

the population live in rural areas although the proportion of the urban population is increasing very rapidly. The key objective of the 8th FYP for the Health Sector was to reduce the population growth rate to about 2%. The intensification undertaken in the promotion of reproductive health in the last six years resulted in the decline of population growth rate from 3.1% in 1994 to 2.5% in 2000 (National Health survey report, 2000:9). The continuation of the trend could well result in the achievement of the goal.

This population growth will significantly change the population-resource ratio. Since most land suitable for agricultural production is already under cultivation, bringing new agricultural land into cultivation cannot modify the population-resource ratio. These population pressures can be expected to give rise to environmental pressures that could undermine the viability of the integrated farming systems and have serious impacts on the nation's biodiversity. The accessible forest areas are already intensively exploited and in some areas, extraction rates for fuelwood and timber are approaching unsustainable levels. As agricultural land holdings become smaller and more fragmented, farming will inevitably extend to marginal land and steeper slopes, with heightened risks of erosion and accelerated land degradation. Growing livestock herds will add to the pressures on forest and to the risks of soil erosion. The progressive removal of vegetation cover, especially in critical watershed areas, is already beginning to affect the hydrological balance, leading to the localized drying up of perennial streams and flash flooding.

The RGOB recognized the threats inherent in a continued high rate of population increase and in the Eighth five-year Plan (starting in 1997) it made an unequivocal commitment to reducing the rate of population growth to 2.56 percent by the end of the Plan period. His Majesty King Jigme Singye Wangchuck issued a Royal Message in 1995 urging the population to adopt family planning as a means for safeguarding the very future of the nation. Population growth is the engine, which drives most of the more serious threats to Bhutan's biodiversity. Consequently, reducing that growth must be a central and underlying requirement for achieving biodiversity conservation in the Kingdom.

a). Actions

- Incorporate considerations of population growth and movement in Biodiversity planning.
- Provide all possible support to the RGOB programs on family planning.

4.2. Domestic Biodiversity

4.2.1 Research and Information

4.2.1.1. Constructing A Comprehensive Information System for Crop Genetic Resources

Many of the Country's biological resources are insufficiently and/or poorly documented relative to what should be known about them for optimal conservation, access and use. Documentation of wild relatives of crops and on-farm genetic resources located in situ is particularly poor. Derived information on where materials have been distributed, pertinent ethno-botanical information, farmer and indigenous knowledge have not been maintained on material conserved in the herbarium and the seed stores. This situation is exacerbated due to the fact that at the national and institutional level, data management and documentation activities are given an inappropriately low priority in the allocation of funding. There is no standard procedure and systematic data-recording format corroborated by the agencies and institutes concerned with biodiversity issues. In the proper format, data can be used not only to assist conservation efforts, but also to "add value" to plant genetic resources for food and agriculture.

With the financial support of the World Wildlife Fund (WWF) Bhutan Program, the NBC along with various partners involved in biodiversity conservation and sustainable use have developed a 5 year

project proposal to integrate the nations biodiversity related information, including PGRFA information, into one web-based system called the Bhutan Integrated Biodiversity Information System (BIBIS, see section 2.9 above). The project proposal has been submitted to the government in January 2002 for the possibilities of securing funds.

a). Action

- The RGOB should approve BIBIS and provide or seek appropriate funding, including actively seeking donors as necessary, so that BIBIS can be established as quickly as possible.

4.2.2. Utilization of Plant Genetic Resources

4.2.2.1. Expanding the Characterization, Evaluation and Number of Core Collections to Facilitate Use

Genebank collections should enable users to respond to new challenges and opportunities. Typically, most genebank accessions have not been well characterized and evaluated, a situation that leads to the under-use of collections and failure to realise their full value, resulting in high conservation costs in relation to derived benefits. Consequently, a joint program on characterization and evaluation of germplasm by RNR-RCs and NBC is being carried out.

Farmers, plant breeders and most other users are interested in having a manageable number of genotypes that possess or are likely to possess the traits needed for the crop development program. Identification of those traits through characterization, and the establishment of core collections (a subset selected to contain the maximum available variation in a small number of accessions), are measures that can encourage greater and more efficient use of collections. Evaluation can also aid identification of germplasm potential for more direct use by farmers.

In addition, characterization and evaluation of data as well as the wise use of core collections are important in the overall efficient and effective management of collections.

A staff has already received training on characterization of field crops for seven weeks from the University of Birmingham, U.K., and a staff has received training on characterization and evaluation of tropical fruit trees for two weeks from the Indian Institute of Horticulture Research (IHR), Bangalore.

a). Long-term Objectives

- To increase and improve the ease of use of conserved plant genetic resources. To facilitate innovative progress in plant breeding through promoting the identification of useful accessions or their component genes for introduction into genetic enhancement and plant breeding programs. To promote plant breeding that results in higher levels of genetic diversity in crops and agricultural systems. To identify germplasm of potential value for direct use by farmers in on-farm programs.
- To promote the co-ordination of conservation, exploration and improvement activities by targeting collecting expeditions, optimizing sampling strategies, optimizing regeneration methodologies, identifying gaps in collections, rationalizing collections, establishing priorities for conservation, forming core collections, and quantifying the relative effectiveness of ex situ and in situ conservation.

b). Intermediate Objectives

- To give high priority to the development of crop specific characterization and evaluation programs to identify accessions and genes that counter those biotic and abiotic stresses which are limiting production of those crops.

- To improve the efficiency of the evaluation process by developing and adapting new technologies for reliably identifying valuable accessions and detecting valuable genes that have been identified as valuable.
- To establish international core collections for crops of global importance and promote establishment of genebank-based core collections for key national crop collections in national facilities. To promote, improve and test methodologies and technologies for important core collections.

c). Actions

Policy Strategy:

The RGOB with the cooperation of the relevant UN bodies and regional, intergovernmental and non-governmental organizations, international agricultural research centers, and including the private sector, and taking into consideration views of the scientific community and farmers' organizations and their communities should:

- Define priorities and periodically assess progress in evaluation in relation to the different needs of the various users of plant genetic resources in the arable agriculture system, with emphasis on identifying traits that counter limits to production in staple crops and of crops of national economic importance;
- Promote collaboration and complementarity between breeders, researchers, farmers and genebanks;
- Encourage exchange of characterization and evaluation information;
- Note that access to plant genetic resources in the arable agriculture system is subject to international agreements. In compliance with such agreements, user of plant genetic resources in the arable agriculture system should be encouraged to agree to provisions for sharing relevant evaluation data with source institutes, giving also due regard to the special need of commercial users for appropriate confidentiality;
- Give appropriate financial support for characterization and evaluation programs for crop species of primary or exclusive importance to food security in their countries, given the importance of medium and long- term financing;
- (Crop networks and genebanks should proceed carefully to develop core collections of crops of major interest to the national system. While core collections provide guidance on the constitution of genebank collections, they do not replace them. Genebanks should not use the existence of an excuse for allowing conservation conditions for other accessions in the collection to deteriorate.

Capacity Development

- Support should be given to begin a step-by-step, targeted characterization and evaluation program for selected priority germplasm. The characterization and evaluation process would begin with an assessment of current information and an effort to assemble, collate, computerize, and make available existing information contained in notes, reports, punched cards, etc. Much evaluation work needs to be done in a use-oriented, site-specific manner.
- The RGOB and appropriate organizations should identify institutions and individuals who may have the capacity and expertise to carry out germplasm characterization and evaluation for specific stresses and should develop a national portfolio of such expertise, including farmers in

high stress areas who may perform preliminary evaluation to identify subsets of accessions that hold promise for further evaluation under more stringent scientific conditions. The cost efficiency of sub-contracting evaluation work should also be investigated as well as cooperation between national programs and the private sector.

- National program staff should receive training in germplasm characterization and evaluation techniques on a crop-specific basis. Such training should begin with crops deemed important nationally, and for which there are current or planned breeding programs.
- Support training of farmers, including women farmers, participating in on-farm evaluation programs, in the necessary relevant skills. As their responsibilities often extend from the propagation, production and harvesting of crops to the processing, storage and preparation of foods, women's knowledge of the uses and usefulness of plants is often extensive.
- Appropriate technical and financial support should be given for multiplication of core collection germplasm.

Research and Technology

Various kinds of research must be undertaken if the cost-effective use of collections is to be encouraged. This could include access to the latest technology and support for scientific research to improve characterization and evaluation techniques.

Research priorities relating to core collections include developing:

- Improved methods of germplasm characterization using, inter alia, biochemical and molecular biological methods;
- Improved diversity stratification procedures;
- Methods for validating core collection selections;
- Methods for linking core collection to the main collection (sampling strategies);
- Improved methods of using plant genetic resources in the arable agriculture system, including targeted trait detection.
- Promote national symposia of germplasm experts to discuss the many technical issues involved in developing and using core collections and to stimulate activity in this area and complementarity with other aspects of the BAP.

Co-ordination and Administration

- Characterization and evaluation efforts should be planned and implemented with the active participation of national central program, and local, crop-specific and regional networks. As appropriate, farmers' organizations, private companies and their associations, and others might also be involved.
- Core collections should be developed with the active participation of breeders and crop networks for major crops. Work on core collections must be considered within and integrated firmly in the context of the entire effort to improve utilization.
- Co-operation and exchange of information are needed, especially by genebanks that manage collections of wide species diversity without corresponding specialization among staff for all species.

- There should be periodic assessments of the use of core collections to guide future work and assist in setting priorities. Such assessments should be made in conjunction with crop researchers, farmers, and seed supply system (DSC) and in consultation with appropriate international agencies, institutions, and NGOs.

4.2.2.2. Increasing Genetic Enhancement and Base-Broadening Efforts

Broadening the genetic base of crops can contribute to increasing stability and performance in crops. However, from the perspective of any individual breeder, company or institute, the costs of incorporating new and diverse germplasm into already adapted material may outweigh the benefits they could realise. Such benefits are often realised only in the long-term and accrue to society in general as well as to other plant breeders. Due to the nature of many genetic enhancement and general pre-breeding activities, international collaboration and public support are warranted.

Approaches to genetic enhancement include:

- (a) Introgression of useful agronomic traits identified through characterization or evaluation into locally adapted or elite material for further use in breeding programs; and
- (b) Base broadening of breeders' material through incorporation of wide genetic diversity.

a). Long-term Objectives

- To increase food security and improve farmers' livelihoods through the development of better plant varieties.
- To increase the utilization of genetic resources and thereby provide incentives for their conservation. To reduce genetic uniformity in crop varieties through the utilization of wild relatives, local materials and/or modern varieties.
- To increase sustainability of agricultural systems and the capacity for adaptation to unexpected environmental changes.

b). Intermediate Objectives

- To increase the genetic diversity available in breeders' populations through appropriate strategies of introgression (base broadening).

c). Actions

Policy Strategy

- The RGOB, private sector, community-based groups, non-government organizations and funding sources should recognize the importance of providing long-term funding and logistical support to pre-breeding, genetic enhancement and base-broadening activities.

Capacity Development

- Support should be given to national agricultural systems, networks, non-government organizations, training institutes and other relevant organizations to carry out pre-breeding and genetic enhancement projects. Priority should be given to addressing problems identified by the farmers, other competent scientific bodies and institutions, and farmers' organizations.

Research and Technology

- Crop development and improvement Institutions, should further develop methodologies for genetic enhancement including pre-breeding, and broadly disseminate these methodologies.

Co-ordination and Administration

- Activities should be planned and undertaken in close collaboration with national programs with the collaboration of crop and regional networks, other scientific bodies and institutions, and farmers' organizations. Close communication with plant breeders and other scientists in both the public and private sector should be encouraged.

4.2.2.3 Promoting Sustainable Agriculture through Diversification of Crop Production and Broader Diversity in Crops

Many major crops are impressively uniform genetically and impressively vulnerable. Uniformity does not equate with nor necessarily lead to vulnerability. And the lack of perfect assessment and forecasting tools and methodologies means that the degree of vulnerability cannot be precisely identified. Nevertheless, it is important to monitor this situation in order to take remedial or precautionary actions when warranted.

The future agricultural systems will need to incorporate a broader range of crops including inter alia crops, which produce raw material or are sources of energy. As a precaution, some actions are warranted now to encourage and facilitate the use of more diversity in breeding programs and in the varieties and species used on farms. Innovative approaches in plant breeding for the purposes of domesticating new crops, the development of new plant varieties and the promotion of higher levels of genetic diversity in crops and on farms, such as planting mixtures of adapted varieties, are recognized as means for adding stability in agricultural systems and promoting agricultural production and food security.

a). Long-term Objectives

- To promote sustainable agriculture and reduce genetic erosion and possible genetic vulnerability by diversifying crop production and increasing genetic diversity in crops.

b). Intermediate objectives

- To review periodically genetic vulnerability in crops and encourage breeders and appropriate groups, to take mitigating action nationally and locally, as appropriate.
- To promote the goal of higher levels of genetic diversity consistent with productivity increase and agronomic needs, including in crop production, plant breeding and biotechnological research and development settings.

c). Actions

The RGOB and relevant organizations in co-operation with crop networks, research institutions, extension agencies, the private sector, farmers' organizations and NGOs, should:

- Regularly monitor genetic uniformity and assess vulnerability in crops;
- Review policies, which may affect the level of diversity in agricultural systems, and specifically the degree of genetic uniformity and vulnerability of major crops;
- Increase heterogeneity by planting mixtures of adapted varieties and species as appropriate.
- Funding agencies should be encouraged to continue to provide support to national agricultural research systems, and other relevant research bodies and NGOs, for work aimed at enhancing levels of genetic diversity in agricultural systems. The release by the international centers of unfinished varieties to national research stations for further development, including on-farm improvement, and in accordance with an appropriate strategy, is one measure, which could

bring higher levels of diversity, adaptation and stability to crops. The selection of high yielding landraces/farmers' varieties is another measure.

Capacity Development

- The RGOB and its national agricultural research system, supported by the International Agricultural Research Centers, and other research and extension organizations should:
 - Increase their capacity to develop and use multilines, mixtures and synthetic varieties, as appropriate;
 - Increase their capacity to use integrated pest management strategies, including the use of race-non-specific (or horizontal) resistance's, the pyramiding of race-specific resistance's, and the strategic deployment of resistance genes;
 - Facilitate the strategic use of a range of varieties;
 - Explore and, in appropriate circumstances, make use of decentralized and "participatory" plant breeding strategies to develop plant varieties specifically adapted to local environments;
 - Make use of modern biotechnological techniques as feasible, to facilitate broadening of the genetic base of crops.

Research and Technology

- Support efforts to identify those activities used in plant breeding, plant research and farming systems that foster on-farm diversity. Such research might include a review of non-homogenous farming systems such as those based on intercropping, polycropping, integrated pest management, and integrated nutrient management, for their possible wider applicability, as well as research to develop appropriate plant breeding methodologies.
- Support should be encouraged for developing improved tools and methodologies for assessing genetic vulnerability and identifying, if possible, the ideal equilibrium in crops between genetic uniformity and diversity consistent with practical, technical and economic considerations that sustain ecosystems.

Administration and Co-ordination

- A committee on Genetic Resources in the arable agriculture system, or an appropriate subsidiary body, should be regularly informed of the state of diversity in collections and breeding populations of major crops of significance to the national food security. The Committee should make such information available to other relevant governmental bodies.

4.2.2.4 Promoting Development and Commercialization of Under-utilized Crops and Species

While a small number of species provides a large proportion of the national food needs, hundreds of other species are utilized at a local level, either through cultivation or harvesting. These under-utilized species contribute substantially to household food and livelihood security; they are often managed or harvested by women. Knowledge concerning the uses and management of these species is likewise often localized and specialized. Many under-utilized plants have potential for more widespread use, and their promotion could contribute to food security, agricultural diversification, and income generation, particularly in areas where the cultivation of major crops is economically marginal. However, current programs and projects for conservation, research and development tend to neglect these species.

a). Long-term Objectives

- To contribute to agricultural diversification, increased food security, and improved farmers' livelihoods; to promote the conservation and sustainable management of under-utilized species and their genetic resources.

b). Intermediate objectives

- To develop appropriate conservation strategies and sustainable management practices for under-utilized species, to improve selected species, to improve the marketing of under-utilized crops.

c). Actions**Policy Strategy**

The RNR sector and its national agricultural research system, with the support of the international agricultural research centers, and relevant organizations, and taking into account the views of farmers' organizations and their communities, are encouraged to promote policies consistent with the sustainable use, management and development of under-utilized species, including land use policies, as appropriate, identified as having a potential to make significant contributions to local economies and food security.

Training and capacity building for scientists and extension specialists and for farmers and local communities, with particular emphasis on women, should be provided in:

- Identifying under-utilized species with potential for increased sustainable use;
- Developing and implementing sustainable management practices for under-utilized species of importance to food and agriculture;
- Developing post-harvest processing methods;
- Developing marketing methods.

Research should be undertaken to:

- Develop sustainable management practices for under-utilized species of importance to food and agriculture and their genetic resources;
- Develop post-harvest processing and other methods to improve marketing possibilities.

The national agricultural programs in co-operation with international agricultural research centers, and other relevant organizations, should regularly review the status of under-utilized species in the country, to:

- Identify possibilities for greater sustainable use;
- Identify common research and development needs;
- Facilitate and, as appropriate, co-ordinate requests for relevant financial and technical assistance.

4.2.2.5 Supporting Seed Production and Distribution

Farmers benefit from having a wide range of seed varieties and other planting materials. Availability can be constrained by (a) poor harvest, inadequate on-farm storage facilities, insufficient means to multiply quality seed, and (b) poor seed distribution systems. These problems can apply to seed of both local and commercially bred varieties. Parastatal and commercial seed

companies sometimes have difficulty supplying seed of varieties specifically adapted to unique and local conditions. Often they cannot offer the range of varieties, or seed of so-called "minor" crops, on which many farmers rely, because of high transaction costs and low purchasing power of farmers. There is thus a need to strengthen local capacity to produce and distribute seed of many crop varieties, including some landraces/farmers' varieties that are useful for diverse and evolving farming systems.

a). Long term objectives

- To increase the availability of good quality seed of a wider range of plant varieties.
- To contribute to the maximization of both agro-biodiversity and productivity.

b). Intermediate objectives

- To improve the complementarity between governmental (or parastatal), commercial, and small-scale enterprises in plant breeding, seed production, and seed distribution.
- To develop and expand viable local-level seed production and distribution mechanisms for varieties and crops important to small-scale farmers;
- To help make new crop varieties available to farmers. To make suitable materials that are stored ex situ available for multiplication and distribution to farmers.

c). Actions

Policy Strategy

The RGOB through the RNR sector and its RNR-RCs, subject to national laws and regulations as appropriate, with support from IARCs, regional co-operation programs and others, and taking into account the views of the private sector, farmers' organizations and their communities, should:

- Develop appropriate policies concerning governmental, commercial and informal enterprises in, seed production, and seed distribution, to help focus efforts of government supported initiatives on the varietal needs of resource-poor farmers in particular, with attention, where necessary, on the needs of women farmers.
- Encouraging the private sector to meet the needs of larger-scale, commercial farmers should complement such an approach. Government involvement with major or minor crops that are inadequately covered by the private sector should not be precluded;
- Provide, and promote as appropriate, an enabling environment, where such an environment does not already exist, for the development of small-scale seed enterprises, including through appropriate incentives;
- Strengthen linkages between genebanks, plant breeding organizations, seed producers, and small-scale seed production and distribution enterprises;
- Consider seed quality control schemes particularly those appropriate to small-scale enterprises.
- Consider legislative measures, which allow distribution and commercialization of landraces/farmers' varieties and obsolete varieties, if they meet the same distribution and commercialization criteria for disease, pests, health and the environment, as conventional or registered varieties. These measures should meet quality standards of seed distribution and commercialization, in accordance with national legislation or applicable regional agreements, as appropriate.

Capacity development

The RGOB, subject to national laws, regulations and policies as appropriate, and in conjunction with international aid agencies, NGOs and existing seed enterprises should:

- Encourage existing seed enterprises to improve the range and quality of planting materials they offer.
- Provide appropriate incentives, credit schemes, etc., to facilitate the emergence of seed enterprises, paying attention as appropriate, to the needs of the small farming sector, of women and of vulnerable or marginalized groups;
- Provide support to and strengthen farmers' organizations in order that they can more effectively express demand for their seed requirements, paying particular attention to the needs of women and of vulnerable or marginalized groups;
- Provide training and infrastructural support to farmers in seed technology; in order to improve the physical and genetic quality of farmer-saved seed.

Research and Technology

The RGOB should:

- Assess current incentives and disincentives as well as needs for support to seed production and distribution enterprises, including small-scale, farmer-level efforts.
- Develop approaches to support small-scale, farmer-level seed distribution, learning from the experiences of community and small-scale seed enterprises already underway.

Co-ordination and Administration

- The government should regularly monitor national capacity for farmers to acquire appropriate seed. The potential for integrating this activity into agricultural development projects should be explored.

4.2.2.6 Developing New Markets for Local Varieties and "Diversity-Rich" Products

Increasingly, diversity is being replaced by uniformity in the agricultural market place. Changes in traditional cultures and in consumer preferences are one explanation. Concentration on productivity, the effects of advertising and the rise of consumer markets leading to stringent requirements being imposed on farmers and the inadvertent disincentives arising from legislation, policies, programs and other institutional activities offer additional explanations. Farmer's nationwide are losing once-strong incentives to provide an array of varieties. Economic and social incentives could be offered to encourage farmers who continue to grow distinct, local varieties and produce "diversity-rich" agricultural products.

A program to assist in the creation of specialized niche markets for biodiverse food crops could act as a positive stimulus to farmers to grow landraces/farmers' varieties, obsolete varieties, and other under-utilized food crops. Such a program should include the identification and removal of systemic institutional barriers and disincentives to biodiversity conservation and production/marketing.

a). Long-term Objectives

- Stimulate stronger demand and more reliable market mechanisms for land races/farmers' varieties and related agricultural products.

b). Intermediate Objectives

- To encourage farm suppliers, food processors, food distributors, and retail outlets to support the creation of niche markets for diverse foods, varieties and products.

c). Actions**Policy Strategy**

- The RGOB should consider, and as appropriate, adopt policies in extension, training, pricing, input distribution, infrastructure development, credit and taxation which serve as incentives for crop diversification and the creation of markets for biodiverse food crops, including standards for labelling of foods which allow the highlighting of use of non-standard crop varieties.
- Consideration should be given to developing appropriate niche variety registration systems to permit and promote the perpetuation, trial, evaluation and commercial distribution of local, obsolete varieties and to monitoring regulations enacted for other purposes to ensure that they do not inadvertently lead to the extinction of varieties.
- As feasible and appropriate, institutions should be encouraged to purchase "diversity-rich" foods for internal use.

Capacity Development

- Processes and activities, which have or are likely to have significant adverse impacts on the conservation and sustainable use of biodiversity, should be identified and their effects on crop diversification monitored. Appropriate bodies should promote public awareness in various media and through appropriate mechanisms, such as street fairs, initiatives in schools, etc.

Co-ordination and Administration

- National and local level co-ordination and administration should be most effective.

4.2.2.7 Policy Issues on Domestic Biodiversity in Bhutan**1). Background**

The Forestry and Nature Conservation Act establishes a legal framework for the conservation, use and access of biological resources under forest and nature reserve areas. However, in the area of crop and animal genetic resources similar legal instrument is yet to be put in place to formalize the aims and objectives of conserving, sustainable use and equitable sharing of benefit arising from their uses. Nonetheless, the utilization, access and benefit sharing mechanism for wild and natural biological resources need to be carefully enshrined in the above Act.

The Convention on Biological Diversity (CBD, Rio de Janeiro, 1992) charges national governments with full sovereignty and responsibility over biological resources on their territory. The Convention in combination with the ongoing negotiations within the GATT/TRIPS highlights the need to regulate ownership of and access to biological resources. Legal and moral ownership and rights are now firmly entrenched in the international trade agreements.

Differentiation is needed between the various forms of biodiversity; natural biodiversity as part of natural ecosystems, agricultural biodiversity as part of agroecosystems, medicinal plants (wild and cultivated), plants being harvested in natural ecosystems (vegetables, like mushroom, etc.). Secondly, it is necessary to differentiate between biological material exported from Bhutan and access of Bhutan to biological material from other countries, notably improved varieties of crops.

The primary objective of rules and regulations are to safeguard the interests of Bhutan and those of individual citizens with rightful claims or interests. This includes access to improved varieties from other countries. Following are some general observations on various issues as a first indication to be detailed at a later date.

2). Sovereignty over Biological Diversity

National sovereignty over natural resources is obvious. However, prior to the CBD, biological diversity was generally considered a common good with few or no restriction to collectors, national or international. This situation has changed. Collectors are now generally required to obtain official permits.

- A possible course of action for Bhutan could be to declare (by law or any other form of regulation) all biodiversity within Bhutan to be national property. Access to biological diversity could be regulated by a Material Transfer Agreement (MTA) mechanism, stipulating the kind of biodiversity concerned and the conditions under which such biodiversity can be exported and used. The rights of Bhutan on sharing of benefits if such material is commercially exploited etc. must be fixed in such arrangement. Some standard MTAs could be developed for the different kinds of biological diversity (see above) and different kinds of potential use (taxonomic research, plant breeding, pharmacology, ornamentals, etc.). Genetic resources collecting in the country may be regulated through a code of conduct for collectors.

3). Importing Biological Diversity

There are various reasons why Bhutan might require access to biological diversity from other countries. The most obvious one is to have access to improved varieties of crops of interest to agriculture in Bhutan. Improved varieties from CGIAR centers are usually free without conditions. However, commercial companies generally demand some form of protection of introduced varieties. In industrial countries this is regulated by plant Breeders' Rights (PBR) legislation harmonized in the UPOV convention. There is, however, no immediate need for Bhutan to adopt a formal PBR system until such time that it decides to promote the establishment of commercial plant breeding companies as the main source of seeds for farmers. PBR enforcement may promote local plant breeding capacity, promote access to latest foreign varieties, and fulfill some prerequisites of WTO resolutions. Till such times, limited regulations focused on specific situation (so-called Sui Generis regulations) would seem appropriate.

- One possible solution would seem specific MTA's on individual varieties. An alternative might be to incorporate certain protection in seed legislation. That may be expressed through issuance of a form of licensing system to give certain control in the seed supply market. The National Seeds Act of MoA deals with variety releases, seed certification and quality control matters.

4). Regulating distribution of planting material to farmers

When seeds (or other forms of planting materials) are distributed to farmers, guarantees are required that they are true to type (i.e. the named variety), have a good level of germination, are healthy (free of pests and diseases), properties that cannot be established from the seed without appropriate tests. It is a form of "consumer protection" regulated by seed legislation. Most countries have seed testing and certification schemes to control the quality of seed produced by either the commercial sector or by government agencies. Seed testing laboratories should be independent of the seed production organization to insure objective judgement and maintain adequate operational standards. Once released to farmers, very often varieties are entered into a farmer-to-farmer distribution system. This system cannot be monitored on quality, but may not need it. In this system formal tests are replaced by social control between farmers. Tests carried out in, amongst others, Indonesia indicate that farmers are well aware of the importance of good seed and generally maintain high standards.

- As in MTAs, seed legislation can be expanded to regulate use and sale of specific named varieties stipulating certain conditions. However, both with MTAs and with specific seed legislation, once seed enter into the farmer system, regulating distribution or extracting royalties on behalf of the owner of a variety becomes extremely difficult if not impossible. Hence in the case of Bhutan, an MTA would have to be signed between the owner of a variety and the Royal Government of Bhutan establishing central payment of agreed reasonable royalties, or transferring ownership at a certain fee. However, the government must develop measures to recuperate the fee payments from the farmers.

4.2.3. Livestock Resources

4.2.3.1. *Research, Education, Training and Services: Present, Planned - Identity Gaps.*

Agricultural research in Bhutan underwent a radical review between 1991 & 1993. The major result was the change from the previous segregated, departmental approach to an integrated Renewable Natural Resources (RNR) focus that recognized the essential interaction between crops, livestock and forestry in Bhutan's farming systems. To this end, the separate research responsibilities of the Departments of Animal Husbandry, Agriculture and Forestry were amalgamated into one RNR program co-ordinated by the Research, Extension and Irrigation Division (now the DRDS) of MOA.

a). Long Term Objectives

- Apply adaptive research on real problems and constraints faced by the farmers. Food security and poverty alleviation, environmental and biodiversity protection.
- More precise research priority setting focused on high potential and impact in farmer's fields in diverse production systems. Therefore, incorporation of the farmers concern in the research planning process will be emphasized.
- Judicious use of resources through project based management.
- Agro-ecological and socio-economic aspects of the farming systems will be taken into account in technology development with strong orientation towards eco-regional approach.
- Involvement of Extension in problem diagnosis, research planning and on-farm research.
- Provide feed back regarding transferred technologies for necessary adjustment to future technologies.
- Integrate research into Renewable Natural Resource Management and promote technologies that:
 - Increase conservation and raise productivity.
 - Use little external outputs but increase productivity.
- Recognize research and extension as two components of the same system.

The RNR research defined as the "Development Research" will make all possible efforts so that doers and users i.e. the researchers, extension agents and farmers understand each other, and in line with the national Policy, the research activities will be geared towards planned outputs. On this basis the RNR sector has outlined the following policy guidelines to the RNR research program:

- Problem orientation: the research program will identify production constraints in collaboration with extension agents and work on them to contribute to solutions of the problems.

- Disciplinary and Inter-disciplinary focus-research program will promote excellence in both disciplinary and inter-disciplinary research in view of the complex nature of the production environment and resource management.
- Make research recommendations relevant to farmers, right kind of technology will be developed with high degree of interaction between researchers, extension agents and the farmers.
- Environmental Sustainability: research program will safeguard against the use of technologies that will hurt sustainability and environmental integrity.
- Institutional Sustainability: the sustainability of the research program in the long run will be seen from the need and the resources available to support the program that is effective and efficient.
- Equity: the RNR program will pay due attention for equitable returns to the farmers of less favorable environment.

4.2.3.2 Research Programs on yaks

a). Actions

- Rangeland management for increasing the productivity of alpine pasture.
- Studies on yak crosses (Dzos and Dzoms).
- Find suitable alternatives to discourage migration
- Study dairy production and processing techniques.
- Conduct studies on yak diseases.

4.2.3.3 Extension Policy and Education

The concept of Domestic animal genetic conservation has come to the forefront in recent times only and not many are aware of it. The extension document approved by the Ministry of Agriculture reflects its environmental and biodiversity concerns by setting one of its ultimate objectives as "to support and promote the development and use of management strategies by rural households for sustained utilization of natural resource". This policy objective would be attained through its subprogram - 8 - Environmental Management, the intervention objectives of which are:

a). Objectives

- To identify with specified farmers in a specified location biological resource constraints and develop strategies and approaches to address these constraints.
- To introduce systems of biological resource management in specified locations that promote biological diversity and contribute to sustainable development.

b). Actions

Based on the above policy guidelines, Domestic Animal Genetic Conservation would be promoted through the following:

- Lobbying at the ministerial and inter ministerial level.

- Training of extension agents through workshops, seminars.
- Awareness raising campaigns.

4.2.3.4 Strategy, Planning and Basic Services

Organized livestock development began in 1960s within the broad framework of programs like breed improvement, dairy development, health coverage, fodder development, sheep and fisheries development, establishment of animal husbandry cum farmers training centers, research and extension development, and human resource and infrastructure development. These programs have been pursued in successive development plans. Livestock programs are looked after by a network of 162 livestock extension centers located in geogs and dzongkhag headquarters supported technically by Regional livestock farms and laboratories.

The strategies adopted are:

- Breed improvement with the introduction of exotic breeds of cattle like Jersey and Brown Swiss. Where feasible frozen semen is used for breeding through the network of 37 Artificial Insemination centers.
- Dairy development by encouraging farmers to go for small and productive herd,
- Sheep development by introducing better breeds of sheep for increasing the wool production to meet the demand of local weavers,
- Fisheries development in potential areas for increasing the cash income as well as the nutritional status of farmers,
- Strengthening the existing animal health services for providing better coverage to the farmers for controlling and eradication of animal diseases of economic importance,
- Increasing the feed and fodder resources of the country by encouraging for pasture development with the better yielding types of fodder seed,
- Strengthening and improvement of the existing animal husbandry farms involved in the production of various types of inputs required for implementation of development programs in the field, and
- Providing required extension services to farmers by building up the required trained manpower strength.

Chapter 5

Additional Sustainable Benefits from Biodiversity

5.1. Options for Action

Overview

The previous four chapters have focused on Bhutan's biodiversity, what is being done now and a plan of actions, which should be done to conserve or sustainably use it. This chapter presents options for additional actions which Bhutan can take to realise additional substantial but sustainable benefits from its biodiversity. The following discussion is based on "*Biodiversity Policy Options for Bhutan*" (REID 1996).

Bhutan's development is linked to its biological diversity and natural ecosystems to an extent almost unmatched elsewhere in the world. Its biological diversity and relatively undisturbed natural ecosystems represent a unique asset that no other nation in the region enjoys. Moreover, unlike virtually any other natural asset, the value of Bhutan's biodiversity and natural ecosystems is destined to increase with time. Throughout South and Southeast Asia, biodiversity is disappearing in the face of expanding populations, expanding agriculture, and poorly planned timber harvest. As this inexorable process unfolds, the relative importance of Bhutan's biodiversity grows.

Bhutan can benefit from its diversity in three complementary ways. First, the existing natural ecosystems will provide greater benefits to local populations than any alternative uses of most of these lands -- and those benefits can be significantly enhanced through careful management. Second, the nation's biodiversity has the potential of providing significant economic returns through international trade and ecotourism. Finally, because conservation of forests and biodiversity is of international value even beyond these domestic benefits, Bhutan stands to benefit from mechanisms for resource and technology transfer established under the Framework Convention on Climate Change and the Convention on Biological Diversity.

But these potential benefits will barely be tapped without increased *investment* in their development. Just as a country must make human, financial, and capital investments in its mining, agriculture, or power sectors in order to expand the potential development benefits they provide, so too it must invest in its natural ecosystems and biodiversity if it is to enhance the benefits from these resources. We traditionally think of agricultural or urban landscapes as "developed lands" and natural ecosystems as "undeveloped". But this taxonomy makes little sense in a country like Bhutan where the natural ecosystem can potentially provide far more economic and social benefits than the modified ecosystem. With proper investment and management, all of the country's lands will be "developed" - some for their agricultural potential, some for industrial potential, and the vast majority -- 70 percent or more -- for their biodiversity potential.

What type of investment is needed to increase the social and economic benefits from the country's biodiversity? Overwhelmingly, the key need is investment in the gathering, creation and protection of knowledge about the biodiversity. There are few countries where the priority for biodiversity investment is so clear. For any country to increase the contribution of its biological diversity and natural ecosystems to its social and economic development, it must adhere to the principle of "save it, study it, and use it sustainably" (WRI, 1992). Unless the natural wealth of a nation is protected (save it) it cannot contribute to development goals. Yet unless countries and local communities obtain benefits from that biodiversity (use it sustainably), there will be no incentive to

protect it. And unless the country works to better understand what biodiversity it has, what role it plays in natural processes, and how its value might be enhanced, it will not be in a position to either save it or use it sustainably.

Bhutan has taken extraordinary steps to protect its natural wealth, and already is tapping that wealth for sustainable local and national economic benefit. However, it has barely begun to build the knowledge base for better managing and utilising its diversity. The potential social and economic gains from an investment in knowledge creation related to biodiversity are thus significant. Building the needed knowledge base is presented in Chapter 4.1.

5.2 Ecotourism

Bhutan has the potential to be a premier eco destination in the Himalayas. It is a fine example of the Himalayan ecosystem where the total environment (culture, tradition, religion, and flora and fauna with their intact habitats) has not been overly impacted by modernization and where there is a conscious drive to conserve it.

There is considerable scope for Bhutan to increase its economic gains from ecotourism without threatening that diversity. Jigme Dorji National Park is, already a tourist attraction, and Royal Manas Park will become one when conditions permit it to be reopened. But other protected areas in Bhutan could also become attractive to tourists with appropriate investment. Bhutan has many of the features of a number of different successful ecotourism destinations -- the unique high elevation trekking experiences that draw tourists to Nepal, the "charismatic megavertebrates" that draw visitors to Kenya, and the species richness and scenic beauty that draws tourists to Costa Rica. The potential for ecotourism in Bhutan could be significant. Belize, a country half the size of Bhutan, had tourism receipts of \$73 million in 1993 and surveys show that over half of the tourists visiting the country participated in nature based activities. Costa Rica - only slightly larger than Bhutan -- reported 684,000 overnight visitors in 1993 who spent a total of \$577 million. Tourists spend on average \$148 per day in Costa Rica (Sizer, 1996). More than 50 percent of the visitors to the Costa Rica state that the national parks are their "principal reason" for visiting the country.

However, just as a high volume of tourists can destroy cultural values in a country, so to it can degrade biodiversity. Consequently it is very important to find the carrying capacity of an area for tourists. Bhutan's current goal of developing high income/low volume tourism applies equally to ecotourism. The "quality vs. quantity" issues with tourists will determine whether the numbers of visitors can stay within the carrying capacity yet bring revenue to the country. To a degree, the carrying capacity will be determined by the infrastructure and development of the service industries. If Bhutan chooses to build a more substantial ecotourism industry and increase the country's economic gains from that industry -- it would need to consider the following investments and policy change

5.2.1 Marketing and Market Survey

If Bhutan chooses to build its ecotourism industry, it should consider conducting basic market research to determine the types of infrastructure, information, trips, and accommodations, that would be attractive to potential tourists, and to analyse tourists' "willingness to pay" to visit Bhutan. With adequate marketing of the unique attributes of Bhutan as a tourist destination, it is likely that tourists would pay even more than the current "minimum" cost of \$200 per day for visiting Bhutan with little or no decline in the rate of growth of tourism, which appears to be limited largely by capacity and lack of marketing at this stage.

In addition, market surveys, i.e., studying the arrivals of visitors by country, age, sex, and purpose of visit can determine the country's strong and weak points, and indicate what is lacking and where to put more effort to attract and provide for visitors.

Currently, Bhutan is not well known as an ecotourism destination -- or even, for most people as a tourism destination at all. If the RGOB, the local tour industry, and international travel agents begin

to more aggressively promote this opportunity - and particularly promote the fact that the culture and biodiversity has not been degraded by excessive tourism -- then the number of people desiring to visit the country, and their willingness to pay, will grow. Among the areas to be expanded are films, news articles, and write-ups in travel magazines. Promotion of the opportunities, however, must go hand-in-hand with the development of more information about biodiversity, preparation of interpretative materials, training of guides, and development of infrastructure. A marketing survey, however, could help the country to more clearly understand the potential for this sector and to identify what specific niches within the ecotourism market Bhutan might best exploit.

The country also has potential for expanding the existing white-water rafting and kayaking tourism industry. Because the presence of such an industry creates economic and political incentives to protect water quality and water flow, it can help to protect freshwater biodiversity and indirectly provide an incentive for maintaining the forest cover in watersheds. This is one of the objectives of the Bhutan water partnership of which the Department of Tourism is a member.

5.2.2 Information

The unique diversity of birds and plants in Bhutan could make the country a "Mecca" for wildlife enthusiasts, particularly birdwatchers and amateur botanists. This type of tourist is low impact, tends to be in higher income brackets and thus able to pay top prices to visit unique locations, and often does not demand high-end accommodations. However, to build this type of tourism, Bhutan will need to invest in further development of basic scientific information on the distribution of biodiversity in the country and then provide interpretative materials -- particularly field guides and biodiversity tour guides -- to interested visitors. World Wildlife Fund has published a short book, *Birds of Bhutan*, listing several dozen of the most common species. Ideally, though, the country should build the knowledge base that would enable the government or private (or non governmental) entrepreneurs to begin to develop a series of field guides to various groups of species in the country - beginning with birds, plants, and butterflies. From this knowledge base, basic information could also be published detailing the types of species that could be seen in various parts of the country. This too could be done through private entrepreneurs, although the RGOB may want to play a role in catalysing the development of such material.

This type of published information would be useful not only for tourism but also for education within the country. Particularly as the country becomes increasingly urbanised, the connection of people with the land and biodiversity will weaken, and field guides, regional species lists or CD-ROMs for use in the classroom could play important roles in building awareness among school children in the country about their biodiversity. Another way to make information more easily available would be to develop a country web site on the Internet, with accurate information, hyperlinked to the tour operators' web sites.

5.2.3 Training

An effective ecotourism industry will require trained guides who could take visitors to specific parks or sites know what is likely to be seen, and be able to identify the biodiversity in the region. These skills can be obtained without extensive formal education - indeed, many rural people in Bhutan probably already have considerable expertise that could be adapted to this purpose if there were prospects of employment. Currently, the large tour operators indicate that the lack of trained guides is a serious constraint to their efforts to respond to potential interest in ecotours.

Over the long-term, one of the best ways to build this capacity will be as an integral part of Bhutan's efforts to build the knowledge base about its biodiversity (Chapter 4.1). Parataxonomists, for example, trained to help with a biological inventory of the country, would gain the experience necessary to become effective natural history guides.

Over the short-run, it may be worthwhile for the country to encourage natural history trips by organizations that could supply their own guides with some knowledge of the region, and pair those "visiting" guides with local people who could enhance their own skills during the trip. Almost

all natural history museums in Europe and North America - such as the Smithsonian Institution, American Museum of Natural History, British Museum of Natural History -- run natural history tours for members. In addition, a number of Non Governmental Organizations like the Sierra Club and Audubon Society also run international tours of this sort. The Department of Tourism could send exploratory letters to these groups, explaining that the country's interest is to begin to build more capacity for ecotourism within the country, to explore whether the trips could be run on terms and conditions acceptable to the government. This would also serve effectively to market ecotourism opportunities in Bhutan to a wider audience.

Training in provision of hospitality to tourists is another key need in developing a service industry. The training should emphasize professionalism and quality of service at all levels.

5.2.4 Infrastructure

Growth in ecotourism will require additional development of infrastructure, however this type of tourism demands somewhat less infrastructure than would be the case with expanded cultural tourism. Historically, many countries built elaborate facilities ("lodges") within protected areas as a key element of developing an ecotourism industry. Most evidence suggests, however, that a superior approach is to restrict development within protected areas to facilities needed for basic management and enforcement, trails or access routes, and basic interpretative facilities in heavily used regions, and to concentrate development of lodging facilities in nearby towns or villages. Development of more extensive facilities within protected areas has typically been done by issuing long-term concessions to private developers. However, it has been difficult for governments to capture an equitable portion of the returns from such developments to help pay the costs of the added maintenance and enforcement requirements that expanded ecotourism requires. Further, the materials needed for more elaborate facilities often cannot be obtained within the country and much of the expenditures thus "leak" outside of the country.

A key consideration is that the more elaborate are the facilities, the more impact they -- and the increased staffs needed to run them -- have on the local natural and cultural environment. Minimal, basic facilities have lower impacts and are more appropriate for wild areas and ecotourism than elaborate ones. Ecotourists are often put off by elaborate tourist facilities that they recognize to be inconsistent with their objectives and with conservation of the environment. If larger, more elaborate tourist facilities are considered for the country they should be sited in appropriate areas, well away from wild areas, and care should be taken to assure that their construction is consistent with Bhutanese architecture and their operation is consistent with other aspects of Bhutanese culture.

In addition, these facilities have not contributed effectively to local economic development in the region near the protected area and have often stimulated greater population growth in buffer zones. The greatest benefit to the country is likely to accrue from local ownership. Experience has shown that community-run campsites, local participation and local stakeholders can best ensure a sustainable infrastructure. Multinationals often are opportunistic, remaining only as long as the endeavor is deemed sufficiently profitable.

Expansion of lodging facilities near potential ecotourism destinations is probably best left to the private sector. -- as visitation grows, the incentive to build new guesthouses will grow. However, the RGOB will need to ensure that the basic protected area management and enforcement capacity is developed in parallel to growing use of protected areas as ecotourism destinations.

5.2.5 Policy Reforms

Effective tourism policy requires clear and distinct directives from the government, especially with regard to factors such as: revenue, employment, conservation of culture/tradition, religion and environment, identity and role of

stakeholders, relative government vs. private sector involvement, and the general role of tourism in the balanced development of the country. A clear tourism strategy and action plan is required to develop Bhutan's unique potentials for a tourism industry.

A typical scenario for tourism development in a country like Bhutan would be the following. Even in a region with high potential attraction for tourists, like Bhutan, tourist visits would initially be small because of the lack of awareness among potential visitors and the lack of facilities (lodging etc.) even for those desiring to visit. As more information and advertising becomes available and as facilities expand, the number of visitors would increase, enabling still greater investment by tour operators in advertisement and greater investment in improving facilities for visitors. The improved facilities and greater promotion would then attract still more visitors. During the period of industry growth, people would visit because of the cultural or artistic attributes, scenic beauty, unique wildlife, climate, and -- uniquely -- the relative lack of tourists compared to other more heavily visited regions. As the number of visitors grows, however, some of the attractions begin to decrease in "value". Cultural features become less distinct as the tourists themselves introduce more of their own culture to the region. The experience of seeing unique wildlife or appreciating the scenic beauty is reduced in value when visitors must experience it shoulder-to-shoulder with other tourists, and the attraction of visiting a rarely visited country disappears. Thus, as tourism grows the marginal benefit to the country of the next tourist begins to fall (the tourist is willing to pay less because the value of the experience is decreasing) and the marginal costs rise (Lindberg, 1991).

The net value to the country is maximised at the point where the distance between benefits and costs is greatest, not where the number of tourists is greatest. Yet as is always the case with open access resources (the tourism "potential" of Bhutan effectively amounts to an open access resource), continued visitation beyond the point of maximum social value still provides benefits for the individual user (and profits for the industry) and so the pressure will be for tourism to grow. The country can act in two ways to limit tourism to the level with the highest social value - either setting a quota or using fees or taxes to raise the cost curve. Many countries have established quotas for visitation to protected areas and some countries, like the Seychelles, set overall quotas for tourism to the country. (In the case of the Seychelles, the government sets limits on the number of hotel rooms, limits camping, and does not allow tourists to stay in private houses.) Under its current policy, Bhutan has adopted the approach of setting a fee (a percent of the \$200 per person per day fee -- currently \$65 peak season or \$55 low season per visitor day), which raises the total cost curve in an effort to reduce the equilibrium number of tourists.

As noted above, it would be in the country's interest to undertake a market study of the tourism potential to obtain better estimates of the willingness of tourists to pay to visit Bhutan. The potential demand that will be generated once more people become aware of the tourism possibilities in the country, and the approximate range of visitor days that will lead to the greatest social gain for the country. Under the current policy, the incentives for local tour operators, foreign travel agents, and local hotel operators will be to increase the number of tourists visiting the country as rapidly as the capacity and market will bear. The RGOB is thus undertaking an experiment with its current \$65-\$55 per day fee to see whether that cost is great enough to limit tourism to the socially optimal level. All of the private concerns will benefit from maintaining costs as low as possible (i.e., encouraging the government not to raise the current fee) and bringing as many tourists as possible to the country. There is thus a substantial risk that the level of visitation will overshoot the optimal level. Once past that level it will be extremely difficult to reverse the trend since the capital investments in hotels and other infrastructure would make reductions in tourism visits highly costly and disruptive to the private sector.

The country could substantially reduce the risk of potential over expansion of the tourism industry by maintaining quotas on visitation and slowly expanding those quotas as the demand and capacity warrants. There are three advantages of a quota system. First, the government is in complete control of the total number of visitors, rather than relying on the estimated elasticity of demand of visitors to the fee currently in use. Second, a quota system, by limiting visitors, creates the incentive for visitors to "bid up" the price of visiting Bhutan. Individuals will be willing to pay