

Current Major Activities on the Conservation and Sustainable Use of Biological Diversity

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1 Introduction

It is now well known that biodiversity is being lost globally at a rate that is faster than at any previous time in history (Heywood and Watson 1995). Worse, this rate seems to be accelerating as growing numbers of people use more resources to support expanding national economies. Some people may contend that the loss of biodiversity is one of the prices we must pay for progress. But this is a short-term view, because biodiversity is essential for human welfare and provides societies with the basis for adapting to the changes which are certain to come. The Convention on Biological Diversity, which China ratified on 5 January 1993, is a clear indication that governments are beginning to listen to the concerns biologists have expressed about the loss of biodiversity. It has stimulated much new thinking about how people can live in balance with their renewable resources. This paper will review some of the new approaches that may be of interest to Chinese scientists and identify several areas where additional progress can be made.

Conserving biodiversity requires governments to face a major challenge. Policies to conserve biodiversity tend to call for fundamental changes in the way people behave and relate to the environment. For example, IUCN, WWF, and UNEP (1991), Ophuls and Boyan (1992), Haila and Levens (1992) and Piel (1992) have all recently called for limits on rates of resource use, following the calls of Schumacher (1974) and Daly and Cobb (1989) for a minimal frugal steady state—like much of rural China—as the appropriate form of a post-industrial society. Prescriptions for a sustainable future based on principles of conservation biology often involve restricting access to resources, expect people to forego material benefits, assign values to resources that are elusive or difficult to measure, and require payment today for abstract future benefits.

However, experience suggests that the most popular public policies are those calling for modest changes in current practices to address immediate, proximate causes rather than imposing comprehensive changes in deeply-imbedded social behaviour (Tobin 1990). Popular policies coincide with prevailing public opinion and do not require people to change their lifestyles or cause them great inconvenience; they distribute material benefits to a majority or to a politically significant and effectively organized minority; they provide more benefits than costs, thereby favouring policies with easily monetized values, such as goods traded in the marketplace or development that provides jobs; and they generate concentrated immediate

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benefits while deferring and diffusing costs. As the economy of China continues to expand at rates approaching 10 percent per year, the public is beginning to experience new levels of material welfare, at the cost of China's biodiversity. What can China's scientists do to ensure that decision-makers, and the general public, are aware of the trade-offs that are being made, and of the alternatives that may be available?

In seeking answers to this question, scientists need to understand that the problem of biodiversity loss is part of a more comprehensive and interconnected web. The world is facing such a multiplicity of crises, inequities, dangers, and stresses ranging from terrorism to instability in financial markets to global warming to ozone depletion to uncertain energy supplies that they cannot all be named, much less studied (Rappaport 1993). The traditional scientific approach of seeking to understand systems by reducing them to components and analyzing the interactions between them might facilitate "problem-solving", but cannot provide an adequate understanding of complex systems. Conserving biodiversity, in the view of many, therefore requires moving toward a comprehensive view which synthesizes contributions from numerous sectors (WRI, IUCN, UNEP 1992); progress will only come from a synthesis of many sciences, institutions, and sectors.

Such a comprehensive view is necessary for understanding the problem, but it is not an appropriate basis for action. The very enormity of the interconnected environment makes it impossible to treat as a whole. In many cases and for most people, it is simply too overwhelming to think concurrently of whole litanies of problems; the response is to sink into passive despair. Instead, tactically defensible, or strategically defensive, points of intervention have to be found. Building a series of "small wins" creates a sense of control, reduces frustration and anxiety, and fosters continued enthusiasm on the part of the public, scientists, and politicians (Heinen and Low 1991).

Thus efforts such as establishing a biodiversity database, establishing individual protected areas, incorporating biodiversity into the school curriculum, encouraging farmers to maintain genetic diversity in their crops, rewarding governors for outstanding conservation action, and so forth are all important measures.

However, these "small wins" can be real victories only if they contribute to an overall strategy for conserving biodiversity, as contained in China's Biodiversity Action Plan (NEPA 1994) and expanded upon in the June 1995 report of the Biodiversity Working Group of the China Council for International Cooperation on Environment and Development. However, converting these excellent policies and specific actions into reality on the ground requires a politically-sophisticated approach involving multi-disciplinary actions such as those discussed below.

2 *The social and political setting*

When conservation was confined to endangered species or national parks that did not involve critical national or international interests, the stakes were sufficiently small for conservation to be left to a few specialized agencies representing the "scientific" perspective. The issues arising were not sufficiently important to merit attention on the domestic political agenda or to gain much international support. But this changed dramatically when "biodiversity" was merged with the concept of development during the discussions leading to the Convention on Biological Diversity (CBD).

Signed by 157 nations at the United Nations Conference on Environment and Development (the "Earth Summit" held in Rio de Janeiro in June 1992), the Convention entered into force at the end of 1993, and over 130 nations had ratified by the end of 1995. The Convention commits governments to conserve biological diversity, use biological resources sustainably, and promote equitable sharing of the benefits arising from the use of such resources. However, advancing from the general objectives to real changes in behaviour will require overcoming a number of formidable political obstacles at both national and international levels (Mathews 1991, Sanchez and Juma 1994).

"Biodiversity" brings issues such as equitable sharing of benefits, intellectual property rights, sustainable development, inter- and intra-generational equity, and national sovereignty to the very centre of modern conservation. Biologists are now sharing a larger and more important political stage with agricultural scientists, anthropologists, ethnobiologists, lawyers, economists, pharmaceutical firms, farmers, foresters, tourism agencies, industrialists, indigenous and traditional peoples, and many others. The fact that these competing groups claim resources, powers and privileges is a political reality that calls for political decisions. This political process is not something to which scientists are accustomed by training, or for which they have a predilection, but it is an unavoidable reality.

Many of the most important decisions affecting biodiversity—especially on issues of budgets, priorities, information, and resource management policies—are taken by politicians and "non-conservation" sectors of government (ministries of finance, trade, defense, etc.). Scientists, who tend to believe that action must follow logically upon their findings, discover to their surprise that governments and industries often treat them as just another interest group. As a result, scientists are in danger of being little more than concerned bystanders when policies are formulated to address the problems of conserving biodiversity (Tobin 1990).

Most problems affecting biodiversity reflect a conflict of interests. Scientists may contend that reliable information is the basis for sound decision-making about such conflicts. But most will admit that they have inadequate knowledge about the natural fluctuations in populations, relations with other variables in the ecosystem, and impacts of various harvesting regimes to prescribe optimal ways of using biological resources; "sustainable use" often remains an elusive goal. Thus for many harvested resources, increasingly knowledgeable and sceptical politicians are asking questions that cannot be answered by scientists with a suitable degree of certainty (Binkley 1992). Therefore, competing interest groups tend to fill the information vacuum with self-serving interpretations of "truth", often based on incomplete knowledge or misinterpretations of the research data collected by scientists.

But even if better knowledge were available, the policy environment is still highly volatile, because many mutually-exclusive choices are possible, the long-term implications of management alternatives are difficult to predict, and different groups have different access to the political process. Political forces will ultimately decide what to do about biological resources, but scientists are most likely to have their point of view heard when they are able to couch their arguments in terms that bureaucrats and politicians find convincing, and feel that their constituents will support.

Appreciating that the loss of biodiversity is not a "scientific" problem as traditionally understood is only a preliminary step in designing strategies for preserving it. The political difficulties of keeping biodiversity on the public agenda are formidable. First, current practices

which are depleting biodiversity often are extremely popular. The fact that the desire for consumption is far more powerful than the conservation-oriented advice of many scientists should come as no particular surprise, as incentives to consume far outweigh incentives to conserve. For example, the United Nations Commission on Sustainable Development found that worldwide the amount of money governments spent in 1992 to support environmental destructive behaviour amounted to about US \$ 1 trillion (CSD 1994). Another indicator is the amount of money spent on advertising, basically encouraging people to consume more than they might otherwise consume; globally, advertising budgets in 1994 amounted to US \$ 337 billion (more than the annual Gross National Product of Australia or the Netherlands.)

Second, no easily-identified opponent is available against which conservation forces can be rallied; unlike such headline-makers as Bhopal, the Kobe earthquake, and Chernobyl, no newsworthy disasters have yet linked human welfare with the loss of biodiversity (Tobin 1990); and indeed, no Chinese birds or mammals are known to have become extinct in the past 400 years (though of course many are on the verge of extinction and could disappear forever in the next few years). On the contrary, many people are making substantial profits from over-exploiting biological resources in China today, and those with the highest political profiles tend to be among those making the largest profits through over-exploitation.

And third, the loss of biodiversity has no immediately observable impact on lifestyles, especially those of people living in cities far removed from the biological resources which support their consumption. If dozens or hundreds of species are being lost per day, as many experts assert (e.g., Myers 1993, Wilson and Peter 1988), then people are already living with the consequences of extinction without any discernible effects on their daily lives. And when conservation biologists argue that efforts to conserve endangered species deserve especially high priority, they have difficulty in linking this argument directly to the resource development issues of greatest interest to politicians because these species have already been reduced to such low population levels that they often can be utilized as little more than symbols.

To the extent that politicians reflect public opinion, an important problem may be the perception of biological reality by the general public. The politically-influential people living in cities often appreciate the natural world, but what they appreciate is not their interconnection with it (Daniel 1990). Rather, they give a sentimental or aesthetic value to nature, as something beautiful or peaceful or magnificent, or as the formidable foe against which their ancestors struggled and prevailed. Rural people, on the other hand, tend to see biodiversity in strictly practical terms of resources, health, and welfare.

This leads to a disparity between the principle of conserving biodiversity and the practice of managing individual species or systems of resources. In many cases, preserving species such as pandas, tigers, or cranes provides primarily abstract benefits to individual members of the general—largely urban—public, while the people who are expected to make economic sacrifices by restricting their activities in the habitat of these species tend to be large-scale forestry interests or developers who are very effective in conveying their concerns to politicians; or small farmers over whom conservation agencies have little influence and who often end up paying most of the opportunity costs of conservation. So while the general public may agree with biodiversity conservation in the abstract, if they think about it at all, the support by rural people and commercial interests for specific action on threatened species or crop vari-

eties tends to be much weaker because they pay more of the costs and perceive fewer of the benefits. Thus many government conservation programs, especially if they are designed in the capital cities in response to the more powerful urban interests or international pressure groups, face difficulties when they need to be implemented in the countryside, sometimes even causing a backlash as rural people protest about the loss of their historical responsibility as resource managers and about having to pay the opportunity costs for conserving what the world regards as its global heritage (Dang 1991).

On the other hand, conservation programs designed by local people or in close collaboration with them and which are designed to meet their concerns for sustainable use of biological resources can earn strong support, and this may be where more scientific effort in China should be directed (Western and Wright 1994).

3 *Biodiversity today: major issues*

Set against the social and political background outlined above, the following issues appear to represent the major current concerns in the field of biodiversity.

3.1 Scientific issues

- Environmental change will continue and even accelerate, because the amount of space on our planet and the natural resource base are fixed, but both energy consumption and human population are expanding; therefore, it is inevitable that pressure on fixed resources will increase.
- Scientific knowledge about many crucial issues of biodiversity is still inadequate; ecologists have not yet developed a body of quantitative science to predict changes in species composition or explain the way in which species composition influences the functioning of ecosystems. Much research is still required to understand species composition in many parts of the world, and what will be the impact of losing species.
- Saving individual species may eventually play a less central role in biodiversity policy, and the species-protection policy is perhaps best seen as a temporary expedient; but in many cases, good ecosystem management will be identical to good species-level management. Policy should be driven by the need to conserve all biodiversity, from genes to life zones, so that sustainable development and the high quality of life on our planet can be supported.
- Nature needs to be managed on multiple scales, including the ecological system scale of time and space as well as the short-term economic scale which seems to dominate most current thinking. While attention to individual species may still be required in some cases, it is clear that managing large-scale systems for one or a few resources can lead to increased brittleness, making them susceptible to collapse or gradual degradation. Therefore, management actions need to be based on system-level characteristics and the dynamic processes that they represent.
- Four main areas with rapidly-evolving paradigms of thought are driving ecosystem management: (1) the perception of a rapidly changing world; (2) the notion of spatial and temporal hierarchies; (3) the resiliency of ecosystems; and (4) the human dimension of management, including humans as agents of environmental change.
- Increased effort is required to document life on earth, but given the enormity of the task and the increasing rapidity of extinction, other alternatives also must be explored, in-

cluding *ex-situ* methods such as cryopreservation (preservation by freezing).

- Biotechnology is at the brink of major new discoveries which will enable scientists to read and use genetic "texts" in ways that are currently unmanageable, but they will not be able to work on texts that have been lost or destroyed by the current generation. We are limited by a lack of imagination which is perhaps understandable at the early stages of a profound, dramatic revolution in biological technology, rather like the Wright Brothers trying to envision a moon landing within three generations.
- Rehabilitation of degraded ecosystems will be an increasingly important activity, particularly in the proximity of urban areas where damaged lands are so prevalent. Sometimes the first option for ecosystem management (i.e., use of native systems and natural succession) is either not available or not sufficient to accomplish the agreed management goals. For example, natural ecosystems may have low net productivity and thus have limitations in situations where maximizing a net yield is necessary; and when habitats are excessively damaged due to careless human activity, natural successions and native systems may not be effective for rehabilitation because native species may grow slowly and succession is arrested. Under these conditions, it may be necessary to import genetic material from other geographic areas to accelerate the healing process of the ecosystem.
- While human activity is not necessarily incompatible with the maintenance of biodiversity, some important components of biodiversity are most likely to prosper best in areas that are remote from human influence; where extreme environmental conditions prevail; or are associated with conditions selected by humans (that is, within protected areas or ecosystems that are managed directly by people and where new environmental conditions select for new combinations of species that form complex ecosystems). All of this requires guidance from scientists.
- Successful policy-making requires continuous feedback from field-level resource management activities. This is accomplished by monitoring ecosystem structure and processes so that the results of previous management actions can be compared with the expectations of the plans that led to the actions; this obviously requires a strong scientific presence. Results from monitoring programs must be made available to planners, managers, policy makers, and other scientists so that they can adjust plans, management actions, policies, and research programmes (respectively). A loop called "adaptive management" must be created between field actions, measurements for monitoring, checking against expectations, and adjusting future actions, with each reiteration of activity based on past experience. The "adaptive management" approach to protecting biological resources is based on a willingness and ability to react to new information as it becomes available. Policies need to be based on the best available science, protect both species and the ecological processes associated with them, and yield new information to support further policy actions.

3.2 Agricultural technology issues

- Technology will never be able to completely substitute for the free goods and services that humans derive from biodiversity. Even so, a critical component in strategies to deal with the loss of biodiversity will be continued investment in new, more efficient and more sustainable technologies for food production. Agricultural technologies which improve productivity and reduce labour-intensive practices may be an essential factor in sta-

bilizing the human population on our planet, and this technology must be based on sound science.

- Biotechnology—a marriage of science and technology—has important contributions to make. It can incorporate new insect-resistance genes into crop plants, thereby eliminating some of the need to convert petroleum resources and energy into pesticides, packaging, and distribution of the chemical product, and disposal of the wastes generated in the process. If genetic improvements are able to improve pest control, overall yields can be expected to increase; these benefits may be possible without huge capital investments or ongoing resource consumption for manufacturing, since they will be built into the seed without significant additional costs of production. Herbicide-resistant crops are also expected to help increase productivity and minimize the environmental impacts of farming, thereby enabling producers to get the most out of their land and livestock in the safest, most efficient manner possible. This can help the best agricultural lands to be more productive, thereby reducing pressure on marginal lands which may be important for conserving biodiversity.
- On the other hand, biotechnology may also work against the efforts to protect biodiversity. Genetic engineers are creating increasing proportions of their own materials, for example through the computer-assisted design of molecules; and biotechnology may encourage the domestication of nature, leading to the replacement of wild habitats with bio-industrial systems of aquaculture, silviculture, and agriculture. New crops genetically engineered to grow on marginal lands may help meet subsistence and commercial needs but they will also increase agricultural use of land that is now *de facto* protected from development.
- Intellectual property rights issues in the field of biotechnology have created difficulties for scientists who suddenly find their professional interests for access to genetic resources being addressed through international agreements rather than scientist-to-scientist exchanges. Trying to balance issues of intellectual property rights and biotechnology relative to germplasm exchange and collection has become a very important unresolved issue for breeders and inventors.
- High-tech agricultural inputs such as purchased fertilizer, herbicides, and genetic materials are often substitutes for the labour of farmers, who once managed ecological and evolutionary processes to earn their living from the land. Services and products once provided by the agricultural ecosystem through the skills and wisdom maintained by culture and practised by individuals have now become industrialized. While this has produced more food, at least in the short term, the result in many countries has been growing numbers of poor people who are unable to purchase the food that is thus produced.
- In the future, much of what the international system needs from industrialized countries will be proprietary property in those countries. And the increased value of plant genetic resources is causing developing countries to rethink their policies concerning access to the natural biodiversity they control; restrictions already exist in some locations. However, unlike developments in many other areas of technology, the genetic improvement of plants is a process in which each enhancement is based directly on preceding generations and the process of adding value requires access to the plant material itself.
- Agricultural research will generate many future advances in crop improvement technology, but may not directly address the needs of the majority of the people in rural China;

experience suggests that the private sector is unlikely to be a major developer or supplier of improved seed to farmers with limited purchasing power. Mechanisms therefore need to be developed that will allow technology to flow from advanced laboratories while maintaining incentives for further research. Such mechanisms require a strong, well-supported public sector agricultural research system committed to meeting the needs of those with limited purchasing power.

- It appears likely that biological diversity in agricultural systems was higher in earlier times, when large numbers of different cultivators had long-term stakes in the land they farmed and they had control over their own technology. These systems of land management were highly variable, following a range of different rules to take into account specific attributes of the physical systems within which they were found, cultural views of the world, and the economic and political relationships that existed in the setting. But such systems often shared certain basic principles such as: clearly defined boundaries; specific rules on how much, when, and how different products could be harvested; involvement of the affected people in these collective choices; a system of monitoring the use of resources; sanctions on those who violate the operational rules; inexpensive local mechanisms for resolving conflict; and the rights of villagers to devise their own institutions. These general principles were organized in a series of layers, with different kinds of institutions at the household, village, commune, county, province, and national level. Modern approaches are tending to seek to ensure that resource-management decisions are taken at the lowest possible level, where feedback from resource-management decisions is most immediate.

3.3 Economic issues

- Economics provides numerous approaches to dealing with problems of conserving biodiversity, and biological scientists in China should become familiar with at least the basic principles of economics as a means of making their science more relevant to economic development. An essential element is establishing clear property rights. One can only buy or sell goods for which property rights are well-defined, where the seller truly owns the goods and has the right to transfer the goods to others. Biodiversity, on the other hand, is a public good that is provided to everyone, rather like law and order and defense. Market economies, if left to themselves, typically under-provide public goods. Thus property rights work well for bread as a private good, but much less well for a public good such as genetic variation in wheat types. The full social benefits of tigers, pandas, portfolios of germplasm, marine resources of the global commons, and so forth, are public goods beyond appropriation by markets, even when market value is fully enhanced by all the devices of the law.
- However, many biological assets, both in the wild and in agro-ecosystems, are potentially private goods, whose use is rival, the control over which can be made exclusionary, and that have marketable commercial value. For these goods, the ideal is to assure that the resources are priced at the full costs involved, including environmental costs; this requires the establishment and enforcement of property boundaries around resource areas and deploying various measures to internalize externalities.
- Conserving biodiversity often requires preventing land from being converted from uses which maintain biodiversity to uses which tend to simplify biological systems, even though the latter may generate higher economic returns. Therefore, incentives for con-

servation must increase the willingness to pay for conservation. Investing in research capacity may increase the value of biological resources by making their qualities more accessible, so expanding the knowledge base should involve the full range of biological research. Managing biodiversity requires complex governance systems. This is especially the case because some biological resources should not be subject to property rights because of the broad public benefits they provide. It may not be appropriate for any one entity to own key aspects of complex biological systems. Such concerns clearly call for more research attention.

3.4 Institutional issues

- Most strategies to protect biological resources will emphasize wise and sustainable use of resources, rather than the unrealistic protection of resources from any human use.
- It is clear that in larger systems it is quite difficult to devise rules that are well-matched to all aspects of the provision and appropriation of that system at any level of organization. Therefore, among long-enduring and self-governed systems of resources, smaller-scale organizations tend to be nested in ever larger organizations. Thus efforts to pass national legislation establishing a uniform and detailed set of rules for an entire country—especially one as big as China — are likely to fail in many of the specific locations where biological resources are most at risk. What works in Hainan will not necessarily work in Tibet. Enabling users to manage their resources locally may be a more effective way of dealing with China's immense variability in diversity from site to site. This especially is the case where the benefits local users may gain from carefully managing their resources are greater when future flows of benefits are appropriately taken into account; and the costs of monitoring and sanctioning rule infractions at a local level tend to be relatively low. A key aspect of such proposals is the effort to enable institutions to more effectively blend local indigenous knowledge with scientific knowledge.
- No single approach is perfect and China needs to rely on multiple strategies. The best beginning is to recognize the institutional and economic structure that underlies and shapes the problem. Many of China's biological assets are either pure public goods, or as joint product with marketable goods, retain an appreciable layer of public good benefit, even after the domestic legal regime has gone as far as it can go to appropriate benefits and internalize costs through available legal instruments. Scientists need to design conservation systems that are effective, adaptive, efficient, and attractive to the general public.

4 *Ten recommendations for conserving biodiversity*

Based on these issues, the following recommendations should be considered by scientists in China.

- Because too little is spent to protect biodiversity and too much is spent to destroy it, much effort must be devoted to converting public opinion that is largely ignorant of this reality to one that recognizes that sound economic development is sound ecological development.
- The preservation of selected natural and semi-natural areas is the major strategy that will result in the preservation of the greatest amount of biodiversity at the lowest cost. This strategy should include managing ecosystems everywhere for maintaining biological di-

versity, and limiting to the extent possible further human-caused losses of biodiversity in relatively undisturbed natural areas.

- Because of a range of economic factors, the supply of biologically-rich areas is doomed to be sub-optimal without a concerted effort to make conservation an attractive option to the rural people who have practical jurisdiction over the resource. The network of agencies and organizations that are in the business of promoting conservation should be strengthened.
- Many organisms or crop varieties will be preserved only if they are brought into cultivation, into zoos, type culture centres, or similar facilities, deep frozen, or otherwise preserved in a living condition outside of their natural habitats; such *ex-situ* measures should therefore be seen as a crucial part of any biodiversity conservation strategy.
- Electronic data processing provides essential tools for the efficient handling of information about biodiversity, and should be utilized fully in this area of human knowledge.
- Human cultural diversity must also be taken seriously into account if biological diversity is to be preserved: the two are intimately connected, so biologists need to seek better ways of working with social scientists, and vice versa.
- Rights under the Convention on Biological Diversity should be extended to local communities. Key elements of the Convention, such as prior informed consent obtained by the collectors and benefit-sharing on mutually agreed terms, should apply to private land owners, local communities, and indigenous peoples with territorial claims.
- While the economic value associated with the transfer of genetic and biochemical materials is often exaggerated, effective mechanisms for dealing with these transfers and ensuring equity in the distribution of the benefits is an important measure requiring a range of actions. This is especially the case because mechanisms that may be useful for controlling genetic resources in the pharmaceutical industry may not make sense for the use of similar resources in agriculture and forestry.
- By making conservation more profitable to the managers of the land and resources, each of the various internalizing mechanisms can temper the pace of destruction. Much work needs to be done to refine and refit traditional mechanisms in the context of new technology.
- The four major types of international action that can influence biodiversity conservation include: international resource management coordination, "bargains" among nations, international financial and trade agreements, and international cooperation in science. All of these need to be mobilized, perhaps under the Convention on Biological Diversity.

5 Conclusions

Biodiversity will be conserved only as a part of an overall effort to promote human welfare. It is clear that, in broad terms, the emerging global strategy to conserve biodiversity will necessarily involve social equity issues, improved agricultural and forestry practices (for example, using cut-over lands rather than mature forests for new enterprises), halting and eventually reversing the activities that are leading to global warming and other drastic alterations of the Earth's environment, limiting over-consumption in industrialized countries to levels that the world can sustain, and building a strong public ethic in favour of conservation. Building technical competence so that countries can manage their own biodiversity for their

own benefit, and thus ultimately for the benefit of the planet, is one of the best investments that can be made. It is only from the organisms that are saved that people will be able to build the productive systems and ecological communities of the future. The preservation of the maximum amount of biodiversity possible would be the most important single contribution that the people of our generation could make to the future.

The Convention on Biological Diversity provides an excellent opportunity for doing so, giving political legitimacy to issues of conservation, sustainable use, and equitable sharing of benefits. It is apparent that public support is crucial to any successful conservation program; such support will need to be based on a sound ethical footing, good information, and economic benefits. Conservation biologists will need to build on science to demonstrate the benefits of conserving biodiversity to farmers, fishermen, ranchers, and foresters, balance the attention given to loss of biodiversity with concern for sustainable use of harvestable species, and build a broader constituency among business, the public, and academics (Ludwig et al. 1993). An effective overall strategy for mobilizing political and economic support for conserving biodiversity will:

- give management responsibility and tenure rights to the people most directly involved;
- ensure that prices fully reflect environmental costs;
- provide economic incentives to encourage individual behaviour which is in the long-term benefit of the larger society;
- provide the best available science to support decision-making; and
- seek a diversity of local solutions to local problems.

In short, scientists must work together with lawyers, economists and policy-makers to contribute to approaches to managing biological resources which are ecologically sound, economically feasible, and politically palatable.

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