Chapter 4

Action Plan: Essential Supporting Measures

4.1. Wild Biodiversity

4.1.1. Implement the Vision and Strategy for the NCD and Protected Areas

The new vision and strategy for NCD (discussed above at section 2.5) is to serve as a guide for NCD to meet the challenges that lie ahead. This vision and the associated strategy have a time horizon of 15-20 years.

The four strategically chosen components are linked to the analysis of the current situation, by addressing threats and realizing opportunities. NCD will focus its efforts at these components, to reach the set targets for each component, in collaboration with partners. These components are Management of protected areas, buffer zones and biological corridors Integrated conservation development projects, Environmental education, and Research, survey and monitoring. NCD aims to simultaneously put into operation these four strategic components, as only their synergy will create the expected conservation impact.

a). Long Term Objective

- Implement the targets and objectives of the NCD Vision and Strategy.

b). Actions

- Improve all aspects of management of PAs, buffer zones and biological corridors.
- Develop and implement a common strategy for ICDPs
- Further develop environmental education.
- Develop standardized biodiversity survey methodologies for all PAs; maintain an information database on species found in PAs; update GIS database and develop working maps for all PAs; and conduct studies on priority species; and initiate surveys on herpeto-fauna and other lesser known species.

4.1.2. Scientific Research to Improve the Status of Knowledge

4.1.2.1 Building the Scientific Knowledge Base

While substantial progress has been made on initiating research, surveys and monitoring, most potential avenues for both expanding economic benefits from biodiversity and better ensuring its conservation are still constrained by the shortage of basic scientific knowledge about the identity, status, distribution of species and genetic resources in the country. Important information has been obtained since BAP I, but lack of scientific knowledge remains an important limiting factor in Bhutan's conservation efforts.

The status and distribution of habitats, the ecological requirements of various species, and the ecological functioning of ecosystems are largely unknown. Further development of nature tourism is constrained by the lack of field guides and individuals knowledgeable about unique biodiversity within the nation. In spite of significant recent advances, the management of protected areas is constrained by incomplete surveys of species and poor knowledge of species requirements. Marketing of herbal medicines is constrained by incomplete information on the status of wild

populations of medicinal plants and information on how to cultivate threatened species. Bioprospecting is constrained by incomplete knowledge of what species are present, inability to assure potential "clients" of the validity of the taxonomic identification of a sample, inability to assure re-collection of a sample, and lack of knowledge of the potential ecological role of particular species. Particularly for a country where the potential to enhance benefits from biodiversity is so great, there is a pressing need for an ambitious program to build knowledge about its biodiversity.

There are a number of possible models for how Bhutan might further develop its own research program. Costa Rica provides one such model since it has pioneered successful approaches for building its own biodiversity scientific capacity through the strategic use of foreign expertise The basic elements of Costa Rica's approach are in the following box:

Ecological Research. The country has more than a dozen ecological research stations run by the Organization of Tropical Studies -- a group of U.S. and Costa Rican Universities with an office and staff in Costa Rica. Classes are conducted at these field stations for scientists and policymakers, and scientists conduct research at the field sites. Considerable financial resources have been invested in the development of scientific infrastructure in the country and a number of Costa Rican scientists have received training through this program.

Biodiversity Inventory. Through the National Biodiversity Institute (INBio), an inventory of the country's biodiversity is now underway. Most of the biological collecting is done by a group of "parataxonomists" -- local residents, typically with only a basic education, who have been trained by professional taxonomists to undertake field collecting and basic taxonomic identification. The parataxonomists bring their collections from their field sites to INBio once each month. There, curators identify those species that they know, and set aside others that cannot be identified for study by visiting experts. Samples of all species collected are held at INBio and duplicates are sent to international collections with extensive holdings for the group of species involved. For plants, for example, duplicates are sent to Missouri Botanical Gardens, New York Botanical Gardens, and Kew Gardens.

Taxonomic research. By virtue of the unique collection that Costa Rica is developing, international taxonomists with expertise in specific groups found in Costa Rica are interested in visiting the country and studying the collection. INBio invites these scientists to the country to help their own experts identify and describe new species, and in turn, the experts use the collections for their research. The result is that the visiting experts are assisting Costa Rica build its knowledge of its own biodiversity. Where historically taxonomists collected samples for research at their home institution, INBio turns the tables, bringing taxonomists to the country to study samples where they are also able to help train local experts.

a). Long Term Objectives

- To create an extensive national biodiversity research program.
- To build a national scientific capacity for biodiversity research.

a). Actions

- **Invite ecological scientists to the country to undertake specified research in collaboration with local experts.**

Ecological research undertaken within the country is a low risk and high yield activity. The RGOB can issue research permits that clearly specify that material cannot be collected and removed from the country. (For any ecological research, "type" specimens of the organisms being studied would have to be collected and examined by taxonomists. The research permit should allow such basic identification, but could also specify that the samples be returned to the country or, more likely, could require that a material transfer agreement be attached to the samples collected which precluded any future commercial use.) Researchers could be required to form teams with Bhutanese experts to ensure that local knowledge and capacity is strengthened through their research and to ensure that any published papers stemming from the research are made available in Bhutan. Research like this provides a "free" service in increasing the scientific understanding of

the species and ecology in the country. In addition, it begins to provide the core knowledge that can be used eventually to build an ecotourism industry or begin other economic uses of biodiversity.

- **Establish a Natural History Museum**

The first Natural History Museum for Bhutan would be established during the 9th FYP. A Memorandum of Understanding to this effect has already been signed between the Ministry of Agriculture and the Field Museum, Chicago in January 2002. The Museum will be established through financial support from WWF and technical support from the Field Museum. Besides show casing country's rich collections on birds, mammals and invertebrates, the Museum would serve as a research center for students and professionals.

- **Invest in the building up of the National Herbarium.**

A new National Herbarium building complex has already been constructed at the National Biodiversity Center, Serbithang that will house more than 20,000 plant specimens. Beisdes wild flora, it will also house samples of domesticated crop specimens, ornamental plants, medicinal plants and other paints of economic significance. The Herbarium is expected to serve for both research and education purposes for all those interested in the Flora of Bhutan.

- **Explore the establishment of additional biological collections.**

In addition to the herbarium, a seed genebank, one of the essential biological collections for any country, is currently being established in the country

- **Encourage several Bhutanese biologists to obtain specialized training in plant and invertebrate taxonomy.**

Bhutan, like any small country, will need to rely extensively on international taxonomists as it builds its knowledge of its biodiversity. However, the value of the international expertise can be magnified if the country also has researchers with advanced training in this field. Additional Bhutanese technical expertise in this field will also contribute to the country's ability to set policies regarding the scientific exchange of information and samples.

- **Encourage international taxonomists to visit Bhutan and help with inventory and collections.**

The biodiversity of Bhutan is of sufficient interest that it is likely that some international taxonomists would be interested in visiting the country to work with the existing collections and undertake some field collections even if they are not allowed to remove samples from the country. This could be an intermediate step to Bhutan's entry into the international taxonomic scientific network. As with ecological researchers, these taxonomists could be required to obtain a research permit that explicitly prevents the transport of samples out of the country.

- **Allow exchange of biodiversity samples for non-commercial research purposes only.**

After the successful initiation of the above steps, it should be possible for Bhutan to begin exchange of scientific samples for research purposes. Two legal instruments now minimise the risk associated with such exchanges. For a country like Bhutan with tremendous potential for gain from the wise management and use of its biodiversity, the "cost" to the country of not knowing more about its resources greatly exceeds any cost that might be associated with the illegal use of samples from the country. Moreover, since much of Bhutan's biodiversity can still be found in the surrounding countries, the risk is somewhat of a moot point in any event -- unscrupulous collectors could be obtaining samples from outside Bhutan today.

All biological material collected after the Biodiversity Convention comes into force and obtained from another country falls under the Convention's terms for ensuring prior informed consent for access to biodiversity and equitable sharing of any benefits derived from that diversity. So long as Bhutan's access legislation requires that collectors provide all information about their intended use of the material collected, then any other use (e.g., for commercial purposes) not agreed to by Bhutan when issuing the permit would be in violation of the Convention. The country could use the dispute resolution procedures provided by the Convention.

Second, Bhutan can make use of "Material Transfer Agreements" (MTAs) associated with each sample that is sent out of the country for research purposes or for incorporation in collections in other countries. A MTA is a short contract between the "supplies, and "recipient" of biological samples. The agreement in this situation would merely state that the samples are being provided for basic research purposes only. It would state that if during the course of basic research a commercially valuable property or innovation is discovered, then the researcher would have to enter into a negotiation with the supplier (Bhutan) to determine an equitable sharing of benefits with the country, ownership of patent, etc. The agreement would place stipulations on transfer of material to a third party (typically, it would simply state that the material is subject to an MTA and the terms of the agreement are binding on the third party). In practice, the likelihood of material being exchanged for taxonomic research ever being used for research of potential commercial value is extremely slim. Even so, the combination of an MTA and the protection provided by the Biodiversity Convention provides strong protection to Bhutan in the event that it is. A model MTA for use in transfer of material for taxonomic research can be found in Putterman (1996).

- **Be prepared to allow bioprospecting as soon as the country has built the knowledge base and enforcement capacity.**

When Bhutan initiates and builds its biodiversity knowledge base and scientific capacity it could be in the position to allow commercial bioprospecting in a relatively short time. With adequate capacity to monitor and enforce regulations and enhanced information about its biodiversity, Bhutan would be capable of expanding the potential economic benefits of its biodiversity while facing little risk associated with the transfer of biodiversity. As many other countries in the region are losing their biodiversity Bhutan should recognize that the value of biodiversity it contains will only increase with time. In taking a cautious approach Bhutan should initially develop the basic policies, infrastructure, human and scientific resource and biological knowledge before embarking on commercial bioprospecting ventures.

4.1.2.2. Research in Protected Areas

One of the main constraints to park management is the lack of knowledge and information on the biodiversity in the protected area to make any informed decision. With priority being given to Park establishment and infrastructure construction, their staffing needs and the planning and implementation of ICDPs, scientific research has not received much attention. As a result the degree to which science is being assimilated in management practices, and the pace of progress toward truly scientifically based management has been slow.

a). Long Term Objectives

The Targets for Research as identified in NCD's Vision and Strategy document are as follows;

- Improved data and information base on biological values, at species, habitat and ecosystem level
- Improved insight on critical habitats for endangered species and biological hot spots, for setting conservation priorities and zoning purposes
- Improved insight in impacts of conservation efforts and ICDP's on biological values

- Subjects for future data collection and research that have been identified by the protected areas are as follows;

Table 12. Subjects for Future Research in Protected Areas

	Data Collection	Research
Jigme Doji National Park	Snow leopard survey Crop damage by wildlife Study on NTFPs such as mushrooms Tiger studies Study on fish population in JDNP Identification of potential Red Panda Habitat in Gasa Mapping of areas with Cordyceps	Determine the seasonal habitat use, movement and demography of Blue Sheep and Takin; Ecological interactions between blue sheep and yak Impact of yak grazing on alpine meadows
Jigme Singye Wangchuck National Park	Biodiversity and fauna survey Pilot ecotourism studies	Grazing impacts and human-wildlife interaction; Species research on tigers, golden langurs
Thrumshingla National Park	Establishment of baseline information and mapping of all tseree in the Park NTFP survey such as Matshutake mushroom harvests, resin tapping, daphne products. Baseline information on wetland sites and the flora and fauna in these sites Data collection on herders and their cattle,	Studies on crop damage by wild animals especially wild pigs Studies on Tiger. Cattle grazing and cattle migration and Birds
Bumdeling Wildlife Sanctuary	Land use changes based on interpretation of recent and old aerial photographs; Fuelwood survey; Wildlife-human conflict resolution, e.g. for livestock depredation and wild boar crop damage. Survey on bamboo use and the management of bamboo areas related to Community based natural resource management activities	Threats to the black-necked cranes and its habitat in BWS Effect of shifting millet seedling cultivation on biodiversity; Effect of pasture burning on species composition and biodiversity; Effect of forest grazing on regeneration, species composition and biodiversity

Future research topics will be selected based on national and park priority, significance of the research to policy and management decisions, availability of funds and staffing, and collaborative partners. The NCD will provide advice and necessary support to the Protected areas in conducting research on topics already prioritized by them. Certain requirements would need to be fulfilled so that Research can be conducted unhampered. These include planning and prioritization of research, preparation of research proposals by the interested PA, guaranteed funding and staff, data storage facilities, technical expertise and finally commitment by the protected area manager to incorporate and utilize research results to make management decisions and in updating management plans

b). Actions

- Development of collaborative approaches to research, surveying and monitoring (joint actions, participatory approaches, action-research, linkages with research centers)

- Co-ordination of research, survey and monitoring activities, establishment of a data bank and information center and library accessible to outsiders, for complete information on biological values and conservation management approaches in Bhutan

- Species and habitat prioritization in terms of biological and protection significance for effective management, based on complete surveys in the Parks;
- Revision and specification of protected status of species for Bhutan based on research data
- Studies on wild pig conservation and management on a pilot basis for a period of three years.
- Other issues of priority are human-wildlife conflicts arising from crop damage and livestock depredation, research on Tiger distribution and habitat.

4.1.2.3 Research on Wild Floristic Diversity

The Flora of Bhutan (FOB) Volumes has now been completed with the publication of the 9th book of the FOB series on Orchids in January 2002. The completion of the FOB however does not mark the end of the inventory on Bhutan's floral diversity. It provides the baseline information, which serves as a basis for identifying and prioritizing future plan of actions. To complement the already existing information of the FOB further research needs to be done on the ecology, and phytogeography of the already documented species. Further the FOB does not cover the lower group of plants such as the Pteridophytes, bryophytes and the lichens, which also needs to be researched and documented as part of the wild floristic diversity in Bhutan

Objectives

- To have a complete inventory of the floristic diversity of Bhutan (including ethno-botanical information).
- Co-ordinate and establish linkages with relevant national organizations for plant collection expeditions.
- To identify and complete the information for the missing plant groups in the FOB Volumes.
- To strenghten the National Herbarium as a reliable reference collection for researchers, conservationist, ecologists, botanist and naturalists.

Actions

- To identify and recruit specialized technical assistance for taxonomic assessment of diversity at species level.
- To initiate surveys and collections of Pteridophytes, bryophytes and the lichen flora of Bhutan starting with the survey and collection of ferns and their allies.
- In addition to herbarium specimens, initiate carpological and wood collections of economically important plant species.
- To identify critical plant groups and habitats that may require special conservation efforts.

4.1.2.4 Research on Forest Biodiversity

The existing research capacity is very small while the research needs are overwhelming. It will be many years before Bhutan will have a modest level of forest researchers ready to significantly tackle its growing problems. Sometimes, where local research capacity exists, the skill is not utilized. Bhutan cannot afford to waste professional skills. Therefore, there is an urgent need to draw strategies to efficiently and effectively address ever expanding research issues to conserve the forest cover while at the same time contributing to the economic development of the country. (Namgyel, 1997).

Long term research objectives

- To contribute to agricultural and horticultural intensification and diversification, so that household food security, income and employment potential of small farm agriculture is

enhanced through sound conservation and development of economically and ecologically sustainable farming practices.

- To contribute to enhanced productive and regenerative capacity of the forest and water resources and most importantly of biodiversity.

- To contribute to the increase in contribution of livestock to the household economy and nutrition of rural and urban populations, and farm productivity with less grazing pressure on forest through improvement of livestock breed, feed and fodder availability and maintenance of good livestock health. (Dorji, 1997.)

Under three components of the project mandate of the Forestry III project a list of forest research, both in Forest Management and Social forestry were identified, as follows:

1. Forest Management/Silviculture

(a) Appropriate silvicultural systems for the broad-leaved, conifer, tropical and subtropical forests.
(b) Stand composition and structure of the major forest types.
(c) Growth and yield studies for the logged over broad-leaved, conifer, plantation forests.
(d) Enrichment planting of inadequately stocked forests with indigenous species.
(e) Habitat management in protected areas in the Forest Management Units
(f) Watershed management studies in the major forest types.

2.1 Social forestry

(a) Coppicing and pollarding trails on species commonly used for fodder, fuelwood and mushroom culture
(b) Appropriate technologies for timber harvesting and wood utilization at the village level.
(c) Socio-economic studies in the community forests
(d) Perceptions and attitudes of user groups towards forest conservation and sustainable utilization.

2.2 Agroforestry

(a) Productivity and acceptability of priority agroforestry species
(b) Hedgerow planting on non terraced Agroforestry farms using, *Leucaena leucocephala, Sesbania reban* and Daphne.
(c) Documentation of Indigenous agroforestry systems and technologies.
(d) Socio-economic assessment of agroforestry practises in the pilot sites.

2.3. Reforestation/Afforestation

(a) Comparison of reforestation methods; a) natural regeneration, b) direct seeding, c) artificial planting
(b) Sites-species compatibility using endemic and exotic species
(c) Biology, ecology and control of serious pests and diseases in reforestation.
(d) Weeding, cleaning and liberation cutting to improve tree growth and increase survival in various reforestation sites.
(e) Establishment of seed orchards for priority reforestation species.
(f) Pruning and thinning techniques for plantations. (Dorji, 1997)

Due to the regeneration problems in the Silver Fir, operations are recommended to be concentrated in the Blue Pine and other low altitude Mixed coniferous forest. Broad-leaved and Fir Forests need more adaptive research before harvesting operations are carried out. Some of the above research are already being implemented and are ongoing.

4.1.2.5. Research on Sustainable Use

Use of biodiversity resources makes a major contribution to the daily way of life of Bhutan's rural population. This involves plants and animals used for medicine, food, construction, fuel and other uses. There is substantial local or traditional knowledge about the resource species and their use, but there is virtually no scientific information about it. Anecdotal information indicates that the present use in many cases is not sustainable, particularly in view of the increasing population and its growing needs. Consequently, substantially more information is needed to provide guidance to assure that local people continue to receive the benefits of use, and that the use is sustainable.

a). Long Term Objective

To assure that the rural people continue to receive the benefit of biodiversity resources through sustainable use.

b). Short Term Objective

To conduct surveys and research to obtain information on which to base effective sustained management of biodiversity resources outside protected areas.

c). Actions:

Develop a program to survey the uses of biodiversity resources by rural Bhutanese. Key elements of the program are:

- To identify the key species and species which are or appear to be in danger of overuse and depletion;
- To collect traditional and local knowledge about species and their uses;
- To conduct scientific research to provide the basis for sustainable management of these resources; and
- To develop management programs such as public education, etc., to apply the knowledge gained and to achieve sustainable use for the benefit of the people.

4.1.2.6. Biodiversity Surveys and Monitoring

With the new monitoring frameworks developed by the NCD, all protected areas are now in a position to begin planning monitoring activities within their PAs. However, keeping in mind the current priorities of the PAs, their staffing situation, and the very recent adoption of the framework by park staff, it is expected that at least one pilot monitoring plan will be made for monitoring biodiversity values and threats and one pilot plan for an approved ICDP. For this purpose, guidelines will be prepared and provided, in addition to support from the Species Conservation, Research and Monitoring Section of NCD. It is also proposed to involve NCD's partners, sectoral agencies, Geog and Dzonkhag staff where possible, particularly for monitoring of ICDP's.

a). Long Term Objectives

- Background monitoring to detect changes and long term trends in biodiversity and factors affecting it inside and as possible, outside of PAs, and use the resultant information to feed back into adaptive management of the biodiversity.
- Biodiversity values and threats monitoring, to detect changes in critical biodiversity values and potential threats, inside and as possible, outside of PAs, and feed back into adaptive management.

- ICDP monitoring, to detect and assess changes in attitudes toward conservation and development, assess success and sustainability of ICDPs, and feed back into adaptive management.

b). Actions

- Implement background biodiversity monitoring.
- Implement monitoring of biodiversity values and potential threats.
- Initiate monitoring of ICDPs, starting with a pilot ICDP.
- Revive and renew the previous 'Protected Areas Survey and Monitoring Techniques' training for park staff from 2002. This will incorporate training for field staff on the new rapid biodiversity survey methodology as well as the new monitoring framework.
- Once such monitoring techniques are standardised for all protected areas, they should be taught to forestry trainees at NRTI and BFI.
- Facilitate detailed surveys of key wildlife species in and outside protected areas. Studies should include current status of populations, distribution, habitat requirements and population trends. Once basic ecological information has been obtained, programs can be implemented to safeguard and monitor them.
- Identify problems, and if adequate trend data are available, undertake small-scale interventions and manipulative strategies. These may include small-scale restoration projects in degraded and disturbed habitats (tseri, landslips, areas impacted by fire etc.).
- Establish monitoring plots in degraded areas and undertake restoration efforts if appropriate. In areas of special concern initiate structured monitoring programs.
- Use satellite imagery and remote-sensing data, aided by GIS to monitor habitat changes and impacts in protected areas. Continual monitoring to identify and follow trends and changes in biological conditions and to check whether the applied forms of management are having the desired effects. If and when they are not, make changes in the management practices.
- Operational monitoring or regular reporting on the overall operations and activities in the park as well as human activity in sensitive areas.

4.1.2.7. Aquatic Resources Survey

a). Long Term Objective

To formulate suitable national and local fishery management plans laws, regulations and adequate conservation measures.

b). Short Term Objective

To develop national capabilities in planning and initiating a fisheries resources survey covering all climatic zones and river systems of Bhutan.

c). Actions

- Provide training to Bhutanese specialists.
- Initiate and conduct a national fisheries resources survey.

- Establish a national reference collection of aquatic species occurring in Bhutanese waters. However, once completed, it is expected that the survey will produce an inventory of water bodies and living aquatic resources, together with a description of their status.

- On the basis of the survey results, formulate fishery and aquatic resources conservation measures, including fishery management plans, necessary laws and regulations.

- Ensure that rivers are not damaged by pollution and accumulation of hazardous wastes

4.1.2.8. Databases

Databases are needed to store biodiversity and related information and make them available for optimum use. The need for such databases exists both at national park and broader levels, but the development, maintenance and management of databases is not possible until qualified database managers are recruited and computers dedicated to housing databases are purchased. Prior to establishment of such databases, work is needed to establish standardized procedures, structures, etc., to assure that the resulting databases will be of maximum use.

a). Actions

- Recruit qualified database managers or provide training to existing staff on data management

- Dedicate or purchase new computers for databases

- Establish standardized procedures, structures, etc., to assure that the resulting databases will be of maximum use.

4.1.3 Improve the Economic Valuation of Biodiversity Resources

a). Long term Objective

Assure that Bhutan's biodiversity resources are properly valued, within the context of modern resource or environmental-economics, so that biodiversity resources are accurately valued in national income accounting and in policy considerations and decisions regarding land and other resource uses.

This objective was also stressed in the co-operative agreement of Bhutan, the Netherlands, Benin and Costa Rica.

b). Actions

- Initiate a project to develop methodologies for economic valuation of biodiversity resources.

- Apply and test the methodologies initially on a limited basis, and if satisfactory, then apply it on a broader scale.

- Develop local capacity in economic resource valuation as a part of the project.

4.1.4 Incorporate Biodiversity in Related Strategy and Planning

4.1.4.1. Land Use Planning

a). Actions

- Place greater emphasis on conservation of biodiversity in all aspects of land management.

- Strengthen the policy of retaining 60 percent of the national territory under forest cover.

- Reduce the impacts of potentially destructive practices such as unsustainable logging, grazing, mining, plantation or orchard agriculture, and the construction of roads and hydropower projects. In order to do this, land-use planning exercises should take place at the water catchment level since each catchment has its own needs for water, farmland, fuel, grazing land, industries and its own requirements for hydrological protection.

- Once they are completed, these comprehensive land-use plans will need to be backed up by enforceable sanctions and adequate legal authority. To this effect the Forest and Nature Conservation Act of 1995, Forest and Nature Conservation Rules of 2000 and the Environment Assessment Act of 2000 provide legal backing to address any aspects of environmental degradation and biodiversity loss in the country.

4.1.4.2. Forest management

a). Long term Objectives:

- To conserve and manage forests on a sustainable basis
- To harvest forest resources within the prescription of scientific management and to generate foreign exchange through export of forest products.
- To ensure ecological stability by maintaining at least 60% of the total land area under forest at all times.
- Rehabilitating and restoring degraded ecosystems and promoting the recovery of threatened species, inter alia, through the implementation of plans or other management strategies.

b). Immediate objective

To formulate and implement Scientific Management Plans for all areas.

c). Actions

- Maintain protected areas in each ecozone in order to conserve the unique biodiversity and ecosystems of the kingdom in their natural state. The uses of these areas will include research, recreation, and appropriate local uses. The principles of selection and development of these areas will include considerations of value for alternative uses and population pressure in the area.

- Territorial divisions must be stricter with the implementation process in order to meet the conservation objectives.

- Manage forest areas in a way that soil losses and erosion are avoided and land capability is maintained. Forest management systems will be developed and practiced, which will improve water quality and maintain proper water balances, allowing optimum stream flow during the monsoon as well as in the dry season, maintain good water quality and mitigate floods.

- Define special management to protect critical watersheds from irreversible changes in their flora, fauna, and ecology. Management rules will focus on avoiding harmful effects to the people and systems downstream.

- The principles regarding the maintenance of biodiversity will also be applied to production forestry. This includes avoiding any drastic alteration in the composition of tree species in extensive areas. Special care should be applied in the introduction of exotic species.

4.1.4.3. Harvesting of Forest resources

a). Long term objective

To ensure sustainable use of the forest resource through identifying important components of biodiversity and monitoring activities that pose threats to biodiversity.

b). Actions

- Put suitable forest areas excluding protected areas, under sustainable management as production forests. Sustainability in production forests means that the annual harvest and other loss of timber does not exceed the average annual long term growth for the total area under each forest management plan, and that soil fertility does not decrease.
- Harvest all forest products in such a way that unnecessary losses are avoided and the productivity of the forest is maintained.
- Harvest forest resources through construction of roads and logging in a way that minimizes land and forest degradation.
- Implement management plans efficiently by developing economically and ecologically sound silviculture and harvesting systems.
- For full appreciation of the forest resource, the royalties and prices should reflect the true value of the wood.

Because of labour shortages within the country, the FDC has mechanized almost all its activities, and sawmills are already engaging bare minimum skilled laborers. In the near future the FDC will be awarding logging and road construction activities to only those contractors who have undergone training and will also be processing certificates, especially for chain saw operators and cable crane crews. With this the FDC will be in a position to take care of the negative environmental impacts caused by logging.

4.1.4.4. Community Forestry

Long term objectives:

- **Protection:** To Maintain or improve the biodiversity and ecological functions of forest land
- **Production:** To Maintain or improve the sustainable supply of forest products and services in order to enhance the self-sufficiency and improve the economy and living standard of local people.
- **Social Equity:** Maintain or improve communal institutions that can sustainably manage forestlands and ensure equitable decision-making, implementation, and distribution of forest benefits by and for its members.

Actions:

- Transfer the primary responsibility for management (protection, development, and utilization) of forests adjacent to communities to local management groups.
- Strengthen the institutional and technical capacity of forest management groups to sustainably manage and equitably share the benefits from the forests handed over to them.
- Assist forest management groups in the development of appropriate forest-based home and cottage industries and provide marketing assistance. (SFES, 1996)

4.1.4.5. Industrial Utilisation of Forest Products

a). Long term objective

To have ecologically sound and economically viable forest based industries that donot deplete Bhutan's forest cover, ecological balance and biodiversity heritage.

b). Actions

- Create a favorable environment for development of forest industries for domestic and export markets consistent with maintenance of the nation's conservation objectives. This support will include institutional development, analysis and exploitation of market opportunities, socio-economic planning, physical infrastructure, and contributions to training, research and development, and financing.

- Based on an analysis of present and future raw material availability, and the demand and supply of wood based energy encourage environmentally sustainable and economically viable forest based industry.

- Undertake proper forest inventories, and Environmental Impact Assessments so that new forest based industries can be established based on guarantees of the sustained availability of raw materials.

- Encourage appropriate home and cottage industries and further processing of primary products that will add value to the basic forest products, support the economy of the local communities and improve the standard of living of people particularly in rural areas.

4.1.4.6. Ecotourism

a). Long term Objective for protected areas

Assure that development of ecotourism is based on the principles of sustainability, ecological soundness, and cultural acceptability.

b). Actions.

- Monitor the impact of trekking (and other) visitors to the protected area;

- Work closely with the Department of Tourism to determine interim allowable numbers and limit the number of visitors accordingly;

- Carefully plan effective management of trekking groups,

- Conduct workshops for tour operators and guides to make them aware of park regulations, negative impacts associated with tourism, and enlisting their cooperation to alleviate and minimize the impacts.

- Assess the impact of tourism on the different habitats and wildlife, as well as on local communities.

- Where possible develop strategies, which will ensure that the local communities become involved and benefit from tourism (see also Chapter 5).

4.1.5. Strengthen Integration of Biodiversity Considerations in Other Sectors and at Local Levels.

Natural biodiversity cannot be conserved and maintained only at one level. National parks and protected areas will ultimately become mere isolated relics if they are left as islands in a sea of manmade ecosystems. To truly conserve a country's natural heritage, biodiversity conservation must function at a variety of scales- regional, landscape, and stand levels, and it must be integrated within the programs of all the sectors, which are involved.

Regional Level

- The primary role for biodiversity conservation at the regional level will be Dzongkhag Integrated Resource Management and Land Use Plans that integrate goals and objectives between sectors. Such plans will usually be developed through multi-party planning processes involving government, private industry and the public, resulting in land use zoning between sectors with the assignment of either management responsibility (government) or tenure (private).

- Common land use designations, in addition to parks and protected areas which may be created both nationally and locally, include critical (degraded) areas requiring priority attention, agriculture, forestry and native grazing, urban and industrial areas, watershed protection areas, and special conservation management areas that include protected areas buffer zones and regional biodiversity corridors.

- The regional landscape that emerges from such planning will be a combination of four broad land use types: core protected areas; "light touch management" buffer zones; ecological corridors linking protected areas both horizontally and vertically; and lands devoted to intensive human use.

- Integrated resources and land use planning holds the promise of rationalizing land allocation by linking it to real land capability, of slowing the processes of land and forest degradation, and of conserving Bhutan's biodiversity.

a). Action

- Continue to seek the active co-operation and involvement of the Dzongkhags in preparing and implementing Integrated Management and Land Use Planning. Accelerate development and implementation of the program on integrated resources management and land use planning, and assure that biodiversity conservation concerns are central to the process.

4.1.6. Strengthen the Institutional Framework Relating to Biodiversity

4.1.6.1. Strengthen Institutional Development and Co-ordination Mechanism at the National level

As biodiversity is cross sectorial and managed by different institutions and organizations, coordination mechanisms need to be developed to establish an integrated national system for biological conservation and sustainable use in Bhutan. The NBC thus needs to develop and propose systems that not only address institutional aspects but also take into consideration the integration of conservation activities with development aspects that would be both economically and environmentally sustainable

Objectives

- To fulfill the mandate and responsibilities of the NBC to co-ordinate and facilitate various sectoral based biodiversity programs

- To establish as integrated national system for biological conservation and sustainable use in Bhutan
- To ensure the effective implementation of the BAP

Actions

- Identify a suitable technical assistance for establishing institutional development and linkage mechanism for national biodiversity programs.
- Facilitate consultative forums such as national workshops to harmonize the roles and responsibilities of the different sectors involved with biodiversity conservation and management.
- Strengthen the role of the Biodiversity Management Board as a nation wide decision-making body on biodiversity issues.

4.1.6.2 Improve the Staff Capacity

The central importance of training in achieving sustainable improvements in biological resources conservation and use is widely accepted. At a time when financial support to many programmes is threatened, funding for training has become particularly tenuous. The dearth of well-trained personnel is evident at virtually all levels and in all scientific and technical specialities in Bhutan. Moreover, training and education programmes, which combine technical training with exposure to other needed disciplines, including management, policy and legal fields, associated with biodiversity, appear not to exist very often.

Considering the importance of the biodiversity to Bhutan, the fact that more than a quarter of the nation is in protected areas, and the needs for effective conservation and sustainable use of biodiversity outside of these areas, the total size of the staff which is needed is vastly larger than what is presently available.

This also impedes progress in the establishment of adequate protected areas and implementation of scientific management of those protected areas that have already been formally designated.

a). Long Term Objective

Obtain adequate trained staff to effectively develop and manage Bhutan's programmes for conservation and sustainable use.

b). Immediate objective

To ensure that sufficient numbers of appropriately trained personnel at all levels are available to support the biodiversity activities as well as reduce dependence on long-term expatriate technical assistance personnel.

c). Actions

- Internally evaluate the existing and required biodiversity related manpower within each division keeping in mind the mandates and responsibilities of each section.
- Place new staff according to the existing manpower constraints in each division as well as the programs and activities outlined in the 9th five-year plan.
- Recruit appropriately trained manpower and ensure the proper placement of all trainees upon completion of training to maximize the utilization of skills and knowledge acquired.

- Identify training needs and appropriate candidates for implementation of various programs and activities.

- Identify the priority needs and seek additional funding for the acquisition, training and recurrent costs of that staff.

- Recognising the key role of human resources development, place emphasis on formal, vocational, and on-the-job training as well as management of human resources.

- Develop a realistic long-term vision of the staff, which will really be required to effectively develop and manage Bhutan's programmes for conservation and sustainable use of its biodiversity resources.

- For protected areas, considering the present situation of manpower constraints, intake of new recruits shall be done in a phased manner, but making sure that protected area manpower requirements are completed at the latest by the fifth year of implementation of the management plan. This will enable substantial progress as well as allow the target outputs to be met.

4.1.7. Assure that Biodiversity Conservation Brings Benefits to Local People

4.1.7.1. Multiple Use of Forest Resources

a). Long term objective

- Monitor and control multiple uses of the forests including production of fodder, firewood and non-wood forest products as well as, livestock grazing. This is in order to maximize their contribution to local economies, to meet the basic needs of the people in a sustainable way and at the same time to minimize the harmful effects due to indiscriminate use.

b). Immediate objective

- To promote social and community forestry through extension programs

c). Actions

- Develop proper agroforestry and agro-silvo-pastoral techniques, in order to increase output and decrease the harmful effects of present farming practices, and in particular, to promote alternatives to shifting cultivation.

- Encourage the use of traditional knowledge in the use of herbal plants and other non-wood forest products and strengthen this by proper research, development and an integrated approach.

- Improve access to forest products for all Bhutanese people by creating distribution, marketing and proper monitoring systems.

- Encourage the users of forests to participate in the development and management of their local forests.

- Review the existing forestry rules and develop favourable conditions for forestry on private registered land.

- Encourage the forest extension service, and improve local forest management. It is important to make certain that the villagers know the rules and regulations as well as options available to them.

4.1.7.2. Human-Wildlife Conflicts

Livestock depredation and crop damage by wildlife are two areas of concern that are now emerging as the main issues/problems encountered by the local communities throughout Bhutan.

Crop damage by wild animals ranked as one of the biggest problems faced by most rural communities, and this mostly concerns species that are not on the protected species list, such as wild boar, barking deer, monkeys (especially macaques), porcupine, sambar, bear, and rats. While there are a number of reports indicating the level of crop damage to be invariably high, the severity still needs to be ascertained through proper scientific research. Measures taken by farmers to protect their crops against damage by wildlife have been insufficient in addressing the problem. In view of the social and economic losses faced by farmers due to crop damage by wild pigs, a task force has been created at the MoA that will provide guidance on the development of a wild pig program that is proposed to be initiated on a pilot basis. This proposal is currently in preparation and will be submitted to the BTF for funding.

Another problem that seems to be on the rise is livestock depredation by wild animals such as tiger, leopard, wild dog, bear and snow leopard. All except the wild dog are protected species in Bhutan. No national policy on compensation exists, but in specific cases compensation is awarded to farmers, which is minimal. In some cases there have been reports of retaliatory killing of predators by livestock owners. This poses a big threat to species like the tigers that may be breeding in marginal habitats, and are forced to depend on livestock where natural prey is limited or it is difficult to hunt. Such conditions have been attributed to the killing of livestock in Bumthang in 1997 (McDougal and Tshering, 1998).

A villager tending to Yak wounds inflicted by Snow Leopard attack

NCD with financial support of WWF has started a scheme to reward a small amount of money for reporting kills made by tiger and other predators. Reports received from territorial divisions and parks are being compiled at NCD. Other socio-economic information from the protected area surveys are also being reviewed. Once reports from all dzongkhags are received a report will be prepared and presented to the Department.

a). Long Term Objective

- Reduce and where possible, eliminate crop damage and livestock depredation by wild animals to benefit the local peoples and assure the long term conservation of biodiversity.

b). Intermediate Objecitive

- Obtain accurate information on the nature and extent of losses and develop measures to deal with the problems.

c). Actions

- Further develop the MoA taskforce to provide information and guidance on the wild pig problem and to propose a pilot control project.

- Implement a project on wild pig management and conservation, at selected pilot sites, so that lessons learned can be used to develop a national program to deal with pest species.
- NCD to continue to collect data on livestock depredation from all dzongkhags, and develop a report with specific recommendations to cope with such problems in the future.

4.1.8. Strengthen Biodiversity in Education and Awareness

4.1.8.1. Formal and Non-formal Education

Formal education- Grade I to X:

Special environmental education programs are now in place in both the formal and non-formal curricula. In the formal curricula, environmental issues are addressed from grade I to X. Effort is being made to incorporate environmental education in many of the taught subjects like Social Studies, General Science, Biology, Geography and Economics. In addition to classroom teaching, outdoor activities like nature clubs and environmental tours are also being encouraged. There is a lot of scope for expanding and improving the programs.

Non-formal education

In the non-formal curricula, environmental education forms one of the main contents. Since the Non-formal Education (NFE) programs deal mainly with adults in the rural areas, advocacy and promotion of environmental education could be channeled effectively. The Education Division is in the process of developing post literacy materials in all aspects of life skills. This would provide ample opportunity to disseminate information on biodiversity.

Institutions and Colleges

In the educational institutions like the National Institute of Education at Paro, National Institute of Education in Samtse, Sherubtse College in Kanglung, Royal Technical Institute and Royal Bhutan Polytechnic in Rinchending, environmental education is incorporated as an optional or co-curricula subject. In recent developments, steps are being taken to offer a degree in environmental education in Sherubtse College and further strengthen environmental education courses in other educational institutions.

Natural History Museum

The establishment of the country's first Natural History Museum will serve as an important educational center for educating the general public as well as the tourists on the country's rich biodiversity, especially the wild faunal diversity besides its research functions.

a). Actions

- Periodically review the effectiveness of the existing environmental education programs from the perspective of biodiversity conservation both in formal and non-formal education.
- Work closely with Education Division and concerned educational Institutions on developing teaching learning material at all levels particularly on biodiversity conservation.
- Train teacher educators and school teachers on biodiversity both in country and abroad.
- Organize study tours to educational centers (in-country: forest research, national parks, nature study centers) for teachers/educators and students.
- Work with NGOs especially the RSPN and WWF-Bhutan to find and develop new teaching materials for all levels.

- Establish Natural History Museum during the 9th FYP

4.1.8.2. Promoting Public Awareness of the Value of Biodiversity Conservation and Use

Public awareness is the key to mobilizing popular opinion and to generating and sustaining appropriate action within the country and internationally. This is true both for the general public and for the people who live in and near protected areas and other areas critical to biodiversity conservation. The capacity to communicate the impact of biodiversity activities to key target audiences is critical to the success of any biodiversity program. A targeted public awareness program can promote the development of institutional linkages and collaborative mechanisms such as networks. Within the country, public awareness can facilitate efforts to involve communities and local and non-governmental organizations, thus ensuring a broader base for conservation.

a). Actions

- Strive to integrate fully public awareness in all national, regional and local levels through support mechanisms for co-ordinated public awareness activities at all levels.

- National policies and planning should recognize the role that public awareness can play in establishing a firm basis for sustainable biodiversity conservation and use. Public awareness should be considered in the development of all national biodiversity conservation activities. National strategies should identify objectives and strategies for public awareness, defining target audiences, partners and tools for public outreach.

- Recognize and encourage the work of RSPN and other NGOs in raising public awareness. Adequate consideration should be given to production of public awareness materials in appropriate languages to facilitate broad use within countries.

- Biodiversity conservation activities should have an appropriate focal point for public awareness. Biodiversity workers, however, should develop the capacity to articulate the importance of the conservation goals and activities in the broader context of sustainable agriculture and development. They should be able to communicate this to all stakeholders using tools provided by public awareness specialists. RGOB could consider enlisting the help of well-known and influential people to increase access to the media and attract added attention.

- It would be helpful to also draw on public awareness tools and technologies generated at the regional and international level. These tools - and the messages they convey - may have to be adapted to reflect national priorities and circumstances. However, it is likely that many of the regional and global messages will prove useful in supporting national public awareness strategies and activities. This will substantially reduce local costs. Awareness of the value of biodiversity, and of the role of scientists, farmers and communities in maintaining and improving them, should be promoted in schools at all levels, as well as in specialized agricultural research institutions and training centers like RNR-RCs, NRTI, BFI, etc.

4.1.9. Encourage and Augment International Co-operation in Biodiversity

4.1.9.1. Technical and Policy Exchange with Costa Rica

There are striking parallels between the biodiversity situations in Costa Rica and Bhutan. The two countries are almost identical in size, and while Costa Rica, with its largely tropical ecosystems, may have nearly twice the biological diversity of Bhutan, they are both extraordinarily species-rich for their regions. Both countries have great hydropower potential. Both have designated more than 20 percent of their area for biodiversity protection, and both have leaders who see that the most promising long-term approach to development, is through the maintenance of their forests and biodiversity, not their conversion.

Costa Rica has far more technical and management capacity related to biodiversity, because of its longer history of research in this field. Consequently, Bhutanese officials and private sector representatives could benefit immensely from a study trip to Costa Rica to observe their protected area system, the Organization for Tropical Studies, the National Biodiversity Institute (INBio), their approach to bioprospecting, and their tourism industry. The organization, objectives and procedures of INBio, in particular, would be of significant assistance to Bhutan in the development of its own biological research capabilities. The same is true of bioprospecting both to learn of Costa Rica's experiences and to explore further collaboration. Many of Costa Rica's current activities could not be transferred directly due to the unique conditions and circumstances in Bhutan. Nevertheless, Costa Rica would provide an opportunity for Bhutanese experts and policymakers to see one potential vision of how they might develop their biodiversity.

The exchange could involve individuals from the DoFS, NCD, NBC, NEC, TAB, and possibly the Energy Agency. The NEC has a list of contacts on the Costa Rica side (REID, 1995). Such a visit would require additional funding, but it might be carried out within the existing co-operative program between the Netherlands, Costa Rica and Bhutan.

a). Action

Plan, obtain the necessary funding, and carry out the exchange.

4.1.9.2. Debt for Nature Swaps

Debts for Nature Swaps are an innovative mechanism for financing biodiversity conservation. In these arrangements a donor will either pay off or cancel Bhutan's debt in order to preserve biodiversity and the natural environment. The Gedu Wood Manufacturing Company provides an example of such an arrangement in Bhutan. Although a feasibility study conducted in the 1980s deemed that company to be both economically viable and environmentally sound, the factory proved to be unsustainable. As a result, the RGOB refused to allow it to expand its logging operations and closed the company in December 1995. The Royal Government of Netherlands in a Debt for Nature Swap provided Bhutan with assistance so that the kingdom could pay off a loan to the Kuwait Fund for Economic Development in order to close down the logging operations.

a). Action

Actively explore other possibilities for Debt for Nature Swaps with Bhutan's present and potential donors.

4.1.9.3. Pursue Active Follow-up of the BAP II with Donor Community

Bhutan already has a number of donors who contribute actively to the country's environmental programs and projects. Biodiversity is a high priority for many donors. This BAP provides a co-ordinated, integrated framework, which identifies a number of priority areas for action, some of which are not funded within the present RGOB plans. When it is approved, the BAP can be used as a basis for additional discussions with donors interested in biodiversity.

a). Action

Actively pursue support for the priority unfunded actions in the BAP II with existing donors, and investigate the possibilities of additional donors who would be interested in biodiversity.

4.1.10. Strengthen and Support Family Planning and other Population Planning activities

In 2001 the population estimated by the RGOB was 698,950 although the UN places the total figure higher with 1.67 million estimated five years earlier by the UN (UNFPA, 1996). It is very young with 42.1% of the total in the age group below fifteen (CSO 2001). The majority (79%) of