

2 The Past, Present and Future Contributions of Farmers to the Conservation and Development of Genetic Diversity

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Introduction

The significant contributions of rural people, particularly women, to the conservation and enhancement of agrobiodiversity remained unrecognized until only a few decades ago. Studies by Darwin, de Candolle, Vavilov, Harlan, Wellhausen and many others have shown a strong positive correlation between cultural diversity and genetic diversity, demonstrating the impact of human communities on the conservation and use of biodiversity. Agrobiodiversity is largely the result of human–nature interaction.

Ethnobiologists and social anthropologists have long recognized the role of rural people in the domestication and improvement of economic plants. However, it is only in the last 25 years that serious efforts have been made to develop ways to recognize and reward the invaluable contributions of farm families to the conservation and development of genetic diversity. A serious debate on this issue started in the forum of the Food and Agriculture Organization (FAO) in 1981 when I was Independent Chairman of the FAO Council. In November 1983, the FAO Council meeting under my Chairmanship set up an International Commission on Plant Genetic Resources (now renamed as the FAO Commission on Genetic Resources for Food and Agriculture, so as to include within its scope animal genetic resources also). Soon debate started in meetings of this

Commission on the concept of farmers' rights. Although there has been a near consensus for nearly two decades on the need for recognizing and rewarding the contributions of farm families to genetic resources conservation, no internationally agreed methodology exists even now for this purpose.

The Convention on Biological Diversity (CBD), which came into force in December 1993, has for the first time in a legally binding document given explicit recognition to the role of indigenous communities to both accumulation and conservation of knowledge and information (Article 8j). The prior informed consent and benefit-sharing provisions of CBD have not become operational so far.

Conservation Methods and Economic Stakes

Sharing of benefits and the concomitant increase in the recognized value of the resources are the most effective ways to foster conservation and to ensure the continued availability of plant genetic resources (PGR). Today, there is a growing economic stake in the exploitation of habitats rich in plant genetic resources. That this will be disastrous is evident from the loss of nearly 3.5% of the world's forests since UNCED in Rio de Janeiro in 1992. *There is therefore an urgent need to create an economic stake in conservation.* In general, the issue of benefit-sharing

has not received the detailed attention it deserves among those formulating legal measures for operationalizing the CBD. If FAO's revised International Understanding on plant genetic resources (PGR) incorporating provisions for farmers' rights becomes a protocol of the legally binding CBD, follow-up action will become mandatory. The adoption of the Cartagena Protocol on Biosafety is a sign of hope.

The different systems of conservation in vogue today are:

- *in situ* conservation;
- *ex situ* preservation;
- *in situ* on-farm conservation.

Unlike cryogenic preservation in genebanks, conservation involves both preservation and evolution. Therefore, *ex situ* preservation alone cannot provide the lasting benefits that accrue from the conservation of habitats and ecosystems rich in biodiversity. The different systems of conservation are shown in Fig. 2.1, which also indicates the agencies actively involved in the different methods of conservation/preservation.

There is need to develop ways to end the prevailing dichotomy in which the primary conservers remain poor while those using their material and information become rich. In the case of *in situ* and *ex situ* conservation, public funds are provided to establish biosphere reserves, protected areas, botani-

cal gardens, genebanks, etc. However, in the case of *in situ* on-farm conservation of agrobiodiversity, rural people conserve landraces or folk varieties for public good at personal cost. Equity demands that their work be recognized and compensated. Thus, we should develop a framework for promoting benefit-sharing under the different conditions of conservation depicted in Fig. 2.1.

At a dialogue organized in January 1990 at Madras by the M.S. Swaminathan Research Foundation (MSSRF) in collaboration with the Keystone Center in the United States, the participants stated,

we agree on the concept of Farmers' Rights and we agree that the contributions to a fund in recognition of these rights should not be voluntary. Practically speaking, a voluntary fund is a fund without resources. Thus, there should be a compulsory funding mechanism. This would ensure that Farmers' Rights are recognized in a real way.

The concept of farmers' rights includes recognition of the fact that farmers have developed and continue to help develop and maintain genetic diversity. In many cases, farmers engage in conscious and creative practices as they select and breed their crops. Ethnobotanists around the world have chronicled the invaluable contributions of tribal and rural women and men in the conservation and enhancement of genetic diversity in plants (Swaminathan and Kochhar, 1989).

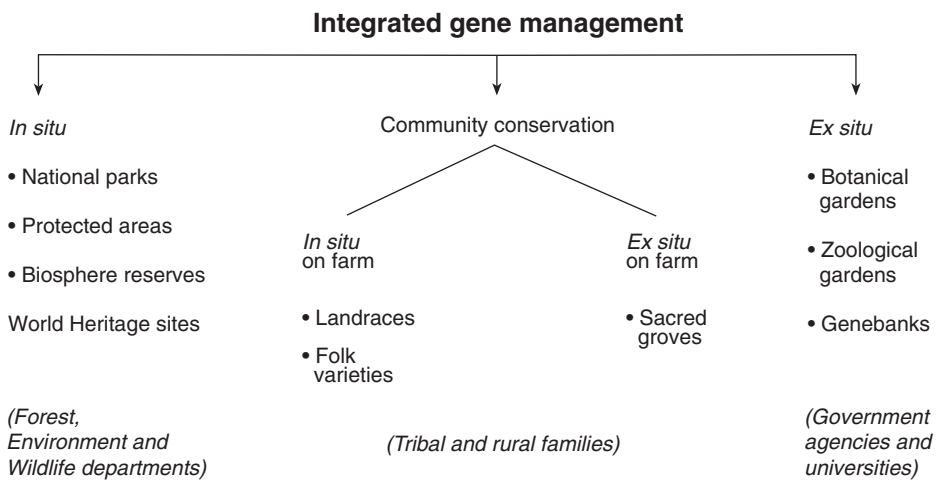


Fig. 2.1. Role of community conservation in integrated gene management.

The Plant Variety Protection Acts in vogue in developed countries generally conform to the provisions of the Conventions agreed to from time to time under the forum of the International Union for the Protection of New Varieties of Plants (UPOV). They are designed to promote invention and investment in plant breeding. However, they do not afford recognition to the conservation and enhancement by farm families of genetic diversity, which is the basic feedstock for plant breeding and biotechnology enterprises. By introducing provisions for farmers' rights, Plant Variety Protection Acts will concurrently foster innovation and conservation. They will thus help to strike a balance between homogeneity and heterogeneity in the genetic make-up of new cultivars. Such a balance is essential for sustainable agriculture. Breeders and farmers are allies in our struggle for a hunger-free world. Hence, their rights should be mutually reinforcing and not projected as antagonistic.

At two dialogues on methods of recognizing and rewarding informal innovations in the area of genetic resources conservation organized by MSSRF in 1994 and 1996, a detailed draft legislation was developed for converting the know-how relating to farmers' rights into field level do-how (Swaminathan, 1995, 1996). On the basis of these drafts, the Government of India has introduced in Parliament a Plant Variety Protection and Farmers' Rights Act.

Equity in Benefit-sharing

The need for internationally agreed methodologies for giving effect to the equity provisions of the CBD is now widely recognized. The issue of benefit-sharing has received considerable attention during the last 15 years in the forum of the Commission on Plant Genetic Resources of the FAO in relation to PGR. Although agreed methodologies for implementing farmers' rights at the field level have yet to emerge, several institutions have developed their own voluntary code of conduct in the matter of benefit-sharing in the commercial exploitation of agrobiodiversity.

Article 15 of CBD recognizes that 'States have sovereign rights over their own biological resources'. It also recognizes:

the close and traditional dependence of many indigenous and local communities embodying traditional lifestyles on biological resources, and the desirability of sharing equitable benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components.

Implementation of the above provisions of CBD will require both material and information transfer agreements within and among nations, which incorporate provisions for prior informed consent and equity in benefit-sharing between the primary conservers and those utilizing their knowledge and material in plant breeding, genetic engineering and pharmaceutical and other biological enterprises. The Consultative Group on International Agricultural Research (CGIAR) has developed well-defined procedures for material and knowledge transfer.

The Trade Related Intellectual Property Rights (TRIPS) provisions of the World Trade Agreement call for either a patenting or a *sui generis* system of plant variety protection. This is for the purpose of providing incentives for innovation and investment in the use of plant genetic resources. Such Plant Variety Protection Acts have been in existence in several industrialized countries for over 50 years. Since 1961, UPOV has been prescribing guidelines for harmonizing the provision of such legislation in different countries. The UPOV convention, however, provides for recognizing and rewarding only the contributions of breeders and not of those who have conserved the basic raw material used by breeders. The time has come to end the sad irony of the poverty of the conservers in contrast to the prosperity of those utilizing the fruits of their knowledge and conservation ethics. Several developing countries in South America, Africa and Asia are currently in the process of enacting legislation incorporating provisions for benefit-sharing. Individual institutions and commercial companies have also been practising their own procedures for sharing benefits with the communities that provided the genetic material. These different steps illuminate the path towards an internationally agreed protocol on benefit-sharing under the auspices of FAO or CBD.

Equity in benefit-sharing is fundamental to the retention and revitalization of the *in situ* on-farm

conservation traditions of rural and tribal families. Material and Information Transfer agreements should safeguard the interests of those providing the concerned material/information. CGIAR institutions are already adopting a Material Transfer Agreement procedure that will prevent the monopolistic exploitation of public-funded research for commercial profit. Benefit-sharing procedures will have to be developed at the individual and community levels. At the level of an individual farmer–conservator–innovator the same procedures for seeking recognition and reward as those available to professional breeders can be used. Only they may have to be helped in obtaining patents/plant variety protection in accordance with the prescribed national legislation. The problem is more complex in the case of benefit-sharing with entire communities. Procedures are available for identifying the area from which critical genes responsible for the commercial success of a new variety came. Thanks to molecular techniques, this possibility also extends to genes controlling quantitative traits like yield and quality. Therefore, appropriate reward can be given from the Community Biodiversity and Gene Funds proposed to be established under Biodiversity and Plant Variety Protection Acts in several developing countries. Breeders will have to be requested to disclose the full pedigrees of their new varieties and indicate to the extent possible the area from where the critical genes, including QTLs (quantitative trait loci), came. The communities concerned can decide how to use the funds provided. Obviously they should be used for community benefits, including the funds needed for strengthening on-farm conservation of landraces and seed technology.

The benefit-sharing methods appropriate to different systems of genetic resources conservation are summarized below.

In situ conservation

This largely takes the form of biosphere reserves, national parks and protected areas. Here, many opportunities are available for benefit-sharing, such as:

- Participatory forest management, involving benefit-sharing with reference to wood and non-wood forest products.
- Bioprospecting based on equity in sharing commercial profit.

- Ecotourism, which strengthens the livelihood security of local communities.
- Symbiotic social contracts between tribal and rural families and the corporate sector with reference to sourcing of material based on assured buy-back arrangements.

Ex situ preservation

Here, methods of sharing royalties with the providers of the critical information and material can be developed. Community Gene Funds can be established to provide recognition and reward to entire communities based on the analysis of the pedigrees of successful varieties.

In situ on-farm conservation

This is an area of vital importance to global food and health security. Community Biodiversity and Gene Funds could be used to compensate local communities for the yield and income loss they may incur by continuing to conserve landraces and folk varieties of economic plants, instead of abandoning them in favour of high-yielding varieties. In addition, both individual and community benefits can be conferred on the basis of transparent procedures. Technical Resource Centres for the implementation of the equity provisions of CBD, like the one existing at MSSRF, will be of help in this process. Thus, benefits can be in cash and kind. Social recognition and material benefits are both important. There are several informal models of such recognition and reward developed and operated by non-governmental organizations, academia, business and industry. Through a combination of political will, professional skill and people's participation, fair and equitable methods of benefit-sharing can now be introduced in all systems of conservation and use of plant genetic resources.

The FAO Global Plan of Action developed at Leipzig provides an excellent blueprint for plant genetic resources conservation. In the ultimate analysis, the success of conservation efforts will depend on people's participation. Equity in benefit-sharing is the trigger for fostering a people-centred conservation movement. Implementation of benefit-sharing procedures – rooted in the principles of ecology, social and gender equity and economics – will be an important step in achieving a better

common future for humankind. This is why industrialized countries and biotechnology industries, for which biodiversity constitutes the basic feedstock, should contribute to a Global Community Gene Fund designed to reward the tribal and rural families who are today protecting public good at personal cost.

The three fundamental concepts of Article 15 of CBD, namely sovereign rights over genetic resources (article 15.1), access subject to prior informed consent (article 15.5) and access subject to mutually agreed terms (article 15.4), provide a framework for a new partnership between holders and providers of knowledge and genetic material and users, based on equity and ethics in sharing benefits.

Unilateral exploitation of biodiversity for commercial purposes is now widely regarded as biopiracy. This method of exploitation should give way to biopartnership based on procedures like copatenting and equitable benefit-sharing. Such biopartnerships will help to foster symbiotic relationships between biodiversity providers and users and will foster the causes of conservation and sustainable use.

The recent initiative of the World Intellectual Property Rights Organization (WIPO) to consider questions relating to according recognition to traditional knowledge systems and informal innovations is a welcome first step in enlarging the concept of intellectual property rights (IPR). The World Trade Organization (WTO) should also initiate steps to enlarge the concept of TRIPS, so as to evolve a new 'TRIPS Plus' paradigm, where the 'plus' refers to equity and ethics in the sharing of benefits between traditional knowledge holders and conservers and commercial companies. Finally, UPOV should also restructure itself so as to become an 'International Union for the Protection of Breeders and Farmers' Rights'. Such action at the international level and appropriate legislative and non-legislative measures at the national level will help to give meaning and content to the concept of equitable benefit-sharing.

Global plan of action

At an International Technical Conference on Plant Genetic Resources held at Leipzig, Germany, from 17 to 23 June 1996, under the auspices of FAO, a global plan of action was developed for both *in situ* and *ex situ* conservation of PGR. Although at this Conference, benefit-sharing methodologies were not specifically discussed, the following areas that

have a bearing on benefit-sharing were given consideration:

- development and commercialization of under-utilized crops and species;
- supporting seed production and distribution;
- developing new markets for local varieties and 'diversity-rich' products;
- expanding and improving education and training.

The Leipzig declaration called for 'a new and more productive partnership between scientists and farmers to build upon the ongoing efforts of farmers to manage and improve their plant genetic resources, especially in marginal areas'.

Such partnership will help to address the twin needs for:

- revitalization of the *in situ* on-farm conservation of agrobiodiversity by rural families;
- creating an economic incentive system that provides for both compensation for loss of yield and reward for contributions to genetic resources conservation and enhancement.

The FAO Global Plan of Action represents the most comprehensive strategy for the conservation and sustainable use of PGR.

In a recent publication entitled *Business and Biodiversity* published by the World Business Council for Sustainable Development and IUCN (Stone *et al.*, 1997) the need for sharing benefits was reiterated in the following statement.

Company management should ensure that local communities are closely involved with decisions affecting the use of natural resources. Of particular importance in some areas is the indigenous peoples' knowledge and the specific issues related to their use of, and relationship to, the land and biological resources. This relationship needs to be harnessed in a positive way, both for the company and the peoples, by developing agreements which promote the equitable sharing of resources.

Thus, the pathway suggested is bilateral negotiations between companies and local communities.

We also have information on both megabiodiversity areas and 'hot spot' locations with reference to threats to biodiversity (see Heywood, 1995). Many of these areas are also characterized by high population density (Cincotta *et al.*, 2000). Hence, extending support to the communities conserving and improving agrobiodiversity is not difficult, if there is a will to do so. UNEP,

FAO, UNESCO and the International Plant Genetic Resources Institute (IPGRI) of CGIAR could jointly help to develop internationally acceptable guidelines for according support from a Global Biodiversity Fund.

Community food and water security system

It is gratifying that several developing countries in South America, Africa and Asia are in the process of institutionalizing benefit-sharing procedures in legal measures relating to CBD. Experience in operating such legislation will lead to the refinement of benefit-sharing procedures by the beginning of the new millennium. This will then provide the basis for the adoption of an agreed protocol on benefit-sharing by the Conference of Parties to CBD. Inaction is not the answer to imperfections in currently available benefit-sharing methodologies. Learning by doing is the pathway to perfection.

In future, the contributions of farmers to *in situ* on-farm and *ex situ* on-farm conservation will depend much on the social recognition and economic incentives provided to the primary conservers. While the older generations conserved as a part of tradition and ethics, the younger generation is likely to continue the earlier traditions only if a recognition and reward system is put in place.

In addition to implementing the ethics and equity principles enshrined in CBD, it will be important to integrate the revitalization of the *in situ* on-farm conservation traditions with a

Community Food and Water Security System of the type described below.

There is need for a community-centred food security system based on attention to all the links in the conservation–cultivation–consumption chain. One male and one female member of a panchayat (village or town council) should be trained to serve as a member of a Food and Water Security Corps. Such a system will include the following four major components.

1. *Field Genebank*. This involves the *in situ* on-farm conservation of landraces and local varieties of crops, through the revitalization of the conservation traditions of rural and tribal families, particularly women.

2. *Village Seed Bank*. The rural families often lose their seed stocks because of drought, flood and other natural calamities. Therefore, in each village a Village Seed Bank will be established through a Seed Security Self-help Group, supported by microcredit.

3. *Village Water Bank*. Conservation of rainwater, sustainable management of ground water and the conjunctive use of surface, ground and recycled water are important components of the Village Water Bank.

4. *Area Grain Bank*. It is important to maintain grain reserves of local staples to meet emergencies like drought and natural calamities. For this purpose, an Area Grain Bank will be established at a suitable location, each to serve about 25,000 families. The Grain Bank will be operated by a self-help group supported by a revolving fund.

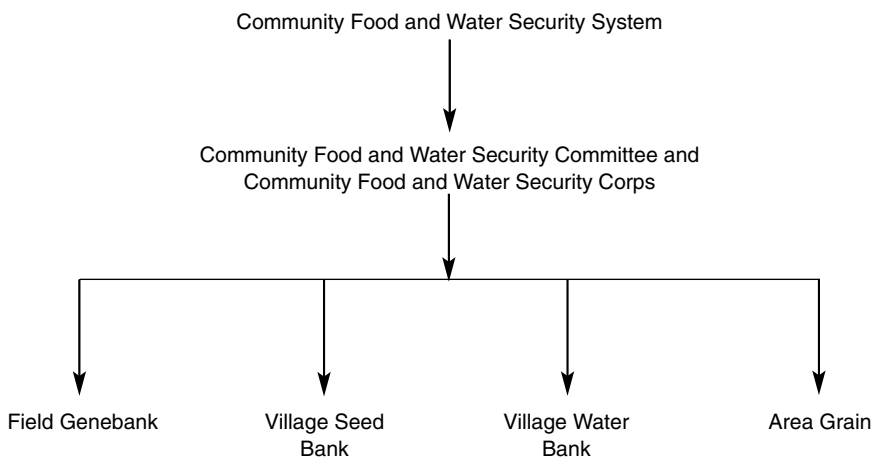


Fig. 2.2. Components of a community food and water security system.

Thus the Community Food and Water Security System will foster a sustainable people-centred and people-controlled method of ending food and drinking water insecurity at the level of each individual. It will help to ensure both food security and genetic resources conservation.

Contributions of Farming Families: A Case Study in Kolli Hills, Tamil Nadu

Past: subsistence mode of production

The local tribal community is known as Malayali. Agriculture is the mainstay of the Malayali economy. For a long time subsistence farming has been the predominant pattern and continued to be so until two decades ago. It was not just for survival; it was a way of life for them. Their traditional management practices enabled them to have a sustainable food system. The traditional cultivated food crops include minor millets such as Ragi (*Eleusine coracana*), Samai (*Panicum miliare*), Thinai (*Setaria italica*), Thirivaragu (*Paspalum scrobiculatum*), Panivaragu (*Panicum miliaceum*), rice (*Oryza sativa*), both wet land and dry land varieties, and pulses.

Almost all the food crops, with one or two exceptions, had a minimum of three to four varieties with different agronomic characters. Given their forefather's knowledge and their own experience, the Malayalis were motivated to adopt different crop varieties to suit local environmental, socio-economic and cultural conditions.

They adopted varieties based on a wide range of criteria. The Malayali farmers, both men and women, pointed out that different food crops and different varieties formed their agricultural system, because of their high yield, cooking qualities, desirable maturity period or ease of harvest. Further, some of the varieties provided good fodder and thatching material for their house roofs. Another significant aspect is the compatibility of different varieties with climatic and edaphic factors, resources, and cropping patterns (e.g. mixed cropping) of the Malayali farming system.

Many varieties were adopted for different reasons, which may be explained by giving a few examples.

- Sadan samai, a medium-duration variety, gives good yield. The straw serves as good fodder material for their cattle, but it is difficult to process.
- Malliya samai matures in 90 days and gives

good yield, but the straw does not have fodder value. The straw is good thatching material.

- While the above two varieties are cultivated in terraced uplands, the long-duration variety of Perun samai is cultivated in the sloped terraces because it fits seasonal characteristics better.

There are cultural reasons for cultivation of particular food crops. A rice variety known as Karu Nelli even today is grown by the households worshipping the goddess 'Kongayi Amman', a local deity, for ritual offering. Similarly, Thinai flour is also offered as ritual offerings to local female deities. The delicacies prepared out of this grain are considered very tasty, and the gruel prepared out of it is given to women after childbirth. Thinai is also considered soodu (hot) by the locals. So the food prepared out of it is taken once a week, particularly during the winter season. This grain is quite easy to pound, compared with other millets. The concept of 'hot' and 'cold' foods is also inherent in tribal families, the 'hot' food being taken during winter months and the 'cold' food being consumed during summer.

Ragi was cultivated on a large scale until recently as it is considered very healthy (nutritious) and can be consumed year round. Ragi is followed by samai, Puzhudikar Nelli (a dry land rice variety) and other crops.

The Malayalis practise mixed cropping (mainly Ragi based) where at least six varieties of crops are sown simultaneously and cultivated in a single plot. It is a risk-minimizing device as well as a means of extending the cropping season.

Present: transformation from food production to commodity production

In recent times, i.e. in the late 1970s and early 1980s, a trend towards a market-oriented economy set in which altered their food and production system. This transformation took place as a result of various developmental activities such as improving accessibility through construction of roads, and setting up cooperative societies and schools. Entry of outsiders and exposure to urban life brought changes in socio-economic and cultural values. Monetary considerations favoured a shift from a subsistence economy to a market-oriented one.

A subsistence-based food production system has

largely been replaced by the cultivation of cassava in the terraced uplands and pineapple in the sloped and rocky lands. Between 1970 and 1984, the area under cassava and pineapple increased more than 50 times. Changes in agricultural practices and access to education forced people to reduce their livestock.

Another crucial factor is the increase in the human population, from approximately 19,000 in 1951 to 32,130 in 1991.

Their food security is gradually declining, making them dependent on the market. Most importantly, the agrobiodiversity of the Kolli Hills is at great risk. Another crucial factor which has a direct bearing on Kolli Hills agrobiodiversity is land alienation, which has been taking place at an alarming rate.

Disturbances in the exchange rates may affect the food supply of the Malayalis. To avoid any such disturbances, an alternative system of the kind described earlier, which will ensure their food security, is a must.

Future: revitalization of traditional agricultural and food systems

If the present trend continues there is more scope for greater commodification in future. Those who continue with farming will concentrate on the

commercial crops that have economic value such as tapioca, pineapple and plantation crops. Those who are away for education or because of new opportunities have drifted towards non-farm activities. Such people and households would be completely diverted from their traditional agricultural activity. Unless they derive economic benefit from their conservation traditions, many of the local crops and varieties will soon become 'lost crops'. If this scenario is to be changed it needs to have a positive and effective intervention with people's involvement and participation.

A two-pronged strategy can help to mitigate the problem: one deals with cultural aspects and the other with the economic aspect. There should be a cultural motivation for the people whereby they will feel proud about their traditional crops. People should be encouraged to rediscover the cultural value of raising their traditional millets and other crops, by according social prestige to such traditions.

Value addition in terms of monetary gains is another crucial factor. Value addition in terms of both cultural and monetary returns would help to reinforce conservation of traditional millet crops and agrobiodiversity of Kolli Hills. The implementation of the concept of farmers' rights will also help. The fast-changing scenario in Kolli Hills is depicted in Fig. 2.2.

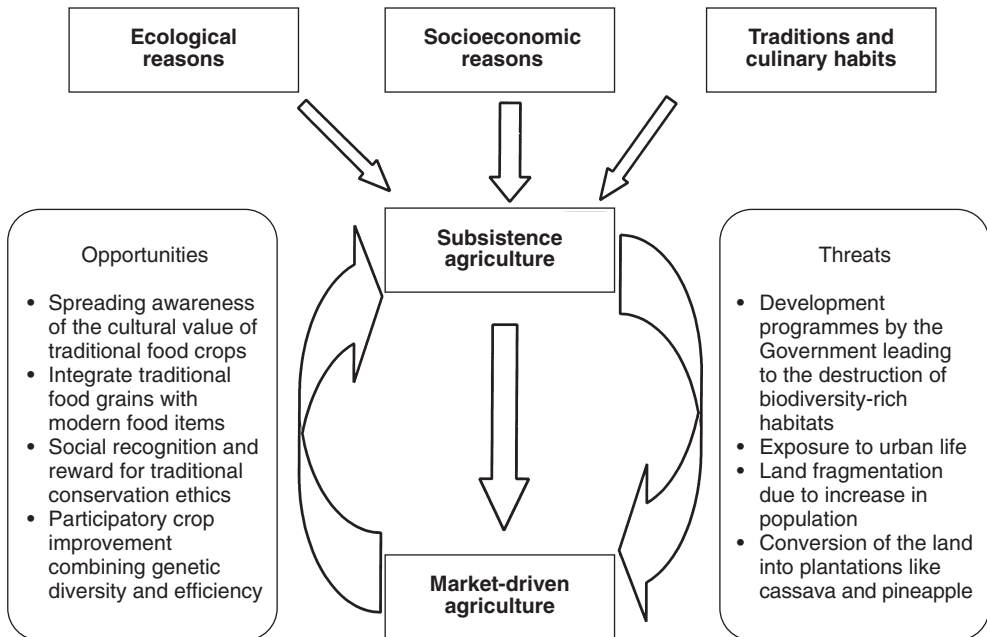


Fig. 2.3. Analysis of strengths, weaknesses, threats and opportunities (SWOT) in Kolli Hills.

Gender Dimensions of Biodiversity Management

Most of the studies on contributions of farming families are not gender disaggregated. MSSRF, in collaboration with the FAO Regional Office in Bangkok, has initiated a series of studies on the gender dimensions of biodiversity management (Swaminathan, 1998). More recently, detailed studies have been undertaken by Dr Virendra Kumar and Dr Hemal Kanvinde of MSSRF on gender roles in biodiversity conservation and management in Sri Lanka and the Maldives. The results so far stress the need to recognize the specific role of women in genetic resources conservation and enhancement. This is particularly important in the context of the equitable benefit-sharing provisions of CBD.

Conclusion

The books *Lost Crops of the Incas* and *Lost Crops of Africa* relate very clearly how ancient civilizations depended on a wide range of food and medicinal plants, and *Biodiversity in Trust* (Fuccillo *et al.*, 1997) reports the enormous range of intraspecific diversity maintained in the genebanks of International Agricultural Research Centres (IARCs) belonging to the CGIAR system. We owe such rich

variability to the conservation ethos of farm and tribal families. Often the conservation habits were not due to any commitment to conservation *per se*, but rather to the understanding that genetic variability diminishes vulnerability to biotic and abiotic stresses. Farming families in the past were motivated by a desire to minimize risks rather than to maximize profits. Risk aversion agronomy involved growing mixtures of crops and crop varieties.

Modern agriculture involves monoculture and the cultivation of the same genetic strain over large areas. There is a fear that when genetically modified varieties covered by proprietary science and released by commercial companies become popular, genetic homogeneity will increase in farmers' fields. The challenge lies in integrating genetic efficiency with genetic diversity. The procedure adopted by MSSRF scientists for this purpose is the integration of pre-breeding with participatory breeding. By adopting such procedures, we can conserve agrobiodiversity and at the same time enhance it through participatory breeding with farm families. This will help to select location-specific varieties adapted to the local agroecological and socio-cultural conditions. If we adopt such scientific procedures and at the same time introduce legal measures for social recognition and economic reward, farm families will continue to conserve, nurture and enhance agrobiodiversity.

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