

Meeting of the MacArthur Foundation Grantees

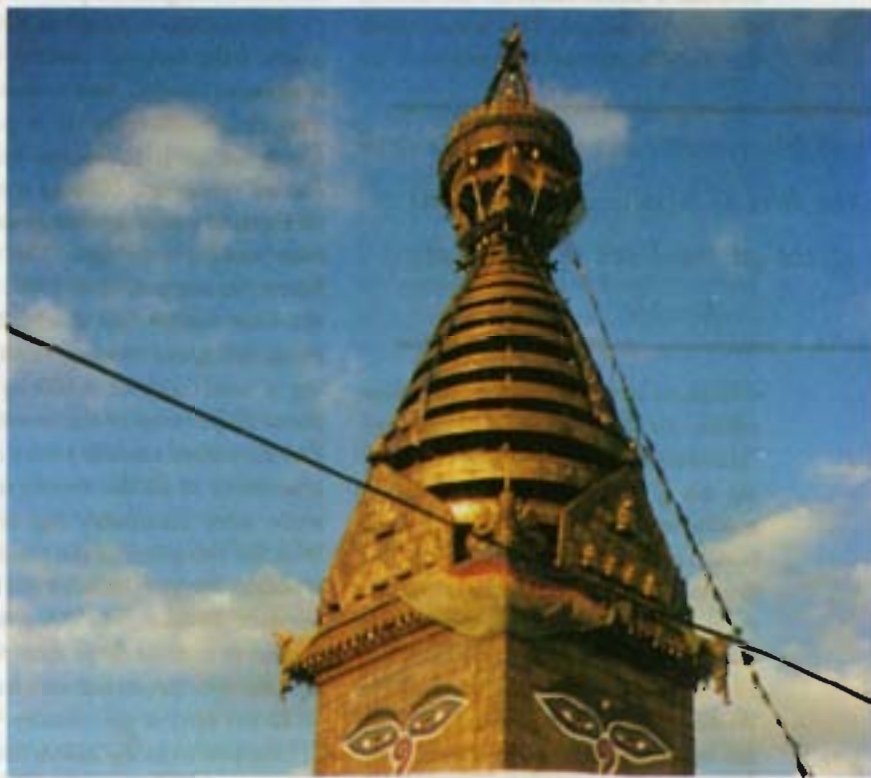


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Site of the meeting

Introduction

Dr. Dan Martin, Director of the World Environment and Resources' Programme of the MacArthur Foundation, opened the meeting by stating its objectives.

The objectives were:

i) to identify developments that had occurred recently, e.g., advances in sustainable development and conservation;

ii) to find ways to support each other - explore new opportunities and set global-biological priorities, e.g., Eastern Himalayan ecosystems; and

iii) to talk about a new set of grants

The loss of biodiversity is immediate and acute; the loss is permanent and has a direct effect on the lives of the poorest people. This is the reason for the MacArthur Foundation's in-

that sees the "interconnectedness" between various elements.

Dr. Kartawinata, a senior programme officer from the MacArthur Foundation, announced the agenda and nominated the chairmen for each country session.

■ Bhutan

Speaking from the chair, Mr. Mingma Sherpa, representative of WWF Bhutan, introduced Mr. Tshewang Wangchuk, from the Bhutan Department of Forests, and Mr. Kunsang Yonten, Secretary-general of the Royal Society for the Protection of Nature (RSPN). A slide show accompanied Mr. Wangchuk's presentation.

Bhutan has a range of ecological zones, from tropical (south) to high mountains (north), and is thus blessed with rich biodiversity. It is predominantly an agrarian society based on natural resources, utilising traditional methods of resource management that have evolved over time. The Bhutan Forest Act was passed in 1969; by 1983 the Government had gazetted several Protected Areas' Systems (PAS) covering a total area of 9,505 sq.km. or about 20 per cent of the country. The PAS previously classified were not representative of all the eco-forest types; some were unsuitably big or small. With the inception of the Nature Conservation Section (NCS) of the Forestry Services' Division, the PA system was revised to address these shortcomings, and the total protected area increased to 22 per cent of the country.

Support from the MacArthur Foundation had been crucial in the formation of the NCS, Mr. Wangchuk said. The NCS activities include documentation of species in three national parks - Jigme Dorji, Black Mountains, and Royal Manas - which will facilitate the

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volvement in biodiversity conservation efforts, Dr. Dan Martin told grantees. *"It is crucial to identify the areas experiencing loss of biodiversity and those rich in biodiversity."* Due to the uneven distribution of biodiversity in the north, the Board had decided to focus on critical areas in the south such as the Andean mountains, the Indonesian forests, Brazil, the Eastern Himalayas, and the Western Ghats. *"These resources are global treasures",* Dr. Martin said; *"hence their protection is a global responsibility."*

Concluding Dr. Martin said that it was vital to support the efforts of those working for their preservation. Unlike most donors, the MacArthur Foundation favours an ecological approach

formulation of management plans by 1997 for government approval and implementation. The proposal for Integrated Conservation and Development in Jigme Dorji could serve as a model for application in other PAS. So far emphasis had been placed on institutional-capacity building.

A separate Geographic Information Systems' (GIS) unit is to be set up in 1994. In addition, the Field Research and Nature Study Centre, currently under construction in the Black Mountains, is expected to function by 1995. The establishment of the Bhutan Trust Fund (BTF) for environmental conservation, with the collaboration of WWF, UNDP, and the Royal Government of Bhutan (RGOB), is expected to promote biodiversity conservation. Already the Fund has organised short-term training courses.

The Royal Society for the Protection of Nature (RSPN) was established in 1985, the first non-government organisation to deal with environment and allied concerns, said Mr. Yonten. Its principal objective is to promote conservation, manage natural resources, and raise public awareness on environmental issues.

In its initial phase the RSPN, with a staff of two and without external funding, devoted full attention to monitoring and protecting rare and endangered species, particularly the Black-necked Crane, and also in lobbying on environmental issues.

In August 1990, with WWF funding, the RSPN set up a permanent office and expanded its functions. The MacArthur Foundation became a donor in 1992, enabling RSPN to discard its watchdog role and to increase its activities.

(a) The basic objective of the RSPN has been a *priori* to heighten public awareness on environmental issues through educational programmes,

campaigns, publications, etc. RSPN has identified eight categories of programmes. Its focus, however, is on environmental education publications, lobbying, and ecotourism. The organisation has three units - audiovisual, environmental education, and general administration and management. In 1993/1994, RSPN will increase its biannual reports to six publications per year.

(b) Since public awareness programmes have so far mainly targetted school children and the literate population, RSPN identifies non-formal education as a future priority for the largely illiterate population. No public funding or support has come in for RSPN yet. The reasons for this are, first, that geo-political factors ensured that the kingdom maintained its ecological balance, so environmental issues are less urgent; and second, that a majority of the population are illiterate and unaware of the environmental repercussions of development. Thus, the still-evolving RSPN must continue to depend on external funding for its programmes and for its survival, making self-sustainability a long-term goal.

(c) Since most donors prefer to support specific projects, MacArthur funding is sought for institutional support.

■ WWF Bhutan and Nepal Programmes

Mr. Mingma Sherpa said that training, institutional support, and the inclusion of social forestry in the Bhutan Forestry Institute curriculum for trainers had been made possible because of MacArthur support. It had enabled staff to obtain technical training abroad and had helped develop curricula in various institutions such as the Bhutan Forestry Institute and Sherubtse College.

Mr. Sherpa said that MacArthur's

'seed' money to the Bhutan Trust Fund had made it possible for them to develop project proposals, widen their donor base, and organise field programmes.

A major development of the WWF Bhutan and Nepal Programmes was the establishment of field offices in both countries. These offices have enabled WWF to play a critical role in several important conservation initiatives, including the founding of the model Bhutan Trust Fund for Environmental Conservation. The field offices have developed the institutional capacity to supervise and support WWF activities in Bhutan and Nepal, and they have greatly improved WWF's effectiveness in providing technical assistance to conservation projects in these countries. They have made it possible to directly implement and supervise WWF activities and have improved the efficiency of WWF programme coordination in the Himalayan region.

The WWF Nepal and Bhutan Country Programmes have developed a long-term plan to work with NGOs and government agencies to conserve biodiversity. Developing and managing priority protected areas, as well as capacity building through education and awareness activities, will be continued. To this end, external funding will be important to WWF and conservation partners.

Discussion

The participants began by raising three points: that Eastern Himalayan temperate forests are intact forests, making their preservation a priority; that training should be a high priority; and that management plans should be formulated for three important areas.

Responding to a question, a Bhutanese discussant said that the importance of local species and their use

is illustrated in Thimphu hospital's traditional wing being bigger than the 'modern' wing. High priority is given to the collection and incorporation of local knowledge in projects and education, which is considered a two-way process between extension agents and the villagers.

He said a Citizens' Report on the State of the Environment is being published by RSPN. Students were conducting a survey on people's perceptions of the environment, and people from different institutes would be involved in the information exchange.

Noting that the Indian forest area, adjoining the Royal Manas Park in Bhutan, has been designated as a World Heritage Site, a UNESCO delegate asked what steps Bhutan had taken to ratify the UNESCO Convention. He said there were conflicting reports from India regarding the area and mentioned UNESCO's interest in sending a mission.

A discussant affirmed that WWF maintained contact with the Manas Park administrators. Although the conflict in Assam had created a management and protection problem, the Bhutanese and Indian sides were working it out together. He said Bhutan was working towards ratifying the convention.

Mr. Samar Singh said the principal issue was protection, especially of the tiger. He told participants that a National Biodiversity Alliance had been created by the Indian President, which included NGOs, media, and government officials, and that the Manas area topped the list of priority areas.

Mr. Yonten said the RSPN membership drive had begun and technical support was being provided by the Forest and Education departments among others. Nature guide books had been published and nature clubs established.

Responding to a question about protected and unprotected areas, a Bhutanese discussant said that 60 per cent of Bhutan has forest cover, 22.85 per cent of which includes protected areas that have human settlements. Besides these protected areas, forests have been designated for watershed protection and household and community use (where tree felling is open for limited extraction of resources).

■ Sri Lanka

Dr. S. K. Bawa, of the University of Massachusetts and Tata Energy Research Institute, New Delhi, chaired the meeting in which programmes in Sri Lanka and India were discussed.

Dr. C.V.S. Gunatilleke of the University of Peradeniya spoke about her research at the Sinharaja World Heritage Site.

The rain forests of Sri Lanka, spread over 15,000 sq.km. of the country and inhabited by 57 per cent of its population, are a relic of the Deccan Gondwanic flora and, therefore, of considerable biogeographic importance to the South Asian region. Ninety per cent of the endemic angiosperm flora in Sri Lanka are also concentrated in these forests. High species' occurrence and point endemism depict nine of the 15 distinctive floristic zones in the country as being exclusive to the small area. Over 50 per cent of the country's endemic flora are found in such forests.

The overall objective of the research in Sinharaja, the largest protected reserve in the wet lowlands, is to provide information useful for biodiversity conservation as well as for sustainable production of forest resources. Initiated in 1977 and funded by various organisations, including recently the MacArthur Foundation, the

research has expanded from an initial floristic inventory to an integrated multidisciplinary programme. The main facets of the research are given below:

Silvicultural Research

a) Seedling studies of selected canopy dominant species (i) in controlled shelters under varied moisture and light regimes and (ii) across natural forest gaps to identify the best micro-environment for establishment of each species. Competition among seven canopy dominant *Shorea* species is also being studied in other natural gaps of the forest.

b) Enrichment planting strip cuts in Caribbean pine plantations in the buffer zone. This trial of natural forest timber and non-timber species, as well as export agricultural crops and exotic timber species, will provide information on how monocultures may be converted to forests of multispecies' production or restored to ecosystems rich in species.

c) Long-term forest dynamic studies in the undisturbed forest. All plants more than one centimetre in diameter at breast height in a 25 ha plot are tagged, identified, and mapped to monitor the long-term changes of all the species within it. This information base will be invaluable in understanding (i) the micro-site specificity of species, (ii) differences in the performance of species in a similar logged forest nearby that will be established in the future, and (iii) plant diversity changes in silvicultural systems to be developed for production forests using knowledge accrued from seedling studies.

d) Vegetative and reproductive phenology of 10 canopy *Shorea* species, each represented by 30 trees, have been recorded weekly since 1985 to

examine their responses to long-term changes in climate.

Conservation Education

Programme : Based on research experiences, conservation education programmes have been conducted for officials of the Forest Department, university students as part of their ecology courses, local guides, and even foreign visitors. The publication, "A Guide to the Common Trees and Shrubs of Sri Lanka", is nearing completion.

Future plans include continuing the existing programme, encouraging village participation in *ex situ* cultivation of Non-Timber Forest Products (NTFP) in home gardens and buffer zones, integrating the latter with ecotourism, and conducting research on suitable silvicultural systems for the rain forests of Sri Lanka that serve multiple roles of production, gene pool conservation, education, and recreation.

■ India

Dr. R. Sukumar of the Centre for Ecological Science at the Institute of Science, Bangalore, said the Centre has been conducting a variety of basic applied and action-oriented research on biodiversity in the Western Ghats in south India. In recent years, there has been an increasing trend to study the entire spectrum of biodiversity of plants and animals, focussing, however, on elements of special human concern such as plant cultivars and medicinal plants. Under the MacArthur funded programme, these shifting priorities had been taken into account. The Centre initiated the following activities in the Western Ghats, focussing on the Nilgiri Biosphere Reserve.

1. Studies of plant-diversity in different ecological zones and habitats. This work involves basic inventories of plant taxa and longer term

studies of forest dynamics in permanent vegetation plots. Plots have been set up in two zones - the deciduous forests of the Western Ghats and the montane evergreen forests of the upper Nilgiris. Apart from the angiosperms, the Centre also intends to look at levels of diversity of lower plant groups such as pteridophytes, bryophytes, lichens, and fungi. These permanent plots are sites for monitoring several animal groups.

2. The wild relatives of cultivated plants and plant cultivars are being studied in the north Kanara district of Karnataka.

3. Diversity of soil micro-organisms, in particular the cellular slime moulds and the diversity of social insect groups, will be monitored in the permanent plots in both the deciduous and evergreen forests of the Nilgiris.

4. Diversity of vertebrates (amphibians, reptiles, and mammals) are being studied in the montane evergreen forests and grasslands. This will later be extended to cover their habitats in the Western Ghats, perhaps with the inclusion of birds.

In addition, the Centre will conduct an Asian School of Conservation Biology in Bangalore in August 1995. Researchers, students, and administrators from several Asian countries are expected to attend. Apart from biological issues relating to biodiversity conservation, policy issues are to be addressed. Grant funds will enable the Centre to set up its own field station to strengthen its field infrastructure in the Nilgiri Biosphere Reserve.

Mr. B. V. Shetty, of Mangalore University, delivered a presentation on the Western Ghats of Karnataka, with special reference to conservation of flora and fauna and plant lore.

An arboretum was established on the Mangalore University campus in an area of 1.8 ha. Of the 133 species

of trees and 189 species of shrubs and climbers endemic to the Western Ghats of Karnataka, seedlings/propagules of 45 species of trees, 19 species of shrubs and climbers, and eight endemic species of herbs have been introduced in the arboretum.

Vegetation studies/floristic surveys of both the forests and grasslands have resulted in the collection of 730 field numbers of specimens. Of the 300 identified, 47 species are from the grasslands. From satellite imagery and aerial photographs, forests of different classes are being identified and quadrat studies initiated to assess their structure and diversity. The Land-use pattern in the township of this mining area has been recorded and will be compared to the land-use pattern before mining operations began to assess the impact of mining and related activities on the area's vegetation.

Studies of the difference between mycoflora of iron-rich and non iron-rich areas have been conducted to identify strains of fungi that may serve as bio-monitors of heavy metals. Another subject of study is litter decomposition in some selected plant species in iron-rich and non iron-rich areas to assess the differences in the rate of decomposition. Research on iron-rich soils, with particular reference to their variation and distinction - depending on the host species - will be conducted to identify the species suitable for afforestation programmes.

Of the five species of chelonians in the Western Ghats, *Lissemys punctata* (flapshell turkey), *Trionyx leithii* (softshell turtle), *Melonochelys trijuga* (black pond turtle), *Indotestuda forstenii* (Travancore tortoise), and *Geoemyda silvatica* (cane turtle), the stream-dwelling black pond turtle was selected for study by the capture-recapture technique, employing a novel trapping device standardised in our laboratory. Re-

sults indicate that there are 23 animals per km of the stream with a sex ratio of 2:8 (male:female); these are active at night, feeding mostly on carcasses and detritus, and rest during the day. Currently, attempts are being made to increase the sample size of the black pond turtle so that the data can be analysed by means of a specific computer software and so that radio telemetry can be used for the study of Travancore tortoise and cane turtle, twin species that are endemic and endangered.

Ethnobotanical Studies: Ethnobotanical studies were carried out on the Siddi and Gowli tribes of Uttara Kannada district and on the Koraga and Melekudiya of Dakshina Kannada district. A total of 108 plant species emerged as ethnobotanically useful from Uttara Kannada district, of which 96 plants are of medicinal importance. The curative property of two orchids, *Bulbophyllum neigherrense* and *Malaxis densiflora*, and the antifertility property of *Calamus thwaitesii* were recorded for the first time. In addition, 51 new medicinal uses were recorded for 43 known medicinal plants. Another noteworthy finding of the study was the use of *Vitex negundo*, *Ludwigia perennis*, and *Phyllanthus emblica* as pesticides and insect repellents. Ethnobotanical studies in South Kanara district revealed the various uses of about 307 plant species, of which about 230 species were medicinal. The abortifacient property of *Sapindus laurifolius* and *Entada pursaetha* were recorded for the first time.

Chairman Dr. K.S. Bawa said that the Western Ghats and the Eastern Himalayas in India are the "hot spots" of biodiversity. Conservation of biota in the two regions, as in much of South Asia, is hampered by a lack of information about (a) the rate of deforestation and degradation of habi-

tats, (b) the relative abundance and distribution of keystone species, (c) the effect of collection of timber and non-timber forest products on forest dynamics, (d) the socioeconomic determinants of forest resource use by indigenous communities as well as by government and non-government agencies, and (e) the regional land-use patterns.

Other impediments to effective conservation include inadequate measures for identifying and addressing the rural requirements of biomass, primarily fuelwood and fodder, and the shortage of human resources to resolve critical issues of biodiversity conservation and sustained use of forest resources.

Referring to the findings of research to address the above issues, Dr. Bawa told participants that the public awareness of the importance of biodiversity and the need to conserve the biota had increased in the preceding three years. During the same time, however, pressures on protected areas, including reserve forests, had intensified. The government agencies recognise that (a) rural needs of biomass must be addressed, (b) prudent use of biodiversity can contribute to the economic betterment of rural people, and (c) local communities should engage in conserving and managing biodiversity.

In concluding, Dr. Bawa said there are opportunities to take new initiatives in biodiversity preservation in South Asia as a result of increased public awareness of the value of biodiversity, the enhanced commitment of government and non-government agencies to conserve biodiversity, and conceptual and methodological advances in conservation biology, including approaches towards the valuation of biodiversity.

A joint presentation by Mr. Thomas Mathew and Mr. Samar Singh followed on WWF India's Biodiversity "Hotspots" Conservation Programme (BHCP). In July 1992, after a year of developing proposals and planning, WWF INDIA initiated the Biodiversity "Hotspots" Conservation Programme (BHCP) as part of its overall Biodiversity Programme.

The Programme attempts to provide a specific focus on two biodiversity rich zones of the Indian subcontinent - the Eastern Himalayas and the Western Ghats. WWF India's Biodiversity Programme brings together several subprogrammes in the following areas.

1. Wetlands
2. Conservation Information (Indira Gandhi Conservation Monitoring Centre)
3. Community Biodiversity Conservation
4. Protected Areas/Project Tiger
5. Conservation Manpower (Conservation Corps' Programme)
6. Illegal trade in endangered species of flora and fauna (TRAFFIC INDIA)

The BHCP provides a comprehensive biodiversity conservation focus, involving elements of every subprogramme mentioned above, on the key biogeographic regions (the Eastern Himalayas and Western Ghats) listed among the world's top 12 or so megadiversity "hotspots."

Used in relation to biodiversity the term "hotspot" has been the source of confusion and controversy. It originally designated major biogeographic regions rich in biodiversity but under threat from anthropocentric causes (development projects, shifting cultivation, logging, poaching, etc). The term is now somewhat loosely used to represent even smaller areas (e.g., sanctuaries under threat) that need concerted attention.

Taken further, advocates of a "landscape ecology" approach point out that a focus on local biodiversity "hotspots" is inadequate to take into account all the natural and man-induced relationships and influences that determine the biodiversity status of a particular region. It is not possible to conserve a local "hotspot" away from the influences exerted by elements in the landscape 'matrix'.

This is a valid argument and a more scientific approach. The term "hotspot" could still be used to indicate areas requiring priority attention. In addition to the two global "hotspots" under consideration, the Steering Committee for BHCP talked of the need to identify other "hotspots" in India.

BHCP Philosophy and Approach

WWF India's approach to the BHCP is built on the recognition of:

a) its position as a leading, influential conservation NGO interacting closely with a network of NGOs, scientific institutions, and official bodies, and

b) the existing programme and initiatives in biodiversity conservation in the two regions executed by a range of official and non-official bodies.

BHCP seeks to strengthen existing priority efforts in the field, in research on policy analysis and campaigning, and in education and legal support aimed at biodiversity conservation in the Eastern Himalayas and the Western Ghats. BHCP's approach in the Western Ghats differs markedly from that in the Eastern Himalayas. The Western Ghats have a significantly wider range of programmes and 'schemes' underway, aimed at conserving *in situ* and *ex situ* the biodiversity of the region, than do the Eastern Himalayas. There are few conservation

NGOs in the Eastern Himalayan region where Forest Departments and State Governments need far greater support from the BHCP than they do in the Western Ghats.

The first step taken in each zone is to scientifically delineate the area under reckoning. While practical and strategic considerations occasionally necessitate a focus on issues and areas outside these biogeographic zones (e.g., Army Biodiversity Conservation Programme), a key BHCP objective is to maintain its area focus in order to try and make a tangible impact on biodiversity conservation within it.

The Planning and Implementation Framework

In its preparatory phase, the BHCP team considered alternative frameworks in which the programme could develop and the thematic and geographical priorities could be selected. In line with the status of WWF INDIA as an NGO with a decentralised structural network, as well as a network of partner NGOs and institutions, BHCP adopted the strategy of providing broad support to and, where appropriate, influencing the priorities of its programme partners in biodiversity conservation. BHCP's main activities in the two biogeographic regions fall under these broad headings.

1. Strengthening the protected area network
2. Conservation of biodiversity outside the protected area network
3. Eco Development
4. Emergent action (campaigns) to prevent destruction of biological diversity
5. Strengthening the legal and policy framework
6. Applied research in biodiversity conservation

Projects and programmes under

each of the heads were identified through a series of planning workshops and commissioned studies in both zones. When the International Convention on Biodiversity was seriously discussed at the national level and finally put into effect in December 1993, it was adopted as the framework for implementation for BHCP.

The Convention on Biological Diversity, to which India is signatory, provides an appropriate planning framework for WWF INDIA's Biodiversity Programme and hence for BHCP. The projects implemented under BHCP, the background monitoring of biodiversity, and the policy analysis and lobbying contribute to the comprehensive requirements of the CBD in the two biogeographic regions. In summary, the Convention calls for the following.

1. National Strategies and Action Plans (Article 6)
2. Identification and monitoring of the components of biodiversity (Article 7)
3. *In situ* conservation (Article 8)
4. *Ex situ* conservation (Article 9)
5. Sustainable use of the elements of biodiversity (Article 10)
6. Incentive measures (Article 11)

7. Research and training (Article 12)
8. Public Education and Awareness (Article 13)
9. Impact and assessment and minimising adverse effects (Article 14)

It should be noted that biodiversity is subjected to macro-level processes such as:

1. structural adjustment policies,
2. population changes due to migration,
3. changes in lifestyle, e.g., the increase of consumerism,
4. increased awareness among politicians, and
5. the reassertion of ethnic identities.

Lessons Learned

The main merit in the broad, facilitative catalytic approach to biodiversity conservation adopted by BHCP lies in the fact that the programme could remain alert to evolving priorities and 'gaps' that needed concerted attention. Clearly, one priority area in which much "sub-critical" activity takes place, that is crucial for biodiversity conservation in India, is livelihood from conservation of biodiversity and the sustainable use of its components. As in the case of exploring *Taxus baccata*, widely believed to be a cure for cancer, powerful commercial interests could wrest away community control over its resources.

Inter-Country Collaboration on Biodiversity Conservation in the Eastern Himalayas

BHCP has identified possible regions for trans-national parks, based on the work of the Wildlife Institute of India and the State Forest Departments of Sikkim and Arunachal Pradesh. Transnational collaboration in biodiversity conservation should be based on sound scientific principles



LU RONGSEN

Common yew (*Taxus baccata*), a Himalayan species believed to offer a cure for cancer

and carried out in a transparent and politically sensitive manner. MacArthur grantees in each country, i.e., Nepal, India, Bhutan, China, and (in future) Myanmar, should consult their governments and take the initiative of putting forward scientifically sound plans for field assessments and information exchange to facilitate biodiversity conservation.

BHCP has made an effort to continuously collate information on current official and non-governmental biodiversity conservation programmes in the Western Ghats. This is carried out primarily by the WWF INDIA Data Centre for Natural Resources in Bangalore and the WWF INDIA Secretariat in New Delhi. There is a proposal to publish a Western Ghats newsletter in collaboration with a partner NGO, viz., the Wildlife Association of Ramnad District (WARD).

There is a need for better inter-programme communications in coordinating and developing synergies in the implementation of MacArthur supported biodiversity conservation programmes in the Western Ghats and the Eastern Himalayas. It would be useful to establish a MacArthur Grantees' Consultative Forum to facilitate an exchange of ideas and initiate complementary activities.

Though there is informal contact between programme staff, no formal communication, coordination, and consultation mechanisms exist at present.

Discussion

Dr. Bawa said the project in the tribal area plans to add value to NTFPs to increase income and to make extraction sustainable. Rural communities share a disproportionate cost of biodiversity maintenance and further studies are needed to find out whether

Rural communities share a disproportionate cost of biodiversity maintenance and further studies are needed to find out whether extraction can be sustainable.

extraction can be within sustainable limits. The extraction rates of non-timber forestry products vary between the two sites, e.g., the rates in the BR Hills are much higher than at the other site. An example of NFTP extraction with high economic returns is broomstick grass (*Amriso*) in Darjeeling and Amla.

Dr. Sukumar said that his project had not yet looked into NFTP availability and extraction but would soon do so. Dr. Mathew said the government had made a major change in its environmental policy framework in the preceding three to four years. Recently, the Government and NGOs had begun to work more closely. In his view, there had been a significant increase in the public's awareness of wildlife conservation in India.

■ Nepal

Chairing the session, Dr. Sharma, Department of National Parks and Wildlife Conservation, Nepal, said that the theme of the session should have been how circumstances of conservation had changed since 1991. Dr. Sharma said protected areas encompass 14 per cent of the country. The protected area system evolved from traditional style national parks in the lowlands to different types of national

park, e.g., the Annapurna and Makalu-Barun Conservation Areas. Changing circumstances dictated a change in the administrative system of protected areas too. He said the administration aspect was critical in successful conservation.

Mr. Anil Chitrakar, Director of Environmental Camps for Conservation Awareness (ECCA), Nepal, gave his presentation on ECCA activities.

Since its inception in 1987, ECCA has conducted a series of programmes with the objective of educating and mobilising school children in conservation and better resource management. The ECCA methodology entails a three-tier structure: 1. a three-day counsellor's training camp to train local youth, 2. a five-day ECCA camp to train school children, and 3. the non-formal and continuous transfer of available skills, technologies, and information to other classmates, parents, and the community as a whole, thus facilitating the formulation of locally-designed environmental plans. In six years, ECCA has covered 32 districts with a total of 700 members. McArthur support has enabled ECCA to take its activities to the eastern *terai*.

ECCA is unusual in several respects.

The revival of traditional forms of organisation and the building of new local institutions where appropriate can empower these communities with the means to counterbalance outside forces, enabling them to conduct development activities that match their actual needs and cultural frameworks.

It takes camps to children, thus accommodating diversity in "topography;" it is interdisciplinary - it provides the total picture; it acts as a catalyst so that there is an "organic chemistry" in the exchanges between experts, youth, and children; it links supply and demand sites and initiates the process of reversing the damage that has already occurred as in the Shivapuri Watershed case where the ECCA camp generated a demand for 250 stoves. Children went on field trips to learn about pond ecology at the local village pond, visited cultural sites to make an inventory of their heritage, and learned about natural processes such as how photosynthesis works.

No programmes have yet been planned for children not attending school. Ironically, children are kept away from school by chores such as collecting natural resources for sustenance; environmental education is thus more important to them. ECCA has set up a paper recycling plant with the help of Development Alternatives.

Ms. Jeannette Gurung, of ICIMOD, presented a slide show on "Promoting Participatory Agroforestry" to introduce ICIMOD's project in Nepal and China, noting that the following day would be devoted to a comprehensive discussion on the results of ICIMOD's action-research.

As remote mountain residents of two protected area buffer zones, the farmers of two ICIMOD project sites - Yunnan Province in China and Sankhuwasabha District in Nepal - have little access to technical advice, services of government extension agents, inputs such as improved seeds and fertilisers, or markets, with which they could improve their private sources of biomass and reduce use of the Protected Area's resources. Besides the insufficiency of regular exten-

sion services, these areas lack strong, alternative village-based organisations that could act as intermediaries between farmers and government agencies and provide such assistance. Where such services do exist, they are usually determined by planners far removed from hill farming. Therefore, they design inappropriate programmes that cannot be sustained by the communities themselves.

The majority of farmers in the two areas belong to ethnic groups other than mainstream Chinese and Nepali nationalities. Their traditional cultures are encountering challenges posed by migration, tourism, and development. The strong spiritual values prevalent in their societies have provided a dimension of life that is under stress from modernising elements. The revival of traditional forms of organisation and the building of new local institutions, where appropriate, can empower these communities with the means to counterbalance outside forces, enabling them to conduct development activities that match their actual needs and cultural frameworks.

The fundamental concept underlying this project is that the transfer of technical knowledge cannot occur without prior strengthening of local capacities, nor without an understanding of local land-use practices and cultural values. Therefore, project activities began only after acquiring a knowledge of this background by a participatory process involving local leaders and the farmers they represent.

The task of strengthening local organisations in the two project areas is being undertaken through a partnership with two organisations, SAGUN in Nepal and the Kunming Institute of Botany in China, in conducting research on indigenous knowledge and cultural factors related to

agroforestry/forest management. Training, the major component of all activities, is provided on the technical aspects of agroforestry and in organisational management. Assistance is provided to the local organisations to develop links with government and non-government resource institutions and with other farmers in the region from whom effective new technologies can be learned.

Dr. J. G. Campbell, Woodlands Mountain Institute (WMI), USA, introduced his organisation, which supports integrated programmes for biodiversity conservation and sustainable development with partners in Nepal and the Tibetan Autonomous Region (TAR), China: the Qomolangma Nature Preserve (QNP) in TAR, the Chinese Academy of Sciences's Institute, TASS, and the Tibet Development Fund; and the Makalu-Barun National Park & Conservation Area in collaboration with the Department of National Parks and Wildlife Conservation of Nepal and cooperating scientists.

These two separate national parks linked up with other existing parks in Nepal and Tibet to create continuous protected corridors over an area roughly the size of Switzerland. Citing the physical diversity and rich biological diversity of the two areas, Dr. Campbell said the high variation in rainfall (200-5,000mm) and remoteness were other factors in making the Mt. Everest and the Upper & Lower Arun areas genuine "hotspots" where both Nepali and Chinese scientists have found new evolving species. As elsewhere in the Himalayas, people form an integral part of the ecosystem. Therefore, these areas were designated as protected areas with the aim of finding innovative solutions to biodiversity conservation, of establishing effective protected areas

(PAs), and of minimising conflicts between people and parks.

Dr. Campbell said WMI's Himalayan Programme objectives are to develop new models for integrating local people in park management by combining biodiversity conservation with sustainable development; integrating interdisciplinary, innovative research with management needs; planning PA management through interdisciplinary teams of local scientists and parks' specialists using participatory research; building new forms of international and local partnerships between governments, INGOs, NGOs, and research institutions; building local sustainability through enhancing indigenous management capabilities; and facilitating cross-boundary and international linkages and exchanges.

Dr. Campbell highlighted the recent lessons and changes and the future challenges. The recent lessons and changes include the need for new models to integrate local people in park management (widespread acceptance and application, conservation area/buffer zone model with biodiversity zoning, integration of cultural conservation and traditional resource-use value, incorporation of women in management); combining biodiversity conservation with participatory sustainable development (user group resource management with integrated biodiversity objectives - forests, pasture, livestock, vegetable seeds, use of Participatory Rural Appraisal (PRA) models and new techniques for village planning, sustainable livelihood, and income enhancement through biodiversity, gender focus on women's key roles and opportunities - user groups, income generating and training programmes, scouts); integrating research and management (management initiated and coordinated research,

interdisciplinary methodology, integrated biodiversity database, mapping and coordination, innovative linkages of the research process with concerting indigenous knowledge and training local resource custodians); planning PA management through interdisciplinary teams and participatory research (task force approach, linking scientists, park managers, local people, translating results into a plan framework and operational plan-log frame with extensive review, utilising team planning methodologies); building new forms of international and local partnerships (government-INGO-NGO, partnerships with local people, management, research partnerships, international conservation community and donor partnerships, capacity building-technical, managerial, financial); promoting local sustainability by improving approaches (user groups, village planning), local training and conservation education, critical support and innovative cross-boundary and international exchanges/linkages, role of INGOs in facilitating unofficial exchange and in scientific conflicts; biological sustainability, economic viability, and locally perceived linkages to conservation; achieving synergy and cumulative results, interdisciplinary methodologies, information sharing, linkages with field managers; refinement and application of existing PAs in the Himalayas; evolving effective models and clarifying areas for joint and complementary activities, bridging organisational culture gaps - the best of both worlds; reaching all critical communities and ensuring sufficient biodiversity conservation compatible incomes; systematic information exchange, joint research and management mechanisms, and financial support.

Mr. Thapa, King Mahendra Trust

for Nature Conservation (KMTNC), Nepal, said that KMTNC had been receiving financial support from the MacArthur Foundation since 1988 to develop the institutional capacity of the Trust in terms of equipment and human resources. In addition, MacArthur had also assisted the Nepal Conservation Research and Training Centre (NCRTC) of the KMTNC in the Royal Chitwan National Park (RCNP).

Mr. Thapa said the Annapurna Conservation Area Project (ACAP) was the most significant achievement of the KMTNC. ACAP played the role of a catalyst in a situation where people's participation as well as financial sustainability were necessary for the programme to be successful. The Department of National Parks, and Wildlife Conservation (DNPWC) had adopted a legislation in 1986 to use the revenue from national parks to benefit the communities settled in the vicinity of the parks in recognition of the fact that conservation and development are not mutually exclusive. The establishment of community plantations outside both Chitwan and Annapurna had given people an alternative source of the natural resources required for every day use, e.g., fuelwood. At ACAP sites, locally made micro-hydro plants had been installed and were locally repairable. More hydro-plants are planned in the ACAP region.

Mr. Thapa believes that most donors are willing to assist scientific projects but the problem of meeting recurring costs remained (basic infrastructure and human resource development). This was the major constraint Nepali NGOs faced. The WWF and MacArthur Foundation support had enabled KMTNC to undertake more project work, but future assistance was needed.

Discussion

Noting that wildlife had rarely been mentioned in the presentations, Dr. Rabinowitz asked what had been done about poaching in Nepal and if regular surveys of wildlife were being conducted. In response Dr. Sharma said that the MacArthur Foundation had funded efforts to control rhino poaching (for horn). Poaching of tigers and bears (for bones and gall bladders respectively) occurred in Nepal. Although the Chitwan and Bardia national parks were protected by the army, rhinos often crossed into adjoining forests and croplands outside the army jurisdiction. Anti-poaching units of local villagers had been organised to inform the DFOs; who had armed guards. The International Trust for Nature Conservation had provided assistance in this. In Tibet, since new regulations on the export of wildlife products were enforced, there had been no poaching incidents in the preceding three to four months.

Mr. N. Ishwaran suggested that creating buffer zones with the local people's participation might be useful in dealing with the problem of species wandering outside park boundaries. For example, the cluster of reserves protecting the giant panda

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habitat in China were linked by corridors. He said that emphasis should not only be limited to increasing the benefits derived by the people and that animals need a larger habitat.

Mr. Mingma Sherpa pointed out that over 60 per cent of the park's budget in Nepal was spent on protection units, but the focus had now shifted to people's participation in protection and in management.

Responding to a query, Ms. Gurung confirmed that ICIMOD was drawing upon local knowledge on the uses of local plants. To another query, Dr. T.B.S. Shrestha said that orchids and medicinal herbs growing at altitudes over 4,000m were being overextracted in the lower region of the Makalu-Barun area. Some medicinal herbs/plants were protected by the law only in theory. The bark of *Daphne* (used for making Nepali paper) was also being over-harvested. Nettle fibres (the longest known botanical fibre) were used for fishing lines and to make *allo*, a certain tweedy type of cloth. A specific programme had been started for its development and for research on *allo*.

Dr. Byers added that the Makalu-Barun project had adequate funding to fill the existing knowledge gaps and that research on plants and sustainable harvesting was continuing. A Chinese participant said that cross-border smuggling (Pakistan, Nepal, Tibet-China, Mongolia) was a big issue and suggested that a survey be conducted to determine the extent of the problem.

Dr. Sharma stressed that the biggest challenge lay in maintaining the required level of biodiversity in the existing national parks and not in setting up more parks. More areas should be declared buffer zones (forest areas and private lands). Thirty to 40 per cent of the revenue

should be ploughed back by the user groups into community development. Unless trans-boundary PAS are established, it will not be possible to preserve the whole ecosystem. The Valmiki Tiger Preserve (in India) and the Chitwan National Park and the Parsa Reserve (in Nepal) could support 180 tigers. In Dr. Sharma's view, the root cause of people and parks' conflicts was poverty. Unless income is generated, the conservation problem cannot be solved.

General Discussion on Grantees' Presentation

Dr. Bawa identified the following changes in biodiversity management:

- increased knowledge of biodiversity,
- more receptivity on the part of individual governments,
- improvement of, and innovation in methodologies (for example, incorporation of GIS in monitoring, mapping vegetation, etc),
- standardisation of protocol for biodiversity monitoring,
- environmental education,
- opportunities for exchanges of ideas and more interaction among people working in the region, and
- although changes in economic development exert pressure on biodiversity, linking biodiversity management and development could be an opportunity.

He identified the challenges as:

- involving local people and accepting their practices and values,
- inadequate understanding of interactions between local people and wildlife: poaching was still a serious problem,
- role of women in management, and
- intellectual property rights: the question of compensating the local people for extraction of their indigenous knowledge.

Dr. Ramakrishnan called for a degree of commonality in methodologies for linking case studies so that valid conclusions can be derived. The linkages between social and ecological sciences are not well developed, thus there is a need for such linkages. Human resource development, in Dr. Ramakrishnan's view, is a key to tackling these issues. He said specific recommendations are required for the replication of methodologies and experiences.

Dr. Bawa said some countries, such as Bhutan, had high levels of biodiversity outside the Protected Areas, whereas others had little. Dr. Ishwaran said UNESCO was very interested in trans-boundary cooperation. He said that multilateral cooperation was necessary, as in the example of Manas National Park where the Indian side of the park is protected but where there is uncertainty over what happens on the Bhutan side. At this, Dr. Campbell stressed the need for database, biological inventories, and joint management decisions in the case of contiguous national parks across borders.

Dr. G. Martin said NTFPs provided a theme for developing a common methodology in which the field of ethnobotany was important. He questioned whether local people were made part of the research team or not. He also noted that while many resource users are women, it is mostly men who are engaged in the research. Dr. Bawa noted that the local communities - through NGOs - indicated the kind of programme activities that interested them.

Dr. Sukumar called for the cultivation of endemic trees, plants, and for NTFP to be encouraged outside the PAs. Mr. Mingma Sherpa noted the importance of institutional sup-

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port and the development of human resources. Dr. Mundy said the introduction of agroforestry schemes would enrich biodiversity outside the PAs.

Mr. Yin Bing Gao said that, from the management point of view, trans-boundary conservation, between Nepal and the Tibetan autonomous region, for example, would be effective in controlling poaching.

■ China

Prof. Wang Sung, of the Endangered Species' Scientific Commission, PRC, said that support from the MacArthur Foundation enabled Chinese conservation scientists to link up with international conservation. He recalled that China had signed the Convention on International Trade in Endangered Species (CITES) in 1981. The two major objectives of the project were to: i) operate the



Sika deer (*Cervus nippon szechuanicus*) inhabit the Chinese Himalayas

Endangered Species' Scientific Commission (ESSC), a task of two components - communications and transport and facilities, personnel employment, and miscellaneous; ii) link Chinese institutions and experts with international agencies, for example, the MacArthur Foundation projects, Biodiversity Working Group/CCICED (China), CITES issues, IUCN, Chinese specialist groups, MAB/UNESCO, and others. The Biodiversity Working Group/CCICED projects covered a wide range of issues such as wildlife trade, *in situ* conservation status, *ex situ* conservation of endangered plants and animals, a meta-database of biodiversity in China, and so on. The BWG/CCICED held a meeting in Hainan which was followed by field surveys.

Professor Wang Sung said there are opportunities for cross-boundary conservation, e.g., between China and Mongolia, and China and Russia. Collaboration is necessary - and IUCN is interested in opening an office in China. Training programmes for students was a means of raising the awareness of the general public about conservation. He said conservation programmes and activities - as well as the status of biodiversity in China, especially endangered species - needed assessing. Threatened species and groups include musk deer, bear, pangolin, leopard, bats, etc.; a species inventory was needed for accurate data on these species. A database on marine species was needed too. Prof. Wang Sung said the ESSC is working towards these. He talked about the Status Report and Action Plan for Biodiversity Conservation, which include the assessment of the Biodiversity Status of China, China's Biodiversity Action Plan, and Action Planning for Species/Groups. It also includes proposals for building a national

biodiversity database, trade survey, quota-setting, e.g., for leopard cat and bear-farming evaluations.

Prof. Wei Zhi Ji, of the Kunming Institute of Zoology, Chinese Academy of Sciences, said that the Kunming Institute of Zoology (KIZ) and the Wildlife Conservation Society (WCS) were collaborating to train and aid conservation researchers and managers as well as to survey the tropical and sub-tropical forests of the Gaoligongshang region in Yunnan.

Five surveys have been carried out, covering 25,000 sq. km. Altogether 485 species of birds and 176 species of mammals were recorded, among which were nine new bird and eight new mammal records for Yunnan. Other new species could include a small muntjak and a hedgehog. Of the species newly recorded, 36 per cent of mammals and 68 per cent of the birds were found at elevations under 2,500m; 71 per cent of the mammals inhabited terrain between 2,000 and 3,000m while 60 per cent of the birds were found between, 1,000 and 1,500m. The highest species' density - 842 per 100 sq. km. (mammals) and 74 per 100 sq. km. (birds) - occurred in areas between 210 and 500m where human population densities were lower than those at higher altitudes.

Prof. Wei Zhi Ji said the main threats to conservation are deforestation, resulting from agricultural encroachment, tobacco plantation, firewood collection, logging, and poaching. A computerised database centre has been established based on the mass system, with a Chinese version for those unfamiliar with English. The data would be available to the Forestry Department and other users. The database covered information (both field data and publications' reviews) on i) species, habitat, and

the protected area's conservation system, e.g., established nature reserves, protected wildlife, endangered wildlife, mammals, birds, and reptiles in China; mammals, birds and amphibians in Yunnan; mammals, birds, reptiles, and amphibians in the Gaoligongshang region; and ii) management system of vertebrate specimens at the KIZ, including a database of bird, fish, mammal, reptile and amphibian specimens (in preparation) as well as data on and location of the collections.

The first Wildlife Research and Conservation Training Course held in Xishuangbanna (March 1993) was attended by Forestry Department staff from all over southwest China. The first Wildlife Conservation Workshop for teachers was held at the KIZ (March 1994) in which teacher-trainers from New York and researchers from the KIZ taught primary and middle-grade teachers from Kunming and Xishuangbanna to develop a curriculum for life sciences' instruction and biodiversity conservation. The use of calendars, articles on wildlife conservation, and other media (T.V.) in teaching conservation education to students and the general public was highlighted.

The KIZ also networked with Yunnan Provincial Forestry Department and Kunming Institute of Botany (KIB) to carry out biota surveys in Xishuangbanna and Gaoligongshang and to compile data and forward recommendations in designing management plans for the region. Villagers were encouraged to participate in wildlife protection and the programmes of the last two years had been successful (wild surveys and public education). As a region rich in biodiversity, Gaoligongshang required an immediate, integrated research programme that included monitoring wildlife

Qomalongma Nature Preserve

MRS. DROLMA YONGZOM, Deputy Director, Working Commission, Qomalongma Nature Preserve (QNP). The QNP covers an area of 34,480 sq. km. with mountain peaks such as Qomalongma (Everest 8,848m), Luozi (Lhotse 8,501m), Makalu (8,470m), Zhou-o-you (Cho-oyu 8,153m) and Xixiabangma (Shishapangma 8,012m); the lowest elevation was Zhangmu (Dram) at 1,433m. The bioclimatic zones range from subtropical to nival and the major rivers are the Jilongzangbu, Mashangzangbu, Rongxiazangbu, Xininingzangbu, and Pengqu (Arun).

Located in southern Shigatse Prefecture in the Tibetan Autonomous Region of China, QNP covers Jilong (Kyirong), Nielamu (Nyelam), Dingri (Tingri), and the western part of Dingjie (Dingque) counties.

A 12-year (1989-2000) agreement has been signed between the Working Commission of the QNP of the Government of the Tibetan Autonomous Region (TAR) of China and the Woodlands Mountain Institute (WMI), and by the latter with the Tibet Development Fund and the Institute of Botany. The area is extremely rich in plant and animal diversity, e.g., 2,300 species of plants and 100 species of animals. An increasing population had exerted growing pressure on natural resources, e.g., fodder and fuelwood. Planning for balance in development and conservation - human survival and protection of the nature reserve - is a problem.

Mrs. Yongzom said illegal hunting and logging on the Tibet-Nepal border made environmental education vital in order to raise the awareness level and management methods. She said certain areas have to be demarcated to develop the local economy, eco-tourism, and the promotion of local handicrafts as options to improve biodiversity.

populations, improving the local economy, and better reserve management methods. Prof. Weizhi Ji called for the continuation of public education programmes for officials, local people, reserve managers, and staff, including teachers, and said the programmes should be expanded to cover south-eastern Tibet and northern Burma.

Prof. Xu Zaifu, Director of Xishuangbanna Tropical Garden, spoke about the project demonstrating integrated conservation and sustainable development systems in the tropical forests of southern Yunnan. In implementation since 1992, the project was supported by MacArthur, Mengla county, Jinhong city, and the

National Committee of Science and Technology, China.

The objective of the project, undertaken by the Xishuangbanna Tropical Botanical Garden and the Chinese Academy of Sciences (CAS), was to conserve and judiciously use the natural resources of Xishuangbanna as well as to coordinate the development of the rural economy of the ethnic communities, natural resources, and indigenous knowledge. Two villages - Manwo village of the Dai people in Menglum Township, Mengla county and Manmuo village of the Akha in Menghan Township, Jinhong city - were selected as sites for demonstration and technology training. Based on socioeconomic and physical environmental survey and analysis, a project team of scientists, village officials, young villagers, and women was formed. The design for project implementation was based on the natural resources and socioeconomic development of the area, combining modern and indigenous knowledge, as well as the requirements/demands of local officials and villagers. The project was implemented by the farmers for the villagers' benefit, with technical support from the technicians funded by the project.

In Manwo village, project activities included tropical fruit development, cultivation of rare and fragrant plants, vegetable seed production, rural fuel development, tourism village construction for preservation of the Dai ethnic culture, and technique training for fruit, cash crop, and vegetable cultivation, consisting of breeding, plantation, grafting, and hybrid seed production. In Manmo village, project activities consisted of tropical fruit development, vegetable seed production, paddy rice cultivation, forest and minor forest products' utilisation, ecological

tourism in tropical rainforest areas, and technique training for fruit tree breeding, grafting, plantation, cash crop cultivation, tourism development services, the determination of scientific names, and the value and main ecological features of plants. The Xishuangbanna Tropical Botanical Garden served as a base for conducting technical training and science education programmes for farmers in the two project villages. Farmer-to-farmer exchanges and visits were organised and scientists working in the Botanical Garden introduced the farmers to various cash crops, regeneration and plantation techniques, and agroforestry technologies.

A paper on the 'Relationship between Indigenous Botanical Knowledge of the Dai and Rural Development in Xishuangbanna, Yunnan, China' was written by the project members. In 1993, reporters from the Fourth Department of Central China Television were invited to make a programme on the Indigenous Knowledge of the Dai people and plant diversity. The programme focussed on wild plant resources and their specific usage (edible flowers, canoe, Dragon's blood used in Chinese medicine, etc.); Buddhist sutra culture of the Dai and its relationship with plants; the use of *Cassi Siamea* as fuelwood; tropical agroforestry systems; and sustainable utilisation of tropical rainforests.

Mr. Li Gui, Director General of Yunnan Forestry Department, said that biodiversity conservation is important as biodiversity determines the level of human civilisation and that forestry is the basis of the national economy. The development of the world economy, rapid in some areas, had exerted pressure on biologically diverse resources, pressure which increased with economic growth. It is necessary to improve people's living standards - but

not at the cost of natural resources, Mr. Li Gui remarked. A reasonable way of using natural resources had to be found so that there was a balance between people and the environment to ensure sustainable development.

Mr. Li Gui said the MacArthur Foundation had provided funds for a project in Yunnan province in 1982. The project had been successful because of the collaboration between the Kunming Institute of Botany and the Kunming Institute of Zoology. Networking with like-minded agencies and institutions, Mr. Li Gui said, enhances international cooperation.

Dr. Alan Rabinowitz noted that Laos had virtually no protected areas when it opened up a few years back. The MacArthur Foundation had funded a training programme for the Forestry Institute management staff, and the Wildlife Conservation Society (WCS) had assessed local use of wildlife resources. In October 1993, the Laotian government created 17 new PAs covering more than 10 per cent of the country's area and outlined a strategy for a PA management system. The government invited Wildlife Conservation Society (WCS) assistance to assess wildlife resources and critical habitats within the new PAs, to train new staff in PA management, and to assess the needs and activities of the communities living within these PAs. A survey had been completed of the country's largest PA, the Nakai-am Theun; five new birds, one mammal species for Laos, and a new mammal species for the world had been discov-

ered. As requested, WCS would make its assessment and make recommendations that would integrate community development with wildlife conservation. As an underdeveloped country, Laos was attempting PA management for the first time.

The challenge for the future was to protect and manage some of the area's wildlife resources in the face of rapid economic development. In Myanmar, Dr. Rabinowitz pointed out, there were 14 PAs (approximately 1.1% of the total area), which the Government wanted to increase to seven per cent. Yunnan provincial authorities and the Burmese government were working closely to manage and harvest timber resources and to fill the existing knowledge gaps.

Discussion

Professor Pei Shengji noted that similar ethnic groups live in Myanmar, China, and Laos. Culture is therefore important for biodiversity conservation in the Eastern Himalayas. These ethnic groups had preserved their traditional practices and approaches; for example, one ethnic group used tree leaves to communicate. Professor Pei warned that, in the next five to 10 years, changes would occur rapidly as a result of economic growth and the expansion of the transport network.

Replying to a question, Dr. Rabinowitz said people from all over China attended Yunnan's training programmes as the province was a "hotspot" for environmental education.