The Biosphere Reserve: A Tool for Environmental Conservation and Management

by

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During the last few years, a new term has crept into the vocabulary of conservation, namely 'biosphere reserve'. Yet few people know what it really means, and many have confused, or even conflicting, ideas about what it actually covers. This situation results from the fact that the concept is relatively new, that it it multifaceted, and that it has already undergone some evolution as theory has been translated into practice. Consequently some clarification is needed, and this is a major aim of the present paper. In this respect, it was felt useful to take a historical perspective which allows us to understand how the concept originated, how it has developed, why some misconceptions have occurred, where we now stand, and what the future prospects could be.

ORIGIN OF THE IDEA

The concept of 'biosphere reserve' emerged from the programme on Man and the Biosphere (MAB) of which it constitutes an essential part. MAB was initiated through a resolution passed by the 'Biosphere Conference' convened in Paris by UNESCO in 1968 as an intergovernmental programme of research aiming to develop an interdisciplinary scientific basis for the rational use and conservation of the resources of The Biosphere. The general approach to, and the ways and means of implementing, this Programme—which has now been in operation for more than ten years—have already been described in *Environmental Conservation* (Batisse, 1980).

The greatest merit of the 'Biosphere Conference' was perhaps its assertion, for the first time in an intergovernmental context, that the conservation of environmental resources could and should be achieved alongside of their utilization for human benefit. One of the recommendations put forward by the 'Biosphere Conference' dealt specifically with the 'utilization and preservation of genetic resources'. It proposed to take specific measures to protect significant ecosystems, original habitats of domesticated plants and animals, and remnant populations of endangered species.

It took a long and painful effort to translate the recommendations of the 'Biosphere Conference' into a manageable international programme (Bourlière & Batisse, 1978). In the autumn of 1969, some 80 scientists from more than 30 countries worked together in an extraordinary atmosphere of enthusiasm and creativity to attempt to draw up this programme. Their ambitious proposals had to be streamlined later on, but one of the ideas which emerged on this occasion was that of a coordinated world-wide network of protected areas to ensure the conservation of genetic material. Such a network would of course include existing reserves; but it had to be extended in a systematic manner which would allow for the protection of many plant and animal genetic resources that, so far, had not been covered. As this was to be part of the Programme on Man and the Biosphere, the term 'biosphere reserve' made its first timid appearance in conversations. It would probably have been dropped if those responsible for the launching of the Programme had not felt the need for some clearly-identified territorial and logistic base for MAB activities, following the experience acquired in the implementation of the International Hydrological Decade, where 'Decade stations' had helped to focus interest on this earlier international scientific programme. Thus, the introduction of the term 'biosphere reserve' was due more to an instinctive feeling that MAB's operational character and visibility in the field had to be asserted, rather than for clearly-defined technical reasons.

The first official definition of 'biosphere reserves' was given in 1970, in the plan proposed to the UNESCO General Conference for the launching of MAB. This definition continued to stress their research and logistic role rather than conservation *per se:* ...'the pursuit of the various studies called for in the Programme will require the availability of undisturbed natural areas for scientific study as well as areas in which the conditions of disturbance are under careful control by the scientists involved in the research projects under the Programme. It will be essential therefore for each Member State to designate within its boundaries "biosphere reserves" containing representative areas of each of the major or otherwise relevant ecosystems within the nation's boundaries. These reserves would have as their primary purpose to serve as centres for the research and, where appropriate, monitoring and observation called for in the MAB Programme' (UNESCO, 1970).

When the MAB Coordinating Council met, in 1971, for its first session to focus the Programme around fourteen main themes, it identified theme No. 8 as 'Conservation of natural areas and of the genetic material they contain', and spelt out the idea of a coordinated world-wide network of protected areas. The term 'biosphere reserve' was mentioned under this theme, the designation as biosphere reserve being simply equated with a 'recognized and acceptable degree of international concern for the long-term conservation' of the protected areas of the network. At the same session, when discussing the infrastructure of MAB, the Coordinating Coun-

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cil continued to stress 'the particular role of biosphere reserves as basic logistic resources for research (where experiments can be repeated in the same places over periods of time), as areas for education and training, and as essential components for the study of many projects under the Programme' (UNESCO, 1971).

Thus, in a somewhat hazy manner, and with some ambiguity about their role and nature, both the idea and the term of 'biosphere reserves' were conceived as a part of MAB. Such haziness and ambiguity were to create some misunderstandings which had eventually to be resolved.

FORMULATION OF THE CONCEPT

All themes identified as components of MAB had to be elaborated in depth during the early nineteen-seventies in order to define precise operational guidelines for their implementation. For theme No. 8 this was done in two stages. A first panel-meeting held at Morges in September 1973 at the then Headquarters of IUCN, worked out the scientific content of the theme, emphatically underlining the importance of ecological, genetic, and evolutionary, principles in conservation, and the serious weaknesses and inadequacies of most conventional efforts in this field (UNESCO, 1973). A task-force organized in Paris in May 1974 was then entrusted with the formulation of criteria and guidelines for the choice and establishment of biosphere reserves (UNESCO, 1974). By and large the recommendations of this task-force are still valid to-day. Thus the primary *objectives* of biosphere reserves are:

1) To conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural and semi-natural ecosystems, and to safeguard the genetic diversity of species on which their continuing evolution depends;

2) To provide areas for ecological and environmental research, including baseline studies, both within and adjacent to such reserves; and

3) To provide facilities for education and training.

The main *characteristics* of biosphere reserves are defined as follows:

1) Biosphere reserves are protected areas of land and coast environments; together they should constitute a world-wide network linked by international understanding on purposes, standards, and exchange, of scientific information.

2) The network of biosphere reserves should include significant examples of biomes throughout the world.

3) Each biosphere reserve should include one or more of the following:

(i) Representative examples of natural biomes;

(ii) Unique communities or areas with unusual features of exceptional interest;

(iii) Examples of harmonious landscape resulting from traditional patterns of land-use;* and/or

(iv) Examples of modified or degraded ecosystems that are capable of being restored to more-or-less natural conditions.

4) Each biosphere reserve should be large enough to be an effective conservation unit, and to accommodate different uses without conflict.

5) Biosphere reserves should provide opportunities for ecological research, education, and training; they will have particular value as benchmarks or standards for measurement of long-term changes in The Biosphere as a whole.

6) A biosphere reserve must have adequate long-term legal protection.

7) In some cases biosphere reserves will coincide with, or incorporate, existing or proposed protected areas, such as national parks, sanctuaries, or nature reserves.

In order to implement the concept thus defined, some important planning and management principles had to be worked out—particularly with regard to the spatial organization of the ideal biosphere reserve. The main idea is that the reserve should normally include a well-protected 'core area' surrounded by one or several 'buffer areas' allowing for manipulative research or traditional land-use, and acting as a transition zone ensuring the proper integration of the reserve into the geographical region which it represents and actually serves.

This idea is not altogether new, having been used for instance to protect certain national parks from external pressures. It is also clear that, in some cases, the core area itself depends on a certain degree of human management (such as in the case of certain wetlands) or that the buffer zone has to be of a very different nature from the core (such as in the case of a lake). What is new here is the specific functions which the core area and the buffer zones have to play in integrating the multiple purposes of the biosphere reserve concept. Admittedly, situations encountered in Nature vary considerably from place to place, so that there can be no single system of zoning for biosphere reserves. Ideally, however, the core area should be representative of a major ecosystem of world significance, and be large enough to allow for *in situ* conservation of the genetic material of this ecosystem. The area thus devoted essentially to conservation would usually receive minimal human interference, and would serve as a baseline for monitoring changes occurring in The Biosphere as well as for research of a non-destructive character.

A 'first buffer-zone' around the core area would be used for education and training, as well as for manipulative research on conservation and ecosystem management. It could include certain traditional land-use activities in a controlled manner—such as timber extraction, grazing, or fishing. When possible a second or outer buffer-zone is recognized, which then serves a variety of purposes, including experimentation on alternative land-uses, education, training, and recreation, and is managed—and possibly reclaimed—for the benefit of local populations while maintaining a healthy environment.

*Anthropobiomes—*see* footnote on page 50 of our last issue.—Ed.*

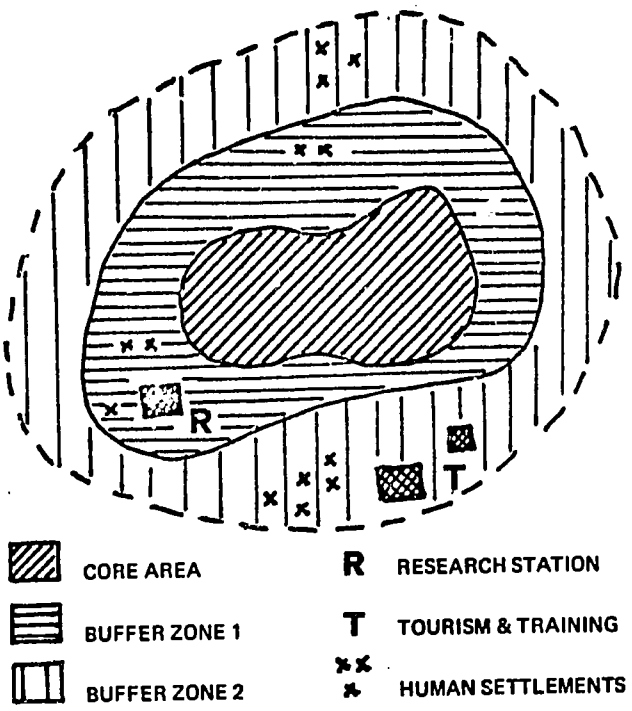

Fig. 1. *Typical biosphere reserve.*

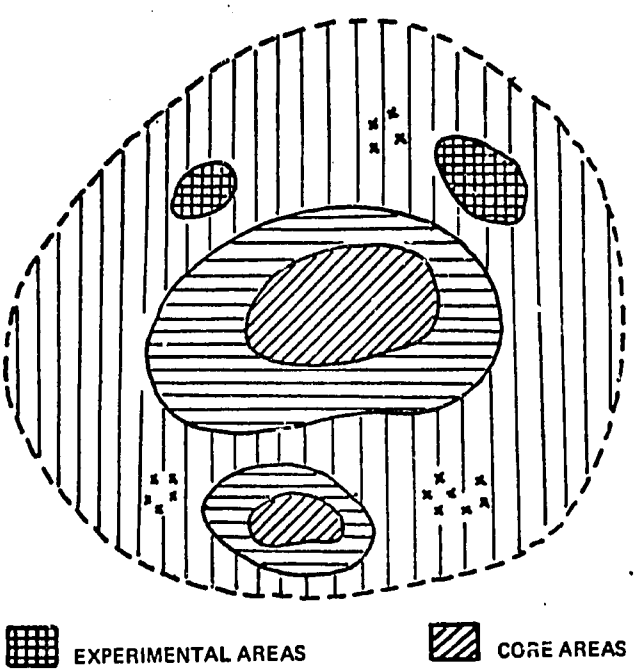

Fig. 2. *Cluster type of biosphere reserve with two core-areas, and with integrated research and experimentation areas.*

This simple zoning (Fig. 1) can of course be adapted to different geographical, ecological, or cultural, situations—including, for instance, cases where animals migrate from one part of the reserve to another, or cases where two or more core areas have to be protected in a cluster (Fig. 2). There is also the more difficult case of azonal ecosystems—such as those of coasts, lagoons, or man-made landscapes—where the concept of a core has to be adapted (Fig. 3).

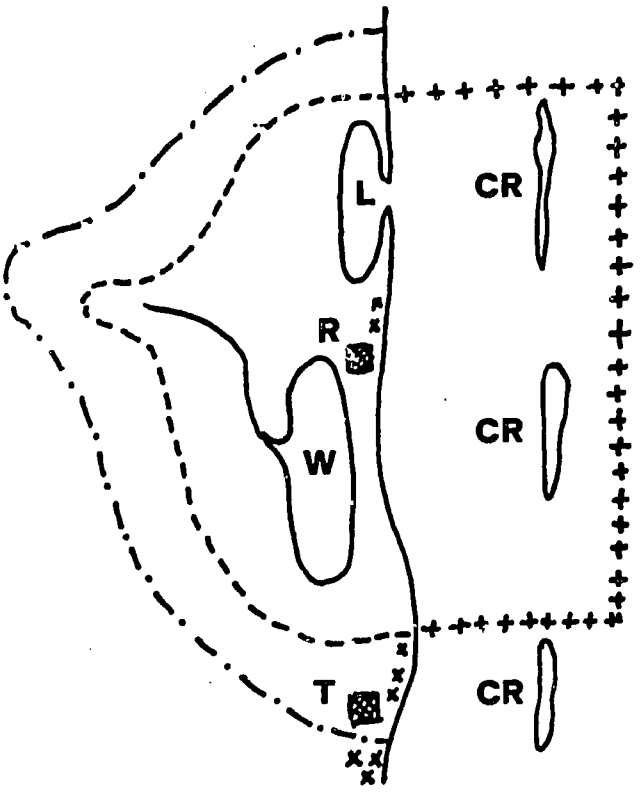

Fig. 3. *Coastal biosphere reserve where the concept of a core area has to be adapted.*

SPECIAL NATURE OF BIOSPHERE RESERVES

It can be seen from these zoning and management principles, which are meant to respond to its multiple objectives, that the biosphere reserve is different from most protected areas that were established earlier—even if it often coincides partly with, or incorporates, such areas. The main point of distinction is that it is not a closed system but rather an open system, looking out towards the management problems of the surrounding areas, and incorporating land-use management concerns of the local populations. In fact, the very term of biosphere reserve has been misleading to many people in this respect. Among strict conservationists it has sometimes been viewed as an unnecessary new name for the conventional type of protected area which they had been pressing for all the time. Among land-use planners it has sometimes been seen as just another conservationists' fancy; for they have not appreciated that only biosphere reserves can accommodate semi-natural ecosystems and even agrosystems equally well. Others have seen a contradiction between the concept of a reserve and the presence of people and human activity around it.

For these reasons, and in order to avoid changing a now well-established term, the 1982 MAB Scientific Conference which celebrated the tenth anniversary of the MAB programme, decided to add the expression: 'representative ecological area' to the term 'biosphere reserve' as a sub-title (UNESCO, in press). It is interesting to note that this same expression has been advocated in the framework of the Economic Commission for Europe, to develop a technique of conservation adapted to the heavily man-modified landscapes of Europe.

Thus, the concept has been progressively elaborated and clarified. Perhaps the simplest way to describe it is to say that it is essentially an attempt to make conservation of Nature more systematic, more scientific, more relevant to human needs, and more socially and economically acceptable to the populations concerned, than hitherto (Fig. 4).

BEGINNING OF A WORLD NETWORK

The theory being established, it remained for us to put it into practice by establishing the first biosphere reserves. This immediately raised several basic questions: Where should they be established? By whom? And how?

Traditional conservation efforts in the past have often been devoted to the preservation of exceptional ecosystems for their scenic beauty, or for the protection of certain endangered spectacular species. And in many countries, protected areas such as national parks have only been created in places of low value for other land-use purposes—such as high mountains or wetlands—while leaving other types of ecosystems almost entirely without protection.

Emphasis in the biosphere reserve network had therefore to be placed on representative ecosystems rather than on exceptional ones, and the international network had to be established in such a manner as to cover them as systematically and adequately as possible. But what is meant by 'representative ecosystems'? As a first attempt to provide guidance for answering this question, a broad classification of major biomes and component ecosystems of the world was drawn up at the request of UNESCO and IUCN (Udvardy, 1975). This global classification was made at a small scale of approximately 1:40 millions, and was based upon the concept of 'biogeographical provinces' defined according to faunistic and floristic differences and vegetation structures. It identifies 193 biogeographical provinces belonging to 14 types of biome within 8 'biogeographical realms'.

The above attempt is obviously a generalized classification which has real merit at the world level but cannot go into the details and refinements which are needed to cover the variety of ecosystems existing at the regional or local level. In the beginning, this approach did actually provide the basic scientific and operational guidance that was needed to proceed in a sufficiently coherent manner, having as a first objective to set up at least one biosphere reserve in each biogeographical province. But experience

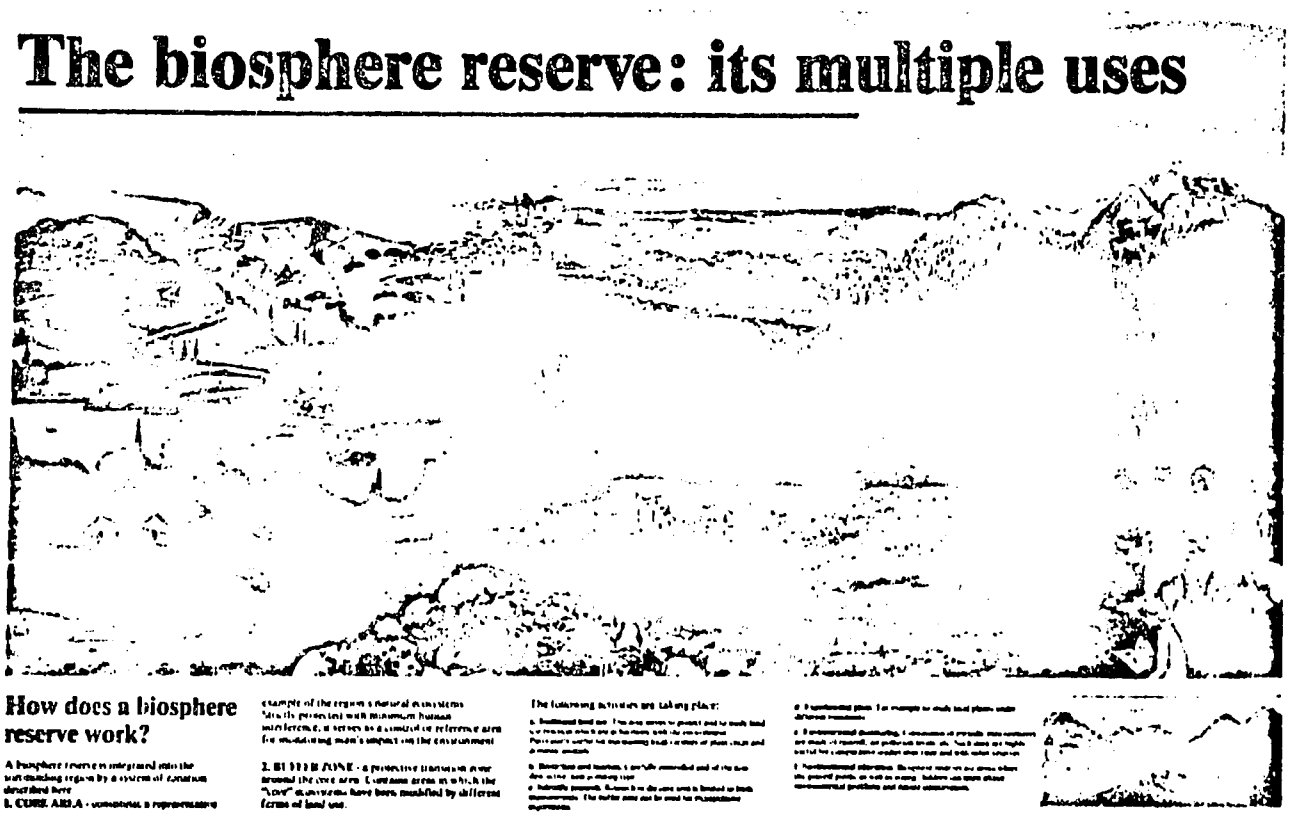

Fig. 4. *This graphic is part of the MAB poster exhibit called 'Ecology in Action'. It represents an idealized biosphere reserve integrated into the surrounding region, with its mountainous core area and its buffer zones for research, experimentation, education, and traditional land-use.*

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was to show very soon how difficult it was to meet this modest objective in certain parts of the world, and also how complex would be the task of defining a more comprehensive, world-wide system.

No matter how refined the international classification system may be, it is of course the responsibility of each country to set aside the land and water areas in its territory which it proposes as biosphere reserves. Their designation, however, is made at the international level within the framework of the MAB Programme. It was probably a wise decision of the MAB Coordinating Council to delegate this designation function to its Bureau, where appropriate and objective attention can be given to the merits of each submission. The task of the MAB Bureau in this respect was not an easy one in the early days of the programme, as many questions remained unclear—such as desirable size or legal protection. Yet, bravely, the MAB Bureau designated the first batch of 57 biosphere reserves in 1976, and this simple procedure is still followed today. The experience acquired since that date now permits a more selective designation of new reserves and therefore a more coherent approach to the progressive build-up of the network.

The designation of a biosphere reserve constitutes a moral commitment for the country concerned to manage it properly and to take part in the international network. There is no obligation for any country to designate biosphere reserves, and these reserves have no particular legal status as such. In most countries the legal protection derives from existing legislation. Some countries are considering special legislation, and it is obvious that, when a biosphere reserve is established in an area which has not so far been protected, adequate legal or regulatory measures are required. But such measures have no value if they are not enforced, as experience has unfortunately demonstrated in a number of existing national parks and equivalent reserves.

What is important, therefore, is the proper management of each biosphere reserve, including the actual protection required in its various components. Actually, it would probably not be wise to endeavour to establish standard new legislation for biosphere reserves, as this could crystallize unduly a concept which has to remain flexible. In this respect, it is worth stressing that the first stages of implementation of the programme have demonstrated the need for a flexible and pragmatic approach. This has allowed us to cope with the great diversity of local situations, as well as with the need to reconcile in each particular case the different—and sometimes conflicting—functions assigned to biosphere reserves (Castri & Loope, 1977).

The design of a coherent network demands not only that biosphere reserves be established to cover those representative ecosystems for which they are needed, but also that they operate as a network and not in isolation. Needless to say, the links between the reserves can only develop when a sufficient number of them has been reached, and when the scientists concerned see the value of reinforcing these links. When once an area has been designated as a biosphere reserve, it will only constitute a valid element in the international network if it functions properly—which implies conducting research in the reserve and exchanging relevant information with other countries. The biosphere reserve must be considered as a field laboratory connected with others in different countries within the framework of MAB. Such linkages can only build up slowly. Significant steps can, however, be taken to strengthen and accelerate this process.

An interesting example occurred on the occasion of the 'summit' talks between Presidents Nixon and Brezhnev in 1974, when a bilateral agreement on cooperation in the field of environmental protection was signed between the USA and USSR, making specific reference to cooperation between the two countries on MAB biosphere reserves. This provision, which must have puzzled many diplomats, has been followed by designation of 'twin' biosphere reserves in these two large countries, and by real cooperation in research and exchange of information.

For its part, and with very limited means, the MAB Secretariat has tried to trigger action in many countries, and has succeeded in a number of them. In particular, several national or regional seminars have been devoted to biosphere reserves in such countries as Australia, Canada, Italy, Mexico, New Zealand, and Turkey, and have stimulated the programme. Several developed countries have provided support to developing countries in this respect, and a contribution from UNEP has permitted the establishment of a small regional network among countries of Southeast Asia.

CURRENT TRENDS

In January 1977, 118 biosphere reserves had been designated in 27 countries. Today there are 214 in 58 countries. The computerized MAB Information System provides compilations of all these reserves, giving details on their geographical, ecological, and administrative, characteristics, on the main relevant publications, and on the research projects that are being carried out in each one. This compilation is an essential tool for establishing links within the network (UNESCO, 1981). It also allows for statistical analysis and evaluation of the various functions of the network and of its present structure (Goodier & Jeffers, 1981).

The progression in the number of designations shows that the concept is now well accepted, even if it is not always fully understood. The reserves are located in both developed and developing countries, which provides a clear indication that the concept is equally appropriate in very different socio-economic situations. These facts are most promising. Yet the overall picture is still far from being perfect, and so should be analyzed critically, as it was during the lively debates on the occasion of the MAB Scientific Conference of 1981.

The first question is to assess how far the present network covers the representative ecosystems of the world, with identification of those regions and biomes which are not yet properly covered. It is equally necessary to

see whether the network is actually functioning, and whether the existing reserves maintain the correct standards to play their role in it. In this respect, the value of the research and monitoring activities must be evaluated, as well as the state of protection and of local support.

Existing Gaps

As biosphere reserves are proposed upon the initiative of individual countries, their designation could not be made in a systematic manner but has been rather haphazard. It is therefore not surprising that, out of the 193 biogeographical provinces of the Udvardy classification, only 91 are represented today in the network by one or more biosphere reserves. Certain biomes, such as mountains and highlands in Europe, tend to be covered by a relatively large number of reserves, because different countries with similar ecological conditions have taken parallel initiatives and the MAB Bureau has felt there was no reason to discourage them by rejecting their submissions, more extensive protection being preferable to too little.

Conversely, very important gaps persist in the coverage of some major biomes—particularly in tropical and subtropical forests and in warm arid regions. Equally important gaps are to be found for interface and azonal ecosystems, such as coastal areas or traditional man-modified landscape. These do not appear specifically in the small-scale Udvardy classification, although they constitute particularly interesting and vulnerable areas. Current efforts, therefore, not only aim at improving the coverage under the Udvardy classification, but also at developing more refined classifications at the regional level where azonal and harmonious agro-pastoral ecosystems are also considered. This has been done for instance for the Mediterranean region (UNESCO, 1977). It is gratifying to note in this connection that specific reference to biosphere reserves has been made in the 'Protocol concerning Mediterranean specially-protected areas', which has recently been signed (April 1982) by the contracting parties of the Barcelona Convention for the Protection of the Mediterranean Sea against pollution. This reference serves as an indication of the type of coastal and marine protected areas which are required along the shores of that remarkable sea, which have been greatly altered during the course of thousands of years by some of the most prestigious—but often careless—civilizations.

When analyzing the current network critically, one cannot fail to note that most existing biosphere reserves have been established in areas which were already protected as national parks or biological reserves. There is obviously nothing wrong with this, as long as the designation of the area as a biosphere reserve is adding new functions and possibly new dimensions to the existing set-up, and is not just a new label given to it. For example, the core of a biosphere reserve could well be an existing strict nature reserve, or a national park, provided the other characteristics of the biosphere reserve are met—thus complementing the previous conservation efforts (IUCN, 1979).

Research and Integrated Projects

The most important functions added in respect of the biosphere reserve are usually the intensification and diversification of research, together with the establishment of international links. However, a brief examination of the current list of research projects in biosphere reserves (UNESCO, 1981) reveals that much of it tends to be of a rather specialized nature, and that, in many cases, little research seems to be carried out. Conversely, a considerable amount of research work related to ecosystem structure and functioning, to species survival, to analysis of human impacts such as tourism, air pollution, grazing, or poaching, or to various aspects of ecosystem management, is actually taking place in some 60 biosphere reserves. This work is being carried out at the moment by more than 2,000 scientists working on more than 600 research projects.

In a number of cases, the biosphere reserve and its various elements are used as the basis for a MAB integrated pilot project—combining interdisciplinary research, demonstration, training, and education. These projects are linked within regional and global networks, and constitute the backbone of the MAB Programme. The association of a biosphere reserve with an integrated pilot project is highly desirable. It should not be construed, however, that their objectives are similar, the focus of the biosphere reserve remaining the conservation of genetic material, whereas the focus of the integrated project is essentially sound utilization of ecosystems. But both objectives can be met in the presence of appropriate researchers and other specialists working together to great mutual benefit in the same research station.

Many examples could be quoted of this fruitful combination of a biosphere reserve with an integrated pilot project—such as Mount Kulal in Northern Kenya, the Tai Forest in Ivory Coast, the Sakaerat experimental station in Thailand, or the Panda research station in China (Fig. 5).

In the early days of the programme it was also thought that biosphere reserves should act as benchmarks to evaluate changes in the environment, and should be used

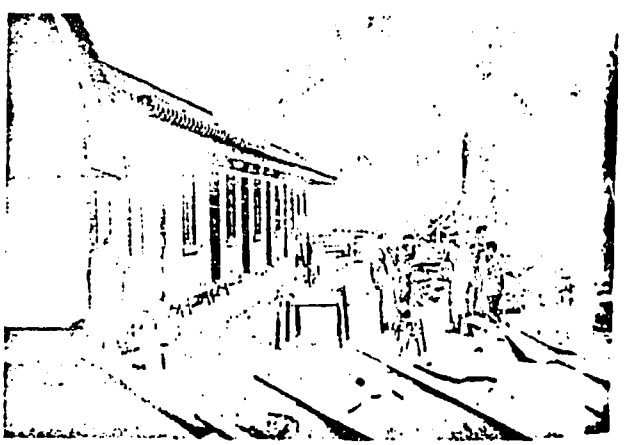

Fig. 5. *Combination of a biosphere reserve with an integrated pilot research project in the Panda research station in China (Photo: L. Teller.)*

for continuous monitoring of physical or biological processes—thus contributing to the Global Environment Monitoring System (GEMS) of UNEP. While this objective is still very desirable, it is fair to say that the ambitious proposals concerning terrestrial monitoring formulated in the early 'seventies have not yet materialized. The difficulties of identifying and correctly measuring the right parameters are considerable, and the cost–benefit ratio for such expensive work remains somewhat uncertain. Nevertheless, attention continues to be given to the potential role of biosphere reserves in an integrated monitoring system of the environment at the regional or global level (Fig. 6).

Protection and Social Integration

The problem of adequate protection of biosphere reserves appears at first sight to be the same as for any other type of protected area. It has been said in this respect that, in so far as they cover man-modified ecosystems and accept the presence of people in the buffer zones—and sometimes in the core area itself—biosphere reserves would be in danger of being insufficiently protected. Paradoxically, however, it appears more and more that the reverse is true. In the first place, the presence of scientists in a research station located in the reserve—normally in the buffer zone but close to the core zone—is a precious means of ensuring a degree of effective protection. Moreover, if the biosphere reserve is set up and managed in the right way, the surrounding population can become its best protector.

The approach taken for the entire MAB Programme is to associate the populations concerned as fully as possible with the formulation and implementation of research projects. It is even more important to take this approach when establishing and managing a protected area, which imposes changes and restrictions on the use of land.

Many conservation areas—including the prestigious national parks in Third World countries—are threatened today by the pressure of expanding local populations who do not understand the significance of these areas, who have not been consulted about their delineation or management, who have been submitted to severe disruption of their traditional ways of life, who need more and more land for grazing or hunting, and who receive almost no returns from the massive tourist industry which ignores their concerns and at the same time can even spoil the protected lands (Lusigi, 1981).

The biosphere reserve constitutes a technique, among others, to reverse this very dangerous trend. Experience already shows that when the populations are fully informed of the objectives of the biosphere reserve, and understand that it is in their own and their children's interest to care for its functioning, the problem of protection is largely solved. In this manner, the biosphere reserve becomes fully integrated—not only into the surrounding land-use system, but also into its social, economic, and cultural, reality.

Some outstanding examples have already demonstrated the value of this approach, in which the populations consider the reserve not as an infringement on their rights but as a tool to serve their long-term interests. Among these examples, those of the Mapimi and La Michila biosphere reserves in the State of Durango in Mexico are particularly striking (Halffter, 1981), and similar instances could be quoted from several other countries (cf. Fig. 7).

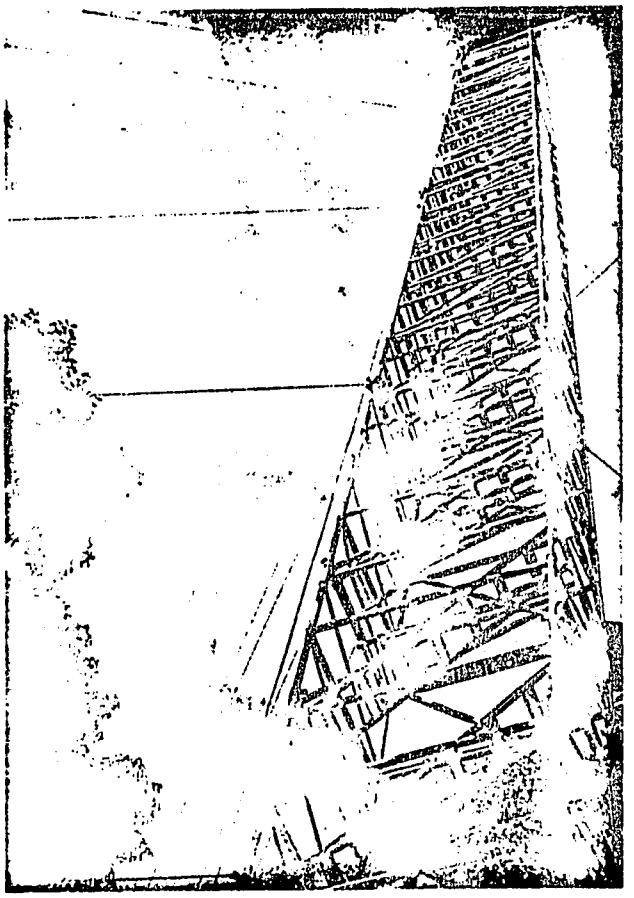

Fig. 6. *A research and monitoring tower in the Sakaerat biosphere reserve in Thailand. The tower allows particularly for study of the tropical forest canopy and for microclimatological monitoring. (Photo: M. Hadley.)*

FUTURE NEEDS AND PROSPECTS

It is clear from the above text that the establishment of a world network of biosphere reserves has gained con-

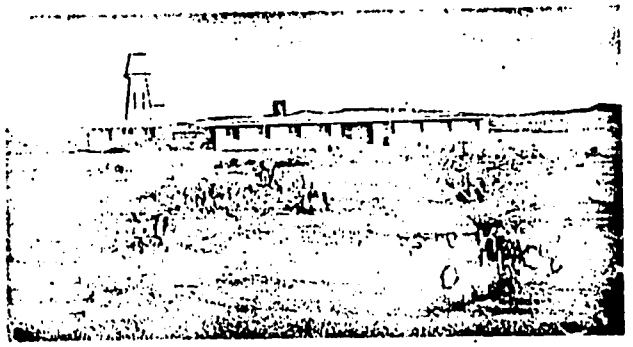

Fig. 7. *The 'Desert Laboratory' recently built for research and training in the Mapimi Biosphere Reserve in The State of Durango in Mexico. Among other species, the Great Desert Turtle is protected in this biosphere reserve, which is also exemplary for participation of the local population. (Photo: Sonia Galleria.)*

siderable momentum, but that much remains to be done to improve the coverage of representative ecosystems, the quality of many reserves, and their proper integration into the ecological and socio-economic environment, in order to meet the objective of a comprehensive and high-standard network.

The historical development which has been analyzed above explains why a number of biosphere reserves, useful as they may be for various legitimate purposes, do not meet all the requirements of such a network. The question arises as to what can be done about this situation. In many cases, significant improvement could be achieved through some international support or through greater attention from national authorities. In some other cases one wonders whether a given designated biosphere reserve deserves to be maintained on the list. The MAB Coordinating Council has not so far considered any procedure for delisting, but this might come in future years. Yet it could be argued that a poorly managed reserve is preferable to no reserve at all, and that the international network could then for practical purposes develop into a two-tier system, with a 'hard core' of fully representative and well-functioning biosphere reserves.

More important at the present stage is to fill the most obvious gaps through the designation of new, high-quality biosphere reserves. While completing the network to include all of Udvardy's (1975) biogeographical provinces—especially the biomes which are not so far adequately covered—consideration should also be given to special requirements of conservation at the regional or global level. The urgent need to protect coastal ecosystems and wetlands, as well as traditional landscapes, has already been mentioned. In fact, a biosphere reserve which covers transition zones and interfaces between ecosystems can be of greater ecological and practical value than a reserve that is located entirely within a single representative ecosystem—if only because such areas are less known scientifically as regards their complex structure and functioning, are more vulnerable to human activities and pressures, and are often more important economically.

Similarly, attention should be given to the protection of indigenous varieties and races of domesticated plants and animals which are used in traditional agriculture, and/or are severely threatened by modern selection, as well as to areas that contain wild relatives of domesticated species, so as to ensure their *in-situ* long-term protection. This includes in particular the 'Vavilov centres of genetic diversity' from which many cultivated crops originated. The protection of wild relatives of crops is essential for plant breeding activities to ensure maintenance of pest resistance as well as increase in yields. This applies not only to endemic wild relatives of crops such as coffee, tomato, potato, or cotton, but also to a number of trees that are needed in forestry or in agriculture—such as cacao or olive trees. The biosphere reserve programme has recently been acknowledged as the most appropriate mechanism for ensuring this selective *in-situ* conservation (R. & C. Prescott-Allen, 1982).

The above considerations show that, given the rich diversity of the natural environments of the planet and the considerable range of human interventions which it has undergone, the establishment of a scientifically sound and truly comprehensive network of biosphere reserves will not only require action at the world level, but also at the regional level. For it is at the regional level that problems are similar and ideas, contacts, and cooperation, can be developed more efficiently than on the wider level—as was pointed out in the example of the Mediterranean given earlier.

It is equally clear that future biosphere reserves—besides some of those which are needed to cover 'missing' biogeographical provinces—will have to be set up and managed in areas which are not protected, which are devoted to various types of land-use, and which are still privately owned. This will require deliberate and far-sighted action by national authorities, with considerable economical, financial, administrative, and political, implications. Lastly but very importantly, it will call for adequate training of personnel, at various levels, who are capable of managing biosphere reserves efficiently (Fig. 8).

Local Support Essential

It cannot be over-stressed that conservation measures—especially those which involve productive lands—will not succeed without the agreement, support, and participation, of the population directly concerned. Unless the administrative habits of most countries, which tend to dictate from above what has to be done in the field of nature conservation—and indeed in other fields—are radically modified, and unless major efforts are made to explain the value of protected areas and to associate the local people with their management, all conservation measures will be bound to collapse sooner or later.

To counteract this threat, the biosphere reserve concept—and the MAB Programme as a whole—is built upon the establishment of a dynamic interaction between scientists, resource managers, decision-makers, and the local people who should ultimately benefit from the

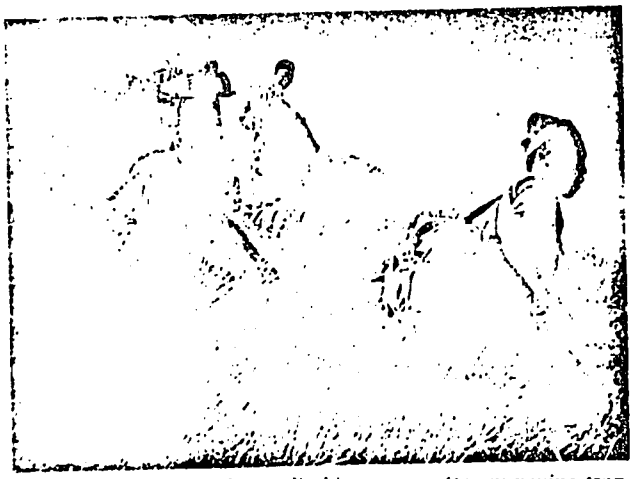

Fig. 8. *A group of trainees climbing down after surveying tropical high-altitude vegetation and soil fauna in the Mount Nimba biosphere reserve in Guinea. (Photo: M. Lamotte.)*

protection measures and from the results of research. All possible means, such as dissemination of information by local media, explanation and demonstration campaigns, and environmental education, will have to be mobilized to develop a favourable perception and new attitudes towards conservation.* The fact that biosphere reserves combine the protection of genetic resources with research towards improved land-management, should help them to play a significant role in bringing about this much-needed change in attitude.

Long-term Conservation

In this process, it should be underlined that long-term conservation is—and must remain—the primary function of biosphere reserves. Obviously, conservation of Nature does not rely only upon biosphere reserves, and indeed the expanding interest for all other methods of protection should be strongly encouraged. Whatever the development of the biosphere reserve programme may be, it will probably never represent more than a small portion of the *ca* 2% of the land surface of the world which is currently under some form of protection, and which is probably too small to allow for even the short-term preservation of a number of threatened species, let alone their genetic evolution. But the programme should cover precisely those ecosystems which do not yet receive adequate protection, and also it should promote a scientific approach to conservation.

Much remains to be done to give a sound theoretical and scientific basis to conservation of ecosystems and genetic resources, and perhaps research projects in biosphere reserves should be primarily devoted to this subject which has never received adequate attention in the past. In this respect, the size of each reserve constitutes a fundamental issue. It has been estimated (Frankel & Saoulé, 1981) that, to maintain fitness and survival of a given species and to avoid excessive interbreeding, the minimum population size should be no less than 50 individuals. But in order to maintain long-term genetic variation at a level allowing a species to adapt itself to environmental change, the minimum population is estimated to be of the order of 500 individuals.

These requirements could be met without too much difficulty for most plants and many small animals. However, when it comes to tropical forest trees and, even more so, to large mammals, the geographic size of the protected area required to maintain their genetic diversity—and even their fitness— becomes extremely great. Very sizeable biosphere reserves or national parks might meet this challenge in the case of tropical trees, but on these grounds there is little hope in the long run for large vertebrates. Yet, provided biosphere reserves are of sufficient size, well managed, and well distributed at world-wide and regional level, the network will offer a major new tool for helping us to assume to the fullest possible extent what O. H. Frankel calls 'our evolutionary responsibility', i.e. allowing most species to continue their evolution through appropriate human protection.

On the other hand, the biosphere reserves are likely to play an increasing role as 'representative ecological areas' devoted to the conservation of landscapes and to the study of sound ecosystem management. In this context, they should also play an increasing role in the maintenance and transfer of indigenous technologies for land and water resources uses, thus helping to preserve cultural diversity in a world oriented towards uniformity.

While the future of biosphere reserves as a multipurpose tool for environmental conservation and management appears very promising, one should not construe from this that they can 'do everything'. Giving them too many tasks and responsibilities, and placing on them too-ambitious and somewhat diverging expectations, could only lead to confusion and inefficiency. As in any other programme, a balance has to be struck between the desirable and the possible. Thus it would probably be inappropriate in them to move too much into the vast area of research and experimentation on environmental management, although in many biosphere reserves this will certainly constitute an important function—especially when they are combined with integrated pilot research projects.

Supporting Measures

These considerations keep pointing to the flexibility required for the national and international development of the programme. At the same time, the world-wide network of biosphere reserves will call for constant contacts and exchanges between countries, as well as appropriate monitoring of its development. For these reasons, an international conference on biosphere reserves is being organized by UNESCO in Minsk (Byelorussia) in September–October 1983, with the support of UNEP. It is expected that this Conference will review in depth the development of the programme, allow for constructive exchanges of ideas and experience, and give a decisive impetus to the further development of the network.

Needless to say, success will eventually depend on the human and financial resources available to the programme, on the determination of the participating countries, and on the dedication of their personnel. In this respect, there are biosphere reserves which happen to be located in outstanding natural areas and which have justified their inscription on the World Heritage List established under the Convention concerning the Protection of the World Cultural and Natural Heritage. These cases will probably remain exceptional. But one might consider some day that the 'hard core' of the world biosphere reserve network could be placed on the list as one entity, and therefore benefit from the support which the Convention provides. One could also recall that the wealth of genetic resources conserved through the network is of direct value to large public or private groups—including those concerned with timber exploitation, plant breeding, or seed supply. It would seem appropriate that some simple mechanisms be set up to obtain reasonable financial or material support from

*Here again we feel the need of more and better environmental education, including the world's 'public at large', which is being stressed elsewhere in this issue.—Ed.

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Note from a 'SAVE OUR BIOSPHERE' Sticker Distributor

The Indian Society of Naturalists (INSONA) recently produced colourful stickers, 11X16 cm, depicting the endangered Blackbuck (*Antilope cervicapra*) under the heading 'SAVE OUR BIOSPHERE' (Gaekwad & Oza, 1981)*. The stickers are of two sorts—one designed to be affixed on an opaque background, and the other to be viewed through glass.

After reading that 'the stickers are available, against a donation, to serve the cause of The Biosphere', I sent $5.00 to the General Secretary of INSONA. In return, I received ten stickers. This was more than I expected, and more than I needed personally. Probably, I thought, the General Secretary sent me extras as a co-initiator of what was then called the World Decade of The Biosphere (Vallentyne *et al.*, 1980)—the action that had prompted INSONA to produce the stickers.

I received the stickers just before leaving on a lecture tour of western Canada that had been arranged by the Canadian Society of Environmental Biologists (CSEB). The focus of my talks was The Biosphere: 'Why I carry a globe on my back.' I took six stickers with me to show audiences an example of the kind of grass-roots actions that are needed to make The Biosphere a reality in the minds of people.

On my trip I showed the stickers to audiences in Winnipeg, Saskatoon, Calgary, and Edmonton. In Winnipeg, my first stop, I held up a sticker for people to see. In Saskatoon I presented one as a house-gift to the person who provided me with overnight accommodation. In Calgary I offered two to persons who would make contributions to INSONA on the understanding that I would forward their names and addresses with the contributions. I received $4.00 from one person and $5.00 from another. In Edmonton, the same offer brought responses of $20.00 from one person and $5.00 from another. The sixth sticker went to my Edmonton host.

Of the total of ten stickers, I placed one on my office door, another on a file cabinet in my study at home, and left six in western Canada. I offered the remaining two to Biosphere supporters in Ontario. Within a week they were in other hands.

As a result of these transactions, a money order for $55.00 was despatched to the General Secretary of INSONA on 28 January 1982, with the names and addresses of the contributors. I was pleased with the result, having turned a $5.00 donation into $55.00 for INSONA. Needless to say, I requested more stickers.

In his book, 'The Open Conspiracy', H. G. Wells (1928) cited the power of imagination as our greatest strength and salvation. The idea of INSONA to produce a sticker combining local and global concerns was, in my opinion, an imaginative venture. What it induced, through my intermediary behaviour, was a transfer of funds from persons in CSEB to the heart of INSONA.

What if this idea caught on generally? What if other concerned organizations in less well-to-do parts of the world produced colourful stickers coupling images of their special concerns with a 'SAVE OUR BIOSPHERE' message? What if persons belonging to concerned organizations in the well-to-do parts of the world offered, as I did, to relay contributions in return for stickers, remitting the proceeds to their sister organizations in less well-to-do parts of the world? Knowing the human propensity for acquisitiveness in regard to stamp collecting, coin collecting, and you-name-it collecting, why not start a new rage for 'SAVE OUR BIOSPHERE' sticker-collecting among children and adults, as suggested by Polunin (MS.)? If this ever 'caught on', the INSONA stickers could, as the first of their kind, become valuable collectors' items.

Organizations in the Third and Fourth Worlds: Send me your stickers! If the design is imaginative, the purpose simultaneously local and Biospheric, and the words 'SAVE OUR BIOSPHERE' (or their equivalent in another language) appear on the label, I am a potential customer and multiplier of customers.

I am a 'SAVE OUR BIOSPHERE' sticker distributor.

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*The sticker figured by Gaekwad & Oza (1981) was an earlier version, without the attractive INSONA emblem and the 'OUR' in the legend. The latter item is remedied in the version figured on page 117 of this issue.—Ed.

10

Biggest Private Donation to Date for the Environment

Mr Ryoichi Sasakawa, Chairman of the Japan Shipbuilding Industry Foundation, who was recently awarded the United Nations Peace Prize in a ceremony at the Geneva headquarters of the World Health Organization, [subsequently pledged] $1,000,000 to the United Nations Environment Programme. The money will finance [an international award] for outstanding achievement in the field of the environment.

Mr Sasakawa's concern for the environment is also reflected in his support for the Institute for Ocean Environmental Technology of the Japan Foundation for Shipbuilding Advancement at Tsukuba, and for the International Federation of Institutes for Advanced Study (IFIAS) in Sweden, which is an organization that specializes in environmental studies.

The donation to UNEP is only the latest of a long series of important contributions by Mr Sasakawa to humanitarian efforts all over the world—particularly through the United Nations system. During the past seven years, through the Japan Shipbuilding Industry Foundation, he has provided annual donations to WHO totalling over $20,000,000, and constituting significant support for the eradication of smallpox, the control of leprosy, and other important health programmes.

Between 1971 and 7 May 1982, Mr Sasakawa donated more than $36,231,000 to various United Nations agencies and organizations—including the UN Secretariat, UNHCR, UNRWA, IMCO, and ESCAP—in his efforts to improve human welfare, alleviate suffering, and promote international understanding. These are goals which illustrate his personal philosophy: 'The world is one family: all mankind are brothers and sisters'.

Among his direct efforts to help preserve world peace, Mr Sasakawa supports the Independent Commission on Disarmament and Security Issues, the present Chairman of which is Mr Olof Palme, former Prime Minister of Sweden. Mr Sasakawa was a member of the Japanese delegation to the UNESCO Peace Forum in Paris in 1979, where he proposed the creation of a nongovernmental commission for peace. The Forum also accepted his offer to establish a peace fund and annual Peace Education Prize.

Mr Ryoichi Sasakawa, the eldest son of a *sake* brewer, was born on 4 May 1899 near Osaka, and was an elected member of the Japanese Diet or Parliament until the end of World War II. He is chairman of more than 50 nonprofit organizations—including the Japan Shipbuilding Industry Foundation, which has given more than $12 thousand millions in donations and subsidies to various causes over the past 20 years.

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'TRAFFIC Japan' Office to Halt Illegal Wildlife Trade

In a move which could have major consequences for world conservation, WWF/IUCN will open a new Tokyo office called 'TRAFFIC Japan'. The office will be modelled on similar operations in the US, the Federal Republic of Germany, and the UK, and follows the decision by Japan to accept the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Japan is a key figure in many aspects of wildlife trade, and the new TRAFFIC (acronym for Trade Records Analysis of Flora and Fauna In Commerce) office will work closely with customs authorities to see that the CITES regulations are strictly enforced. A Japanese-speaking American conservationist, Thomas Milliken, will be in day-to-day charge of operations, reporting to Mr Hyosuke Kujiraoka, former Director of the Japanese Government's Environmental Protection Agency. TRAFFIC is backed by a strong Scientific Advisory Committee headed by Dr Hideo Obara, one of Japan's leading zoologists and a member of the Board of WWF Japan.

Mr Eugène Lapointe, recently appointed Secretary-General of CITES, described the opening of TRAFFIC Japan as 'a major step towards the development of the awareness required for international cooperation in controlling the trade in endangered species; awareness and cooperation are two absolutely key elements in the attainment of our objectives.' For Japan, after the US, is the world's largest consumer of wildlife and, on a *per caput* basis, may be number one. Approximately one-third of the world trade in birds involves Japan, and almost all of the musk and most of the tortoise-shell in world trade is consumed by Japan. Moreover, next to the Federal Republic of Germany, Japan is the largest trader in fur-skins of wild species, and is a leading importer of shells, coral, reptile skins, primates, butterflies, and tropical fishes. In short, the Japanese are deeply involved in almost every area of wildlife trade, and according to Mr Milliken their stockpiling of furs, which occurred before the acceptance of CITES, guarantees that endangered species will continue to be traded for some time to come.'

The Japanese are also the world's largest consumers of ivory. Eighty per cent of African raw ivory exports are to Japan or Hong Kong. Until recently, Japan was a major trafficker in rhinoceros horn as well, importing an average of 800 kilograms annually. Thus, public awareness regarding endangered species issues is very low in Japan, and TRAFFIC will play a major educational role in publicizing CITES and the world trade in threatened wildlife.

Dr Obara's above-mentioned Scientific Advisory Committee will be largely responsible for assisting in the identification of wildlife and derivative products, accumulating and interpreting data, reviewing and evaluating TRAFFIC reports and projects, and distributing TRAFFIC reports and newsletters.

David Mitchell, *Director of Public Affairs*
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