object is to line up the next victim for slaughter. Isn't it ironic that, throughout

the course of history, the very resources that humankind has extinguished have been renewable? One wonders whether we are driven by some kind of death wish that challenges us to test the outer limits of our capacity to destroy everything we touch, including ourselves. Perhaps Bertrand Russell was right when he observed, "Ever since Adam ate the apple, man has never refrained from any folly of which he was capable."

It requires a special kind of arrogance, I think, to assume that we *Homo sapiens* are the lords of creation and that it is there to serve only us. That kind of pride is not just one of the seven deadly sins, it borders on pathological stupidity. In our headlong selfishness we forget that, in destroying what we deem nature has put there to serve us, we increase the likelihood of our own extinction.

We must realize there is nothing intrinsically hospitable about planet Earth. Our planet does not support a rich and complex way of life because it is ideally suited for that purpose. It is ideally suited to support life because of the rich and diverse ecological systems. Without the moderating effects of vegetation, of gas exchange and of the recycling of materials conducted by billions of invertebrates—the unsung heroes of planetary survival—the planet Earth would be as unlikely a site for the Garden of Eden as Mars or Venus.

The message and challenge of the Brundtland Commission has come none too soon. Canada is committed to meeting that challenge.

In October 1987, as Canada's spokesperson in the special UN debate on the Brundtland Report, I will respond formally to the Commission. A major portion of our response will be based on a Canada-wide task force on environment and economy established last year in anticipation of the Brundtland Commission's report. It has drawn on the skills of six federal and provincial environment ministers, industrial leaders, environmentalists and academics.

The task force will be issuing its plan next week in Quebec City. The plan underscores the need for fundamental changes in the way environmental and economic decisions are made. And it will call, in particular, for the development of conservation strategies—an approach already taken in my home province of Prince Edward Island and begun in Canada's north by the Inuit and territorial governments.

Reflecting an awareness that conservation must be woven into the very fabric of the economy, Canada is attempting to practice the Brundtland ethic. On the international front, the Canadian International Development Agency—the federal government's principle arm for foreign aid—has adopted a radically different policy to avoid the kind of misguided altruism in the Third World to which I referred earlier.

In the same vein, Canada's minister of external affairs announced earlier this month that the country is forgiving almost a billion dollars of debt owed by African nations to Canada. Many more millions will be forgiven by Canada in the future. We believe it is insane, if not criminal, for the poorest nations on earth to pay more money to wealthy nations like Canada than they receive in aid from those same countries.

Canada has just hosted arguably the most important international diplomatic conference on the environment and economy ever held. At that conference, nations around the world agreed to an historic protocol: to slash in half by 1999 the production of chemicals that destroy the stratospheric ozone (that layer of gases around the earth that protects the human race and all other life forms from the most lethal of the sun's rays). The Montreal Protocol constitutes the first-ever global treaty on the atmosphere—in effect, a law of the air.

Scientists confirm that since 1970, the earth's sun shield has been weakened by some 3 percent. It is projected that, without the Montreal Protocol, the ozone layer would be depleted by 15 percent in the next 45 years. With each 1 percent decrease in ozone, the incidence of cancer would increase by 4 percent, not to mention increases in eye disease and in injury to the human body's immune system. The same chemicals risk devastating the world's capacity to feed itself. Grains and fish are especially vulnerable.

Indeed, at the current rate of destruction, the ozone layer is thought to have a life span of no more than 100 years—a period that scarcely extends beyond that of our generation's grandchildren. One does not need to be a prophet of doom to recognize that a planetary time bomb is ticking away and that the pace is accelerating. The Montreal Protocol imposes tough restrictions on governments, on industry and on consumers around the world. The Protocol contains provisions for tough trade sanctions against violators. Every country contributed to the success of the Montreal conference.

To my mind, the ability of the human family to forge a genuinely useful global law on such a contentious set of issues demonstrates that when the political will is mustered, it is possible to improve the odds in the risky game the world has been playing with its own future.

Surely, the Montreal Protocol and the way in which it was forged should serve as a model for the world community in addressing other transboundary environmental problems.

Of particular concern to Canada are sulphur dioxide emissions that travel long distances, even countries away, from their origins. Acid rain is devastating the natural environment of my country. Some 14,000 lakes have been acidified, 150,000 others are in the process of acidification and another 150,000 are vulnerable. Nowhere else is the environment-economy link more obvious than in the area of acid rain. Just ask the hundreds of tourist operators whose lodges face closure as the lakes die, the fish disappear and the sports fishermen no longer come. Acid rain is now one of the government of Canada's two or three major policy priorities. And it is the number one Canada-U.S. issue with the Canadian public.

Within Canada itself, strict controls have been imposed on industry through legally binding federal-provincial accords, supported by a \$3 billion government-industry program designed to slash total acid rain-causing emissions in half by 1994, based on 1980 levels. But our program, strong as it is, deals with only half the problem, because the United States exports to us 50 percent of the total

emissions that destroy our crops, retard our forestry, kill our lakes, destroy our built heritage and compromise our health. When our prime minister said he wanted free trade with the United States, acid rain was not what he had in mind!

The acid-rain issue is not just an environmental or economic issue to Canadians. We see it as a litmus test of whether Canadian-U.S. relations are merely an accident of geography or an exercise in genuine cooperation in areas of common concern. The chilling fact is that if two countries with such close historic ties cannot make progress on an issue like acid rain, with its terrible consequences for both countries, what hope is there for progress on environmental issues among nations less bound by links of friendship? Is the Montreal Protocol, however important, to be merely an aberration in world affairs?

Just when one is tempted to despair, something miraculous occurs to give all of us reason for hope. One such miracle occurred in my country. And because of the worldwide salience of the issue, that miracle should inspire us all.

At stake was a remote and magnificent archipelago, an area that many of you know as South Moresby. It has been described as the Canadian Galapagos, harboring, as it does, species of flora and fauna unique in the world. It also contains some of the last virgin rain forests in this continent, with Sitka spruce and cedar over 1,000 years old and as large as any in the world. Just as it is home to bald eagles, sea lions, the world's biggest black bear and streams rich with salmon, so also it is the ancestral home of the Haida. That great nation flourished in the area 5,000 years before Christ. While their numbers in the last century were decimated by white man's disease, the Haida did survive and their rich cultural heritage is as much a part of what makes South Moresby unique as the wilderness itself.

But all of the natural and cultural splendor was nearly lost to the world in a classic struggle. The Haida, allied with dedicated environmentalists, fought to save their ancestral homeland as a powerful but troubled forest industry set its sights on the trees that rise so tall their lowest branches are like the vaulted ceilings of the great cathedrals of Europe.

Most of you are familiar with the happy outcome. Instead of clashing fatally, the environmental and economic goals were reconciled. Following an eleventh-hour intervention by the Canadian prime minister, the government of Canada and the relevant provincial government agreed on a multimillion dollar package—\$106 million from the federal government alone—to create in South Moresby a national park as part of a total economic development strategy for the area. The Haida themselves will play a leading role in that connection.

The great Haida artist and carver, Bill Reid, wrote during the height of the battle to save South Moresby, "These shining islands may be the signposts that point the way to a renewed, harmonious relationship with this, the only world we're ever going to have."

For Canada, South Moresby was a watershed. Thousands of Canadians who had not before seen themselves as environmentalists were galvanized in a great national cause to save what they instinctively recognized as part of themselves.

No other issue had so illuminated the fundamental importance Canadians attach to environmental values. I am convinced that, appearances and Lord Russell to the contrary, we humans have it in us to save ourselves from ourselves.

An ancient Chinese proverb goes something like this: "If we don't change our course, we will end up where we are headed." I assert that we don't want to be where we are headed.

The World Commission on Environment and Development provides a new path. Let us follow it and, in doing so, ensure that we end up where we and our children and, indeed, the generations yet unborn, would want to be.

THE UNITED STATES— WHY WILDERNESS?

Roderick Frazier Nash

This is a time of irreversible decision for wilderness on earth. As a species, our kind has followed with a vengeance the advice of the Old Testament prophet and "made the crooked straight and the rough places plain." The transformation of wilderness into civilization has taken on aspects of a religion and crusade and nowhere is this more than in the United States. Presently in the 48 continuous states, excluding Alaska, the amount of protected wilderness is approximately equal to the amount of pavement: about 2 percent of the total land mass is in each category. Michael McCloskey's world inventory of wilderness (also included in these proceedings) makes the point another way. Wilderness is indeed an endangered geographical species.

Today, not 1890, is the effectual end of the American frontier. Our generation is making the final decisions about the continuing presence of wildness in the environment. The limits of the earth are rapidly being reached, and what this means is that wilderness will no longer exist as left-over or forgotten land that nobody knows. It will either be consciously and deliberately preserved by policy and law or it will vanish. The future will hold us accountable for the quality of environment it inherits. Will we pass on an enduring legacy of wilderness or will we bequeath a totally-modified earth?

Pioneering in the past involved the destruction of wilderness, and it has almost completely succeeded. Future pioneering should emphasize preservation. The mission of the new frontiersmen should be centered on restraining, not

extending, civilization. The point is that we have conquered the wilderness; now we need to conquer ourselves and our appetite for growth and development. Axes and rifles, barbed wire and bulldozers were useful in a time when civilization was struggling for a foothold in the wild world. But now it is wilderness that is struggling for existence, and the need is for new tools. Research into and education about the value of wilderness are the appropriate tools for the new frontiersmen. So are institutions such as the proposed World Conservation Bank. A congress like this one gives promise of a new perspective.

There is substantial wilderness left on parts of the planet. The polar regions are largely wild, as the McCloskey inventory suggests, so is the floor of the ocean and the moon. But for most of us these are not "meaningful" wildernesses. Like heaven, it is nice to know it exists, but most of us are never going to get there! More specifically, in the tropical and temperate latitudes, where most humans live, wilderness is melting away, as Bob Marshall liked to say, like a snowbank in the August sun. Extrapolating from the recent growth of science and technology, can we be certain that we will not have within our power in a few decades the ability to civilize the poles, the oceans and even the stars? The necessity, again, is for restraint. We need to understand that on a limited planet everything must have limits. This includes our numbers and our impact. It is time to understand that civilization can be ironic: some is undeniably good, but in excess it can destroy itself by its own "too much." Balance is the key. Wilderness should no longer be seen as a threat to civilization, but rather as a valuable part of a rich and full civilization—an asset and not an adversary. In time we might discover something the old-style pioneers could not have been expected to know: Wilderness is not the enemy of civilization, but a necessity if that civilization is to live up to its potential as a human habitat.

Just a century and a half ago, on the great plains of Colorado, buffalo thundered, wolves howled and grizzly roamed the creek bottoms. Humans living then were wilderness people. We called them Indians. In 1837 another kind of people, the mountain men, were entering Colorado, and the last thing on their minds was the preservation of wilderness. What concerned them, understandably, was the preservation and extension of the civilization of which they were vanguards. Yet ironically, these frontiersmen sowed the seeds of wilderness appreciation. Their success in extending civilization made wilderness rare and, according to the scarcity theory of value, appreciated. Whereas a century and a half ago it could be said that there was too much wilderness, now, as we look around Denver's smog-fouled air basin, there is too much civilization. We have come full circle from the plains where deer, antelope and buffalo played to a metropolis where we plan strategy for finding places for the buffalo to roam again.

Edward Abbey, the writer, says that wilderness needs no defense, only more defenders. Respectfully, I disagree. There is a pressing need for elucidation of the underlying principles and values upon which an effective defense of wilderness can be built. Such a philosophy of wilderness has been notable for its absence in the U.S. preservation movement.

We have, rather, witnessed a series of frantic, subjective and highly-emotional defenses of particular places. "Save the grizzly!" or "Save Grand Canyon!" we cry. If anyone asked, "Why?" there was a sharp intake of breath, a scowl and the reply that it was the *Grand Canyon*. But that is not enough. The questions remain: *Why* save a place like the Grand Canyon, *why* keep it wild?

The point is that wilderness appreciation has been a creed, a faith, something you felt in your bones, something that was almost sullied by analysis and explication. But that is not good enough, especially when the world's wild places are increasingly hard-pressed by demands for the expansion of civilization. There is a need for an articulation of wilderness values based on historical fact, contemporary experience and the projected future needs of human life and of all life. This is the vital philosophy of wilderness. It must lie behind the defense of particular wild places like the philosophy of human dignity lies behind defenses of human freedom. Philosophers have spent 2,500 years setting forth the liberal philosophy. So, when Thomas Jefferson wrote his famous Declaration, when Lincoln emancipated the slaves or when more recent protests of discrimination occurred, few needed to ask, "Why?" The value of liberty and equality is well defined. Not so with the value of wilderness. The appreciation of wild places and wild creatures is, after all, barely a century old.

We should pause for a moment to consider several ways *not* to defend wilderness, ways that do not make the best case for preservation. The first is *scenery*. The problem here is that wilderness is not about scenery; it is about the absence of technological civilization and its controlling influence. Now some people do find the absence of civilization "scenic," but many others find it strange, weird, harsh, frightening and decidedly unlovely. They value it not because it is beautiful but because it is wild. Basing a defense of this kind of country on scenic beauty is to leave the case open to all sorts of logical pitfalls. How, for instance, is fire to be justified as a natural part of a wilderness ecosystem? Using beauty to defend wilderness, in sum, is like saying that only beautiful people are to be accorded rights to exist. We abandoned that tactic long ago in defending human rights, and it is time to question its validity in making a case for wilderness.

Recreation is another sandy foundation for wild country because it is not wilderness dependent, to use a concept developed by John Hendee, Robert Lucas and George Stankey. People can and do recreate and generally have fun outdoors in very nonwilderness settings. Camping can be had in KOA campgrounds, and excellent hunting and fishing is available in fenced and stocked compounds. We need to investigate what it is about *wilderness* recreation that is different and valuable.

A third way not to defend wilderness is *economics*, and I say this with the full realization that cost-benefit analyses and the expenditures of tourists have been used repeatedly to justify the existence of wildness. Generally, proponents of the economic argument are interested in offering a countervailing argument to the developers' calculations of the cash value of natural resources present in

wilderness. The problem is that wilderness almost always loses in such figuring. Its "benefits" are invariably less than, say, that which timber or mineral extraction, or condominium building, would provide. And tourists utilizing hotels and restaurants always spend more than backpackers. Economic arguments are thus a dead end for wilderness. Moreover, there is the point that wilderness should be measured on a different scale of value, like the Parthenon or Chartres Cathedral or a beloved person. I am reminded here of an exchange I once had with a distinguished resource economist who was using the cost-benefit technique to evaluate wilderness. At the conclusion of his remarks, I simply asked him, "What's the cost-benefit ratio of your 87-year-old mother?" Affronted, the economist blustered, "Well, that's different." So, I submit, is wilderness. It's our biological and cultural mother. The point is that wilderness defenders should have the courage to not go to the economic mat with their opponents. They should remember that economists are sometimes accused of knowing the price of everything and the value of nothing.

A corollary to this reasoning is that the wilderness we have protected around the world is generally worthless land. There are few designated wildernesses in Iowa or France. We have saved places that are high, dry, cold and remote. When an economic use is found for such a place, more likely than not, its wilderness value is forgotten. The classic instance in U.S. history is Yosemite National Park's once-spectacular Hetch Hetchy Valley. In 1913 San Francisco convinced Congress that the highest value of the region was as a municipal water reservoir and hydropower facility. It was removed from the national park and flooded, a reminder to our foreign guests that the U.S. example can demonstrate how not to care for wilderness as well as how to preserve it. The lesson is that those who lean too heavily on economic arguments for wilderness run the risk of having their leaning posts cut off at the roots.

Reviewing the liabilities of scenery, recreation and economics as defenses of wilderness, and thinking about the reasons why we love it, I thought about an analogy. May I address the men in the audience for a moment? Isn't it true, gentlemen, that we have all been asked by a woman at one time or another (usually, it seems, late at night), "Why do you love me?" I suggest that three reasons that won't be satisfactory are scenery, recreation and economics!

So how are we to answer the question, "Why do we love wilderness?" I will sketch, briefly, seven reasons that are wilderness-dependent, historically valid and shaped by an understanding of both the realities of wilderness and the needs of civilization. They have been refined by our best wilderness philosophers and they constitute the granite philosophical bedrock in which the case for wilderness should rest.

1. The first might be called the *scientific value*. It rests on the idea that wilderness is a reservoir of normal ecological and evolutionary processes as well as a kind of biological safe-deposit box for the many forms of life. One variation of this value is quite utilitarian and might be called the "cure-for-cancer" argument. The wild places of the world harbor species presently and potentially

important to human welfare and even survival. As David Brower is fond of saying, "Wilderness holds the answers to questions we do not yet know how to ask." Norman Myers prefers the metaphor of an ark: those who protect wilderness are like Noah. They make sure that nothing is lost from the full complement of genetic raw material evolved on earth. But on a less instrumental plane, the scientific argument suggests that humans have no right to disturb the evolutionary process. We have already modified the planet enough. When it comes to the existence of species, we should be careful about playing God in Yellowstone or anywhere else. Perhaps Aldo Leopold put it best when he observed that the first law on successful tinkering is to save all the parts. Our own survival, and that of many other creatures, depends on wilderness environments far more than we think. And mistakes in this area are generally final. Extinction, as the Nature Conservancy likes to point out, is forever.

2. *Spiritual values* are the second important pillar in support of wilderness. For many people wilderness is as important as temple or church. We might start with the American Indians and other aboriginal people who regarded places, not just buildings with steeples, as sacred. Commonly, these sacred spaces were in the wilderness where the messages of divine powers seemed the clearest. Later generations, pursuing answers to the weightier problems in human existence, found wilderness to have religious significance. Some worshipped nature outright, some found evidence of God in the natural world and some simply turned to wilderness as an appropriate place to pray and reflect. Henry David Thoreau and Ralph Waldo Emerson, the American Transcendentalists, certainly believed that nature was the symbol of the spiritual world. And John Muir regarded Hetchy Hetchy Valley as a temple. Even Colorado's own John Denver sings about cathedral mountains. Around the world we find that the deserts and open spaces have been the source of many of the world's great faiths. Jesus was not the only religious leader to commune with deity in the wilderness.

The religious significance many find in wilderness raises the possibility of defending it on the grounds of freedom of worship. This is a basic right in U.S. culture and in many others. Even if wilderness is a church for a minority, do not they have a right to worship as they choose? Indians have been accorded this right under the Native American Religious Freedom Act of 1978. Although hitherto neglected, it could become a bulwark of non-Indian defense of wilderness.

3. Earlier I dismissed scenery as a basis for a wilderness philosophy, but there is an *aesthetic value* dependent on wild settings. The Romantic movement of the seventeenth and eighteenth centuries had a word for it: "sublimity." It involved awe in the face of large, unmodified natural forces and places such as storms, waterfalls, mountains and deserts. Some people find a beauty here that cannot be replicated in pastoral settings, cities or art museums. If the destruction of beauty is to be avoided, then wilderness should be preserved.

4. The *heritage value* of wilderness is grounded on the fact that wild country has been a major force in the shaping of character and culture. As a species, we have lived in the wilderness a thousand times longer than in civilization. In

nations like the United States, Canada and Australia, wilderness has had a very recent and very strong formative influence. The U.S. historian Frederick Jackson Turner pointed to one form when he argued in 1893 that the frontier experience built respect for the individual and, later, for democratic institutions. We need wilderness, Turner implied, if we are to understand the source of freedom. Wilderness nourishes it by permitting people to be different, to escape the controlling force of established institutions. The Puritans in Massachusetts Bay and the Mormons in Utah understood this association. So do contemporary freedom fighters who take to the hills to continue their rebellion if the hills exist. Parenthetically, the totalitarian regime that George Orwell described in his novel, *1984*, made its first concern the elimination of wilderness. Big Brother could not control thought in wild country.

Wilderness is also an historical document just as much as a collection of manuscripts or a bill of rights. Losing wilderness means losing the ability to understand our past; it is comparable to tearing pages from a book in the library. Could we go even further and say that people have a right to their heritage, their history? If so, the preservation of wilderness is incumbent on our generation.

5. Physical health is not wilderness-dependent. You can become very fit at an urban health club. But wilderness has *psychological value* based on the contrast it offers to the environments which most people occupy most of the time. When these civilized environments become repressive, to use a concept the psychologist Sigmund Freud popularized, wilderness offers a unique opportunity for psychological renewal—literally recreation. The reason is that our minds developed under wilderness conditions for millions of years. Suddenly in the last few hundred we have been propelled into a world of bewildering speed and complexity. For some people occasional relief is a vital mental necessity. They covet the chance to drop back into the older and more comfortable channels. Isn't this what Grey Owl, whose statement graces the program of this Congress, meant by offering distraught civilized humans a green leaf? He is not alone in holding that idea. Primitivists from Jean-Jacques Rousseau with his "noble savage" to Edgar Rice Burroughs and Tarzan have argued that the wild world produces a superior human being. Overcivilization is a real and growing danger. Contemporary therapy programs, such as those of Outward Bound, use the challenges of wilderness to build self-reliance and self-respect. A wilderness area may well have more psychological importance than hundreds of beds in a mental hospital.

6. Wilderness has *cultural value*, because in the words of Ralph Waldo Emerson, it permits an opportunity for an original relationship to the universe. The wild world is cultural raw material. Artists, musicians, poets and writers have turned to it repeatedly in their quest to shape a distinctive and distinguished culture. In the United States, cultural independence from the Old World did not come until writers such as James Fenimore Cooper and painters such as Thomas Cole began to use wilderness as a setting for their work. This has been true around the world. If we preserve it, wilderness can continue to inspire cul-