

Home Gardens in Nepal

Proceedings of a national workshop , 6-7 August 2004, Pokhara, Nepal

Resham Gautam, Bhuwon Sthapit, Pratap Shrestha, editors



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Foreword

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This book on Nepalese home gardens brings together new research findings and perspectives to show us how home gardens contribute to the development, nutrition, and well being of rural households. The extensive literature on home gardens has addressed the various aspects of food security, nutrition, income, gender, biodiversity and ecosystem services that characterise home garden systems. The authors of this volume have gone further than simply enumerating the attributes of home gardens; they have shown how home gardens can be supported and mobilized as a development intervention that contributes to empowering rural households by generating income and improved nutrition in ways that are embedded in local cultures and traditions.

One of the analytical contributions the authors make is to reveal the importance of the traditional multi-story, multi-purpose home garden that is rich in biodiversity as a crucial asset for livelihood and health. While terms like kitchen garden have been used by development agencies in order to emphasise the food security and income aspects, especially for women, the other health, nutrition, and ecological benefits to households may have been undervalued. This book has established a clear link between home garden biodiversity and the dietary diversity that underpins good nutrition and health. Working with nutrition programmes and development agencies from government and non-government agencies, the authors have been able to document these linkages and contributions to incomes, food security, nutrition and health in practice. Finally, if not belatedly, we are reaching a global consensus that economic development of the rural poor must be part of a process of empowerment based on control over resources, governance and support for local institutions the poor can manage. For the authors of this book, home gardens are essential biological assets under the control of rural households, managed by rules that are embedded in the culture and customs that lie at the heart of community cohesion and identity. The great achievement of this book is that it demonstrates how development based around the traditional Nepali home garden systems fosters community empowerment and well being.

The International Plant Genetic Resources Institute is grateful to have been part of the research partnerships that produced this work. The support and motivation provided by the Swiss Development Corporation (SDC) in Nepal enabled us to build innovative partnerships among LIBIRD, the National Agricultural Research Council and Department of Agriculture, National Nutrition Programme of Nepal, Plan Nepal, Care Nepal and leading global actors in health and nutrition such as Helen Keller International. We hope that this work in Nepal can serve as model to further community-based biodiversity management for food security, nutrition and health.

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Acronyms

AEZ	Agri-Ecological Zones
ANOVA	Analysis of Variance
BLM	Broad Leaf Mustard
CBS	Central Bureau of Statistics
DADO	District Agriculture Development Office/Officer
DDC	District Development Committee
DEPROSC	Development Project Service Center
DFID	Department For International Development of UK
DLSO	District Livestock Services Office/Officer
DoA	Department of Agriculture
DOS	Disk Operating System
FFS	Farmers' Field School
FTLW	Farmers' Traveling and Learning Workshop
H'	Shannon-Weaver Index
HARP	Hill Agricultural Research Project
HG	Home Garden
HGRC	Home Garden Research Committee
HH	House Hold
HKI	Helen Keller International
IAAS	Institute of Agriculture and Animal Science
ICIMOD	International Centre for Integrated Mountain Development
IDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
IGA	Income Gnerating Activities
IK	Indigenous Knowledge
INGO	International Non-Governmental Organisation
J	Evenness Index
KDS	Kami, Damai and Sarki (ethnic group)
Kg	Kilogram
KSLUB	Kerala State Land Use Board of India
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
MV	Modern Varieties
NAF	Nepal Agroforestry Foundation
NARC	Nepal Agricultural Research Council
NEST	Nucleus for Empowerment through Skill Transfer

NGO	Non-Governmental Organisation
NNP	National Nutrition Programme
NNSWA	Nepal National Social Welfare Association
NOVIB	Netherlands Organization for International Development Cooperation
NRCS	Nepal Red Cross Society
NRs	Nepalese Rupees
PRA	Participatory Rural Appraisal
RRN	Rural Reconstruction Nepal
SALT	Sloping Agricultural Land Technology
SDC	Swiss Agency for Development Cooperation
SOLVE	Society of Local Volunteers' Effort
SPSS	Statistical Package for Social Sciences
Sq.m	Square meter/meter square
SWI	Shanon-Weaver Index
TOLI	Team Organising for Local Initiatives
UBINIG	Policy Research for Development Alternatives (in Bengali)
VDC	Village Development Committee
Vit	Vitamin
VMN	Village Model Nursery
VMNPF	Village Model Nursery and Poultry Farms
WTO	World Trade Organisation
λ	Simpson Index

The Value of Home Gardens to Small farmers

Bhuwon Sthapit, Resham Gautam and Pablo Eyzaguirre

ABSTRACT

The home garden is a traditional component of the rural ecosystem that has been practiced for a long time by farmers. Home gardens are often overlooked as an important source of food and nutrition at national level. For subsistence and poor farmers, crop varieties and cultivars adapted to particular micro-niches around homesteads are crucial and accessible resources available to provide a secure livelihood. The purpose of this paper is to review the value of home gardens that contribute to not only food and nutrition but also a wide range of social, economic and environmental benefits to people. The paper also describes the goods and services provided by agricultural biodiversity in home gardens that interface between the natural ecosystem, orchards and crop fields. The paper suggests that the home garden could be an entry point to empower the community to manage on-farm agricultural biodiversity while promoting dietary diversity for healthier families and ecosystems.

Key words: Home gardens, kitchen garden, ecosystem, value, dietary diversity, nutrition

DEFINITION

A home garden is a micro-environment composed of a multi-species (annual to perennial, root crops to climbers etc), multi-storied and multi-purpose garden situated close to the homestead (Quat, NX, 1996; Watson and Eyzaguirre, 2002; Hodgkin, 2002). A home garden refers to the traditional land use system around a homestead, where several species of plants are grown and maintained by the household members and their products are primarily intended for the family consumption. Several terms have been used to describe these garden production systems, such as “homestead garden, backyard garden, kitchen garden, agro forestry, mixed garden, garden culture, etc” (Helen Keller International, 2001; Mictchell and Hanstad, 2004). The term “home garden” is preferred because it stresses the close relationship between the garden and the social group residing at home. The home garden provides a bridge between the social and biological, linking cultivated species and natural ecosystems, combining, and conserving species diversity and genetic diversity (Eyzaguirre and Linares, 2004). The importance of home gardens is evident across countries and societies. Different cultures and customs have different names for this homestead production system, for example, *Conuco* in Cuba and Venezuela (Castineiras *et al.*, 2000; Mulas *et al.*, 2004), *Vuon nha* in Vietnam (Trinh *et al.*, 2003), *Pekarangan* in Indonesia (Abdoellah *et al.*, 2003). Those millions of households throughout the world that keep their biodiversity close at hand, that use it daily for multiple purposes, that imbue it with cultural and spiritual value, are providing a lesson to all humanity on the importance and value of biodiversity. For this reason alone, Eyzaguirre and Linares (2004) voiced that home gardens are to be celebrated, supported and conserved.

The Nepalese context

The home garden, literally known in Nepali as *Ghar Bagaincha*, refers to the traditional land use system around a homestead, where several species of plants are grown and maintained by household members and their products are primarily intended for the family consumption Figure 1, (Shrestha *et al.*, 2002). The term “home garden” is often considered synonymous to the kitchen garden. However, they differ in terms of function, size, diversity, composition and features (Table 1). In Nepal, 72% of households have home gardens of an area 2-11% of the total land holdings (Gautam *et al.*, 2004). Because of their small size, the government has never identified home gardens as an important unit of food production and it thereby

remains neglected from research and development. Traditionally home gardens are an important source of quality food and nutrition for the rural poor and, therefore, are important contributors to the food security and livelihoods of farming communities in Nepal. They are typically cultivated with a mixture of annual and perennial plants that can be harvested on a daily or seasonal basis. Biodiversity that has an immediate value is maintained in home gardens as women and children have easy access to preferred food, and for this reason alone we should promote home gardens as a key element for a healthy way of life.

Home gardens, with their intensive and multiple uses, provide a safety net for households when food is scarce. These gardens are not only important sources of food, fodder, fuel, medicines, spices, herbs, flowers, construction materials and income in many countries, they are also important for the *in situ* conservation of a wide range of unique genetic resources for food and agriculture (Subedi *et al.*, 2004). Many uncultivated, as well as neglected and underutilised species could make an important contribution to the dietary diversity of local communities (Gautam *et al.*, 2004). Nepalese home gardens are dynamic in their evolution, composition and uses. Their structure, functions, and both inter- and intra-specific genetic diversity, have been influenced by changes in socioeconomic circumstances and the cultural values of users of these gardens. Furthermore, farmers often use home gardens as a site for the experimentation, introduction and domestication of plants (Shrestha *et al.*, 2002; Eyzaguirre and Linares, 2004). Typically, home gardens are valued for the following specific uses (Shrestha *et al.*, 2002):

- Food security, nutrition and a cash income
- Fodder, firewood and timber
- Spices, herbs and medicinal plants
- Green manures and pesticide crops
- Cultural and religious uses

Home gardens also constitute a valuable part of the *in situ* conservation method, but their importance for genetic resources conservation is still not widely recognized. Home gardens are common in many rural areas of Nepal. They usually have a well defined structure with fodder and fruit trees predominant at the periphery of homestead. Moving inwards, the canopy is progressively reduced by planting vegetable and arable crops. Gautam *et al.*, (2005) reported that there are many key species that are found only in home garden and they are interconnected by informal germplasm exchanges.

Reasons for the rich diversity of species in home gardens

Home gardens, one of the oldest forms of managed land-use systems, are considered to be the richest in species diversity per unit area. Several landraces and cultivars, and rare and endangered species have been preserved in the home gardens (Watson and Eyzaguirre, 2002; Kumar and Nair, 2004). However, species richness of home gardens within a region is influenced by homestead size, structure, climatic conditions, market and socio cultural forces.

In the wetter parts of the middle hill areas of Nepal (e.g. Ilam), more than 75% of home gardens have 21 to 50 diverse species per household, whereas the drier conditions of Gulmi nurture 11-40 species (Gautam *et al.*, 2004)¹. In Nepalese home gardens, richness of home

¹ A project entitled “enhancing the contribution of home gardens to on-farm management of plant genetic resources and to improve the livelihoods of Nepalese farmers” is being implemented by LI-BIRD and the farmers group with financial support from SDC. The project is coordinated globally by IPGRI. The project is implemented in four districts of Nepal viz., Ilam (representing eastern mid-hill, wet weather conditions), Jhapa (representing eastern *Terai*, wet weather conditions, mix ethnic group of indigenous *Terai* communities and migrants from hills), Gulmi (representing western mid-hill, dry weather conditions) and Rupandehi (representing western *Terai*, dry weather conditions, mix ethnic group of indigenous *Terai* communities and migrants from hills).

garden species can be seen in the following order: vegetable, fruits, spices, fodder, medicinal, ornamental and other species (Subedi *et al.*, 2004).

Besides direct use values, farmers maintain local crop diversity in home gardens for the following reasons:

- 1) To meet the specific needs of local ethnic food culture
- 2) To increase the options of availability of fresh leafy vegetables, herbs, spices, fruits etc., at the household level
- 3) For easy access to fresh food as refrigerators are an uncommon option for preservation
- 4) To save money by reducing expenses on daily needs, especially condiments
- 5) To improve self-reliance, as access to markets is difficult in remote areas
- 6) To improve access to low cost sources of vitamins and minerals
- 7) To increase the variety of vegetables, fruits, etc. to ensure a healthy, functional level of nutrition (e.g. antioxidants, carotenoids, phenolics, dietary fibers and foods with low glycaemic index) (Sthapit *et al.*, 2004).



Figure 1. A typical structure of home gardens in Nepal

VALUE OF HOME GARDENS

Sustainable livelihoods

The contribution of home gardens to the household food supply is significant in rural and peri-urban areas of Nepal. A baseline study carried out in four sites of the home garden project in Nepal revealed that the contribution of fruit and vegetables to the total meal of a household is about 44%. Home gardens provide 60 % of the household's total fruit and vegetable consumption (Gautam *et al.*, 2004). A survey conducted in the Philippines revealed that 20% of the foods consumed by families are produced in the home gardens whereas in Vietnam 51% of their produce is used by household members (Trinh *et al.*, 2003). Clove production in home gardens in Sri Lanka was found to contribute an average of 42% of farm income (IPGRI, 2000). In Bangladesh, UBINIG (Unnayan Bikalper Nitinirdharoni Gobeshona ie. "Policy Research for Development Alternative"), a community-based NGO, has noted that uncultivated food items such as leafy greens, fish and tubers collected from ponds, farmers' fields, roadsides and common lands, make up a large proportion of the daily diets of the rural poor, accounting for at least 40% of the food consumed by the poor (UBINIG, 2000).

The following additional new information, concerning a better understanding of the role of home gardens in Nepalese life, was presented at a recent workshop on home gardens, organised by Local Initiatives for Biodiversity, Research, and Development (LI-BIRD) and IPGRI in Pokhara Nepal (Gautam *et al.*, 2004; Subedi *et al.*, 2004, Sunwar, 2003):

- Although home gardens occupy a very small proportion of the total land holdings of the family (2-11%), they are rich in biodiversity (up to 87 species recorded in the home gardens surveyed by the project).
- Home gardens are a major source of vegetable and fruit supplies for the family (60% of the requirements are fulfilled by home gardens).
- Nepalese home gardens are largely vegetable based (37-48% of the total species planted in home gardens), with fruits, fodder, medicinal and ornamental plants.
- Home gardens have their own management systems and their production systems are mostly organic-based, with the maximum utilization of locally available resources.
- Many important plant species are undergoing a process of domestication in home gardens (11-37 species in studied sites) for their various uses. Mainly, those plant species with medicinal values are domesticated in the hills and mountains whereas in the Terai, fruits and vegetable species predominate.
- At least 4-8 percent of the food consumed by the poor comes from uncultivated sources in Nepal and supplement food requirement during periods of food scarcity.

Dietary diversity and health value

Diets poor in leafy vegetables, fruits and animal proteins may lead to xerophthalmia (a form of blindness) associated with vitamin A deficiency. It is also recognised that a diet rich in energy but lacking other essential components can lead to a heart disease, diabetes, cancer, and obesity (Frison *et al.*, 2004). These conditions are no longer associated with affluence; they are on the increase among poor people from urban areas in developing countries. A diverse diet offers nutritional buffers and there should be a key policy reform to combat this unhealthy trend (Johns and Sthapit, 2004). In this context, the value of home gardens for family health is paramount as home gardens harbour a wide range of genetic diversity that increases economic options, dietary variety and nutritional levels for low-income households in both rural and urban communities (Helen Keller International, 2001). Besides this, home gardens maintain a wide range of herbs and medicines for immediate household treatments (Agnihotri *et al.*, 2004; Trinh *et al.*, 2003).

Availability of quality food

Since a significant share of the production in home garden systems is for home consumption, farmers use few purchased inputs and the system is aimed at satisfying household needs. Home gardens are largely organic-based. Traditional vegetables are often adapted to low input agriculture, therefore these are free from chemicals and pesticides. We plant a variety of crops in home gardens to ensure access to fresh produce throughout the year. Nepalese food culture also appreciates the value of consuming fresh harvest produce, from both a taste and a nutritional perspective. Many studies from Asia, Africa and Latin America conclude that home gardens provide early maturing varieties that carry families over the food deficit season until the main crops mature; contain reserve resources of plant genetic resources, should the main crops fail; and function as both conservation sites for special varieties, and as testing grounds for new varieties (Oakley, 2004).

Cultural, spiritual and aesthetic values

Cultural diversity in Nepal helps to conserve biodiversity in home gardens. The composition of unique plants in home gardens varies with ethnicity, food culture, religion, and spirituality (Sthapit *et al.*, 2004). Unique flowers, plants, and fruits needed for religious and spiritual purposes are a distinctive cultural feature of home gardens.

Home gardens in Nepal are also important for their aesthetic value and cooling effect, and are regarded as a symbol of wealth and social prestige. Beautiful trees, climbers, orchids, ferns, ornamental plants and flowers are important species in Nepalese home gardens as

they enhance the aesthetic value and harmony of the homestead environment. While studies exist, the psychological and social benefit of home gardens for families is worth noting and investigating further.

Ecosystem functions and services

A range of management practices are employed by farmers to manage biodiversity in the agricultural landscapes. Home gardens are micro-environments within the system that provide many goods and services of environmental, economic, social and cultural importance. These environmental goods and services also contribute to sustainable livelihoods in a number of ways. Nepalese home gardens are integrated with a mixed farming system, and therefore livestock and fodder trees are important components. Hedgerows are common for boundary fencing, but their harvests are also used for indigenous green manures, mulch, pesticides, fuel wood, and fodder and also as supports for climber crops such as sponge gourds, chayote, yams, etc. Mixed, inter and relay cropping practices are used for efficient and effective maximization of solar energy, space (vertical as well as horizontal), soil nutrients and water resources. Besides the above-mentioned rationales, farmers keep biodiversity of crops and varieties to ensure stable yields by managing pests and diseases, weather related vulnerability, labour availability and market forces. This strategy is commonly seen in multiple layers of species in agro-forestry and home garden systems.

Biodiversity, especially that of the below ground part of the system, performs a variety of ecological services such as nutrient recycling, regulation of local hydrological processes, and detoxification of noxious chemicals. Farmers have a rich traditional knowledge on the complementarities of annual-perennial species composition and structure, and they use this traditional knowledge and genetic diversity for rich and healthy home gardens. Healthy home gardens not only increase the diversity of soil micro-organisms and predators of natural enemies, but also increase populations of pollinators; fruit setting and gene flow (Westernkamp and Gottsberger, 2000). The study shows that the closer coffee bushes are planted to patches of forest or home gardens, the higher the quality and quantity of beans they produce, due to greater pollination by wild bees (Shanahan, 2004). However, as research in understanding these complex interactions is limited, we still need a better understanding of ecosystems, functions and services of home gardens in Nepal, and elsewhere, to manage vulnerability, shocks and uncertainties of household livelihoods.

Consolidating farmers' role

In Nepal, we have used the methodologies developed in IPGRI's global project in understanding the dynamic of home gardens and this initiative is supported by SDC, Nepal (Hodel and Gessler, 1999; Watson and Eyzaguirre, 2002). At the community level, "Home Garden Research and Development Committees" are the primary implementing agencies of the project with the support of LI-BIRD. Each committee is composed of 36-42 'research' farmers, representing different socioeconomic (wealth and ethnicity) strata, nominated by the farming community. The project aims at strengthening the capacity of local committees to assess biodiversity, develop annual work plans, and implement research and development activities that increase biodiversity in home gardens, dietary diversity, and livelihood options for the community. The project played a role in strengthening the capacity of local institutions and farmers for enhancing:

- access to human capital (knowledge, information and education, training)
- access to financial capital (market linkages, development funds, micro credits, savings, etc.)
- access to natural capital (choice of genetic diversity and conservation of indigenous plant species)
- access to social capital (social networks, local institutions, local markets, linkages and strengthening)

- access to physical capital (community infrastructure, community seed banks etc)

Using this holistic livelihood approach, agricultural biodiversity, including local genetic diversity, is a core resource for reducing poverty, complementing the other forms of assets of the poor farming households. For local biodiversity management to succeed as a development strategy, local community institutions should be strengthened through the support for community based knowledge systems in order to identify, conserve, manage, add value, and exchange on-farm local diversity (Sthapit *et al.*, 2004). Communities have their own guiding principles of community biodiversity management in home gardens that foster ecosystems' health and services, and they include (Subedi *et al.*, 2004):

- an understanding of the local context
- the use of little or no inorganic pesticides to protect pollinators and underground micro-organisms
- the exchange of local crop diversity to at least 5 farmers
- the collection and conservation of own seed/planting materials/breeds
- documentation of a community biodiversity register for traditional knowledge documentation

UPSCALING

From the outset of the project implementation, each group member also targeted 8 to 12 neighbouring households for up-scaling good practices and germplasm within the community. The proposed strategy will help achieve social, economic and environmental benefits within the range of 300-500 households per village and is integrated into the community biodiversity management model, which empowers the community in decision making. At the national level, the project is designed to collaborate with international NGOs, Nepal Agricultural Research Council, and the Department of Agriculture, in order to upscale some good practices through regular sharing and learning of activities. The project has already planned to up scale good practices in home gardens to four satellite sites in each district (Ilam, Jhapa, Rupandehi and Gulmi), where the project is currently being implemented in partnership with the respective district agriculture development offices. The most important benefit of the home garden project is social learning for the community, which empowers the community to have access to all kinds of assets for both economic and environmental benefits.

CONCLUSION

The home garden is an important source of food security and livelihoods as it supplies diversified vegetables and fruits, rich in micronutrients; spices herbs and medicines. It meets cultural requirements and provides ecosystem services and is also a source of income.

Genetic diversity valued by resource-poor farmers is often maintained, selected in the land available around the homestead. Materials and knowledge are exchanged through these farmers' social seed networks. By saving seeds and planting materials from home gardens and exchanging it with neighbours, friends and relatives are able to maintain not only a considerable amount of agrobiodiversity, but also a cultural legacy from generation to generation.

Despite their small size, the network of home gardens together is a biodiversity rich production system which should be considered a viable unit of on-farm biodiversity conservation. However, the home garden is yet to be recognized as an important source of unique, nutritious, and quality food security and livelihoods. The system is often overlooked as serious sources of food and nutrition, and national statistics do not demonstrate its importance. In fact, home gardens provide successful examples of how locally adapted crops

and varieties support food security, and have an important economic, dietary, cultural and agro-ecological function. Resource-poor farmers consider agro-biodiversity in the home garden production system to be an important livelihood asset for managing their natural and socio-economic circumstances, and therefore, access to and control over such resources are a critical policy issue.

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Table 1. Contrasting characteristics of home garden and kitchen garden production systems in Nepal

Characteristics	Home garden	Kitchen garden
Function	<ul style="list-style-type: none"> • Subsistence-household needs • Multi-purpose • Seasonal food and nutrition supply • Easy access to fresh harvests for home cooking and local food culture • Site for introduction, experimentation and domestication 	<ul style="list-style-type: none"> • Intensive cultivation • Surplus for commercial use • Seasonal plus off-season use • Site for introduction, and experimentation
Size	<ul style="list-style-type: none"> • Variable in size and design as determined by choice of species (crops Vs trees) • Larger than a kitchen garden • Often linked with large agro-ecosystems 	<ul style="list-style-type: none"> • Size determined by market and family needs • Mostly a component of a home garden
Diversity	<ul style="list-style-type: none"> • Species richness • Home for unique species and varieties • Site for conservation of rare species 	<ul style="list-style-type: none"> • Intra-species richness within vegetable crops
Composition	<ul style="list-style-type: none"> • The layers consist of root crops and herbaceous layer-leafy vegetables and crops • Annual and perennial crops • Intermediate and tall layers of busy fruits, forestry, fodder, wood fuel, etc. • Composition changes with altitude 	<ul style="list-style-type: none"> • Mostly a single layer of crops. In some kitchen gardens 2 layers are also common (of some annual vegetable species) • Dominant species-vegetables • Mostly seasonal/annual crops
Features	<ul style="list-style-type: none"> • Multi-layer canopy structure • Both traditional cultivars and MV present • Mixed of annual and perennial crops to meet regular supply of diverse food • Meets ecosystem services and functions associated with other biodiversity • Common in subsistence farming and remote areas • Mostly organic based • Provides good and services of community interest 	<ul style="list-style-type: none"> • Single or maximum of 2 layers • Mostly hybrid/MV seed cultivars • Dominant by short season annual crops • Some times environmentally unfriendly (knowingly or unknowingly) • Fairly common in urban and peri-urban areas • Inorganic and chemicals often used or overused/misused
Value	<ul style="list-style-type: none"> • Food security and income • Dietary diversity and health • Quality food • Cultural, religious and spiritual significance • Aesthetic value • Ecosystem support and health 	<ul style="list-style-type: none"> • Food and income • Supply of Vitamin A and yellow coloured vegetables

Characteristics	Home garden	Kitchen garden
	<ul style="list-style-type: none"> • Conservation of unique/rare species 	
Ecosystem services	<ul style="list-style-type: none"> • Habitats for pollinators and associated biodiversity • Coping with vulnerability by managing pests and disease • Support nutrient recycling • Carbon sequestration • Water and soil retention • Regulation of local hydrological processes • Detoxification of noxious chemicals 	<ul style="list-style-type: none"> • Less conducive for pollinators and associated biodiversity in the ecosystems (limited species diversity and use of pesticides)
Government focus	<ul style="list-style-type: none"> • Not a priority area for research and development 	<ul style="list-style-type: none"> • Priority in development agenda

Contribution of Home gardens to Livelihoods of Nepalese farmers

Ram Pulami and Deepak Paudel

ABSTRACT

Home gardening is an ancient practice of Nepalese societies. The majority of the farmers have been cultivating various types of plants around their home or homestead with poultry and small domestic animals for home consumption. Home gardens help in conserving biodiversity including the indigenous knowledge. For the development of home gardens, the Government of Nepal has formulated policies like diversification of agriculture, development of agricultural technology, conservation and protection of agricultural and environmental diversity for sustainable agricultural development targeting the dalit, disadvantaged people, gender and women and farming communities of the remote areas. In this regard, the Department of Agriculture has implemented programmes like vegetable kitchen garden, fruit kitchen garden, bee kitchen garden, fish kitchen garden and the department of livestock services has focussed on livestock development including piggery, goats and sheep for poor farmers, women and disadvantaged group of the communities. Home gardens should be integrated in the development programme so that it can contribute in food security, income generation and for improvement of livelihood of the Nepalese farmers.

Key words: Home gardening, biodiversity conservation, food security

INTRODUCTION

Agro-biodiversity in Nepal

Agro-biodiversity is the subset of biodiversity, which feeds and nurtures people and is nurtured by the people. It encompasses diversity of crops, livestock, fish, insects, micro-organism, and related wild species of cultivated flora and fauna at genetic, species and ecosystem levels. Farming communities have conserved and used agro-biodiversity for the survival of the humankind over time and space. The food security and sustainable utilization of agro-ecosystems depends on the extent of availability of diversity and its management practices in the ecosystems. Biological diversity in Nepal is closely linked to the livelihoods of many people and their economic development and it touches upon agricultural productivity and sustainability, human health and nutrition, indigenous knowledge, gender equality, water resources and aesthetic and cultural well-being of society. The biodiversity profile project (1995) has ranked Nepal as having the tenth richest flowering diversity in Asia and 31st in the world (Upadhyay & Joshi, 2003).

Nepal's agro ecological diversity is associated with the hills and mountains, where variations in topography, slope, aspects and altitude allows an enormous range of biological environments, climatic regimes and varied ecosystems. Broadly speaking, farming systems in Nepal vary according to the three major ecological zones of the country viz. *Terai* (plain area in the southern part of the country), Mid-hills, and Mountains. Major cropping patterns in each ecological region and their associated cropping diversity is depicted in Table 1 and 2. Crop landraces are the major building blocks of traditional farming systems. This suggests that the promotion and continued existence of traditional farming systems are essential for agro-biodiversity conservation in Nepal.

Agricultural biodiversity is vital to marginalized mountain communities. Out of more than 500 edible plant species used by these communities, 200 are cultivated. Crops such as rice (*Oryza sativa*), rice bean (*Vigna unbellant*), eggplant (*Solanum melongena*), buckwheat (*Fagopyrum esculentum*, *F. tatricum*), soybean (*Glycine max*), foxtail millet (*Setaria italica*),

citrus (*Citrus aurantium*, *C. limon*, *C. medica*) and mango (*Mangifera indica*) have high genetic diversity (GN/MFSC, 2002). Similarly, the diversity in under-utilized food crops and tropical fruit species is noteworthy. This variability in crop species has been maintained through traditional farming systems that also include a number of wild relatives found in proximity.

Table 1. Major cropping patterns in different physiographic zones of Nepal

Physiographic region	Land Type	Cropping pattern
<1000 m (Tropical/Subtropical)	Irrigated	Rice-Wheat, Rice-Rice-Wheat, Rice-Rice-Maize, Rice-Rice/Legumes Rice-Vegetables-Maize-Mustard-Fallow
	Rain-fed	Maize-Buckwheat-Fallow Maize+Soyabean-Mustard-Fallow, Maize/Finger millet-Wheat, Maize+Upland Rice-Wheat, Maize-Wheat-Fallow
1000-2000 m (Warm temperate)	Irrigated	Rice-Wheat, Rice-Barley, Rice-Potato, Rice – vegetable crop, Maize/Finger millet-Wheat, Maize/Finger millet-Fallow
	Rain-fed	Maize+Soybean-Mustard/Fallow Maize+Upland Rice-Wheat /Lentil/ Fallow
>2000m (Cool temperate)	Irrigated	Maize+Soybean-Mustard Rice-Naked Barley, Rice-Wheat, Buckwheat-Naked Barley, Potato-Buckwheat or Mustard or Vegetables, Maize-Fallow, Wheat-Fallow
	Rain-fed	Potato-Fallow, Naked Barley-Fallow, Maize-Wheat, Maize-Wheat+Finger millet, Maize-Naked Barley-Finger millet

(Source: GN/MFSC, 2002)

Table 2. Crop diversity in selected ecological regions of Nepal

Ecological region	Crop diversity
Siwalik Hills and Terai (Hot, humid and dry)	Rice, Kodo millet, chickpea, pigeon pea, lentil, jute, Niger, sesame, Brassica species, Perilla, wild relatives of rice, Eggplant, okra, mango, jack fruit
Eastern and Central Himalaya (Cool and humid)	Rice, Maize, Covered barley, foxtail millet, buckwheat, Barley, finger millet, black gram, soybean, field peas, Niger, Perilla, sesame, Brassica species, wild relatives of Buckwheat, pigeon pea, citrus fruit
Western and Far- Western Himalaya (cool and dry)	Cold tolerant rice, proso millet, wheat, naked barley, maize, Buckwheat, amaranths, chenopods, rice bean, black gram, Soybean, field peas, radish, Niger, sesame, Brassica species, Perilla, wild apple, wild pear, walnut

(Source: GN/MFSC, 2002)

Home garden and its importance

The area around the house containing different fruit trees, vegetables, medicinal plants and ornamental plants; poultry, small fish pond and cattle or pigs, goats is called Home garden or

homestead garden. Depending upon family requirements, climatic conditions and geographical features, plant species and types; and trees are cultivated to harvest the yield round the year. Similarly, poultry, fishes, honeybees and cattle or goats or pigs are raised to meet family requirements throughout the year. Fodder, green manure, botanical pesticides; and the plants of medicinal and religious value are also cultivated in home garden.

Home garden as a source of nutrition

The fruits and vegetables contribute to a balanced diet by providing not only energy-rich food but also supply of vital protective nutrients like vitamins and minerals. Comparatively vegetables are the cheapest source of nutritious food. However, the quality and bio-utilization of animal protein is higher than plant protein and contains essential amino acids, so we need animal protein along with plant protein, in our daily diet. Fish and dairy products, from home gardens, are good sources of proteins. Mushroom production and bee keeping needs less area but produce nutritious foods. Fresh fruits and vegetables provide us carbohydrate, protein, vitamins, mineral, fats which are essential to our body. Hence, home garden can provide nutritious and balanced diet to the family that makes the farm families healthy and strong. This is the reason that home garden is also called a Primary Health Centre (Thapa, 2004)

Home garden as a means of food security

Sustainable food security involves strengthening the livelihood security of all members within a household by ensuring both physical and economic access to balanced diet including the needed micronutrient, safe drinking water, environmental sanitation, basic health care and primary education (Swaminathan, 1996). Table 3 depicts that the mountain and hill areas are facing severe food deficit though there is availability of cereals in terai region; mainly due to lack of transport facility. In such cases home garden can play vital role to meet food security. Table 4 shows that more food should be produced to meet the target of food requirement in the tenth plan.

Table 3. Belt wise food availability (MT) and requirement of cereals, 2002/2003

Belts	Total edible production	Requirement	Balance
Mountain	262764	330102	-67338
Hills	1867328	2124176	-256848
Terai	2511374	2111542	399832
Nepal	4641466	4565820	75646

(Source: Marketing Development Directorate, 2004)

Table 4. Present per capita food availability of food stuff and target in Tenth Plan

SN	Food (Kg/capita per annum)	Present availability (Kg/capita per annum)	10 th plan Target
1.	Vegetable	66.74	79.15
2.	Fruits	16.17	17.89
3.	Fish	1.5	1.87
4.	Meat	8.5	9.85
5.	Milk	47.05	50.85

(Source: GN/NPC, 2002)

Home gardens as a source of income

Along with nutrition supply and food security, home garden is a source of income. The surplus cereals and vegetable, livestock, poultry, fish, honey can be sold in local market. Due to integration of different agriculture components in home garden, the productivity of each component increases stability in income. In the rural and remote areas where other employment opportunities are meagre, it plays an important role considerable role in providing additional job and income.

Home garden as a practice of conservation of agro-biodiversity

Agriculture is the mainstay of Nepalese economy and displays a high level of diversity of agro biological resources and traditional knowledge based farming system. An estimate indicates that over 500 plants species are edible, out of which nearly 200 species are cultivated. In most of the home gardens, farmers use locally available diversified species to fulfil their various demands of food supplies, energy and so on.

Home garden as a means of socio-cultural expression

Nepal has diverse socio- cultural and ethnic groups with various religious and cultural values. From ancient time the Nepalese people have been practicing the culture of planting trees and flowers around their homestead that are used for religious and cultural ceremonies like birth, marriage, worshiping, death etc. For these purposes, the pious material *Panchaamrit* (the combination of pure milk of cow, honey, ghee, curd) can be obtained easily from the home garden. There are other examples of offering animals like chicken, goat, fish, which can be, fulfilled from the home garden. Home gardens play a vital role in meeting socio- cultural requirement in the Nepalese context.

Home gardens help to reduce environmental pollution and control soil erosion

Environmental pollution in the form of air and water pollution and soil erosion have become a major problem in the country that needs to be addressed to make the environment healthy and safe for all the living beings to live. The different kinds of plants that are grown in the home-garden contribute in absorbing carbon dioxide and releasing oxygen in the environment. In slopping lands, it helps in conserving the soil and water. Moreover, Home gardens also support in recycling the household organic waste.

Home garden as a contributor to medicinal and aesthetic value

The various kinds of trees and plants in and around the homestead of farming families carry high medicinal and aesthetic value. The different flowering trees and plants add beauty to the landscape of homestead and so has become the culture of Nepalese people to have them, a few to many in and around their homestead. On one hand the use of "Ayurvedic medicine" for treatment of various diseases is an old practice of Nepalese people and to meet this purpose, plants having medicinal value are planted in the home garden. For example holly basil, *Neem (Azadirachta indica)*, *Bojho (Acorus calamus)*, ginger, garlic etc have high medicinal value and they are commonly found in almost every home gardens.

Home gardens in inter linkage of components in Nepalese farming system

A small vegetable plot, a few fruits trees, 1-2 dairy cattle, goats, pigs, hens, a fish pond, bee hives (1-2), fodders trees and some ornamental plants are major components of Nepalese home garden. With combination of this type of integration, household get their daily

requirements and the productivity of every component increases through nutrient cycle among them as shown in Figure1.

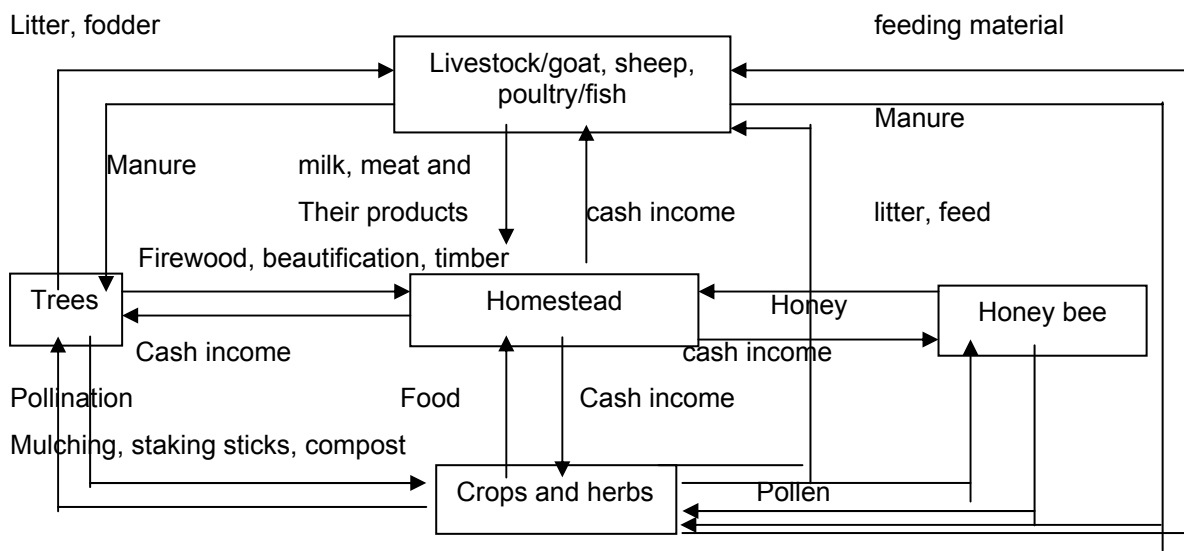


Figure1. Inter-linkage/Interrelation among various commodities in Nepalese home gardens

Present status of home gardens in Nepal

Over time, traditional types of home gardens have been transformed either to specialize and /or commercialize and with fewer plants and animal species. Ever rising population, introduction of new technologies and plant and animal species; and socio-economic factors are the major reasons leading to changes in the traditional home gardening systems in Nepal. With the introduction of new species and types of plants; and technologies, many important and useful plant species have been or are disappearing. Farmers are in some cases maintaining less biodiversity. The decline in biodiversity in home garden production may adversely affect economic, medicinal and aesthetic yield. The Table 5 presents the status of home gardens in Nepal by geographical area.

Table 5. Present status of home gardens by geographical areas

Geographical Area Ecological Zone	Household with home garden (%)		
	n	None	Yes
Terai	7263	37.5	62.5
Hills	7084	21.0	79.0
Mountains	1205	8.6	91.4
National	15552	27.7	72.3

(Source: NMSS, 1998)

Determinants of home garden diversity

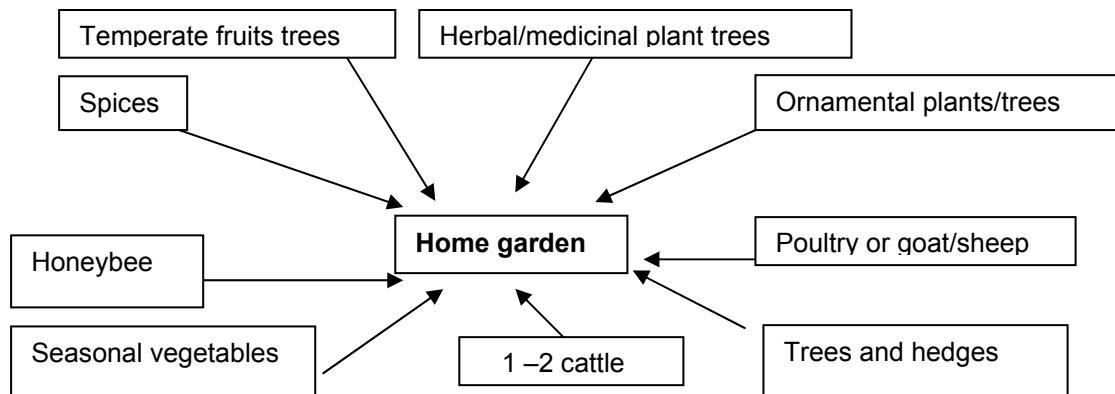
The following factors are key determinants for home garden.

- *Socio- cultural and economic factors*: Food habit, gender, ethnicity, market, religious values and norms, gender role, structure of society (homogenous/heterogeneous), access to market, demand and supply of food materials.
- *Ecological factors*: Climatic and ecological factors such as availability of indigenous and exotic flora and fauna, altitude and the management and ecological functions by soils, water and forest.

- *Farmers' knowledge and awareness* : Traditional knowledge and practices, formal and non- formal education, extension delivery system including government, private sectors; exposure and relationship with other group , people and place

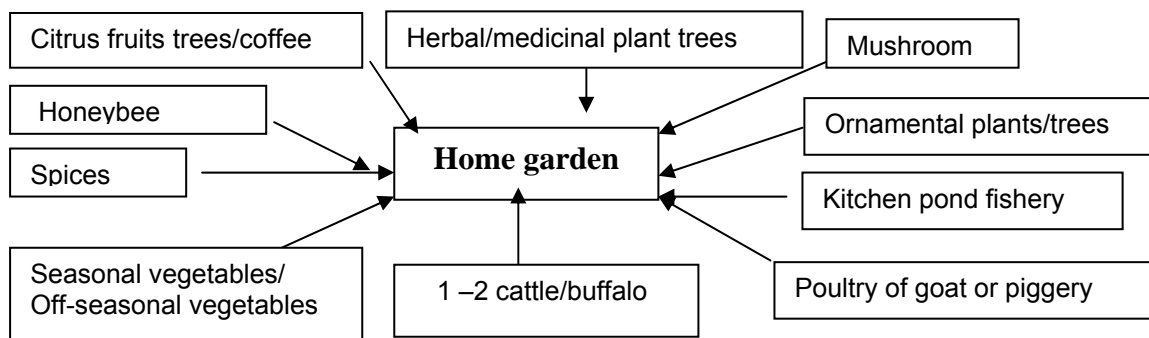
Proposed Models of home garden with various biodiversities

Model I Combination of biodiversity



This model represents the combination of biodiversity in the high hills. In this ecological zone with cool climate, temperate fruit, herbal and medicinal plants and trees, spices, vegetables, cattle, poultry and goat/sheep, fodder trees and bees are incorporated in the home gardens. In this zone, the farm communities can conserve and utilize the traditional flora and fauna found in forests and high mountains in pastures. The traditional knowledge of biodiversity in both cultivated and natural landscape is particularly rich and important in high mountain communities. Mountain communities depend on agriculture with symbiotic relationship with forest and forest based products. Agriculture, understood as a rural economy with important impacts is addressing biodiversity or of climate change issues.

Model II Combination of biodiversity



This model represents the combination of biodiversity in the mid-hills. In this ecological zone with warmer climate, citrus fruit/coffee, herbal and medicinal trees, spices, vegetables, ornamental plants/trees, cattle, poultry and goat/sheep and/or piggery, kitchen pond fishery and honeybees are incorporated in the home gardens. In this zone, the farming communities can conserve and utilize the traditional agrobiodiversity and knowledge as well as modern technology and inputs thereby improving livelihood.

Agricultural policies related to food security and agro-biodiversity conservation

Agriculture is the predominant sector of Nepalese economy contributing to about 38% of gross domestic product and more than 80% of the total employment (GN/NPC, 2002). Agriculture's pivotal role in the economy of the country is reflected in the programs under

Agriculture Perspective Plan (APP) launched as part of the Tenth and Eleventh Plans 'Agriculture Decade'. The overall goal of the Agricultural development is to increase production and productivity by prioritizing high value commodities on the grounds of agro-ecology, comparative advantage and market potentials. Enhancement of production capacity for food grain and livestock in terai; increasing production of fruit, off-season vegetables and livestock in hill and high hill areas can contribute to the overall balanced development of the terai and hill areas. In this context, the sectoral objectives of agriculture in the tenth plan are to reduce poverty by increasing production, productivity and income in the agricultural sector and contribute to food and nutritional security and to contribute to the sustainable production and growth by adoptive research and development of the technology to be used in agriculture, conserve, develop and use of agro-biodiversity and balance the environment by reducing pollution from the use of external inputs (GN/NPC, 2002).

The strategies adopted to meet the above two objectives are to commercialize and diversify agriculture and to sustain agricultural development by developing agricultural technology and by protection, promotion and use of agro-biodiversity and environment. On the basis of the above sectoral objectives and strategies, the policies and work plans such as dissemination and use of the available agricultural technology to minimize the prevalent level of malnutrition, implementation of agricultural extension and research programmes in an integrated manner promoting local food grain production in Karnali zone and other remote districts will be followed. Likewise, for sustainable production and productivity increase in food production, horticulture and animal husbandary, the private sector will be encouraged for the research study, conservation, promotion and the use of biotechnology with emphasizing on the identification of biodiversity and its registration process.

Institutional base for national agro/biodiversity conservation in Nepal

The overall responsibility for implementing the National Biodiversity Strategy (NBS) lies with the Ministry of Forest and Soil Conservation (MFSC), which is the focal point of the Convention on Biological Diversity (CBD). The relevant ministries and departments are responsible for implementation of their sectoral biodiversity plans. National Biodiversity Coordination Committee (NBCC) will facilitate inter-sectoral coordination during National Biodiversity Strategy implementation and oversee, monitoring and evaluation. The National Biodiversity Unit (NBU), under the Environment Division of the MFSC, will act as the secretariat for the National Biodiversity Coordination Committee (NBCC) and will serve as the forum for information exchange between government line agencies, NGOs, and the private sector during implementation of the NBS. The NBCC will establish five sub committees to address the "Biodiversity Themes" identified in the CBD, namely: forest diversity, agricultural biodiversity, sustainable use of biological resources, genetic resources and bio-security (GN/ MFSC, 2002).

A National Agrobiodiversity Conservation Committee has been constituted in 2000. The secretary of the Ministry of Agriculture & Cooperatives is the chairman of the committee. The committee is composed of representative from governmental and non- governmental sectors. It's role is to advise Government of Nepal on policy and management issues related to agro- bio diversity conservation and use.

Programme of Department of Agriculture (DOA) in the development of home garden

General vegetable production programme

General vegetable production programme is aimed at rural and remote areas, where structured market facilities are not available. This program provides opportunities for year-round vegetable production and consumption for nutrition and food security. In the areas of market and road facilities (urban and per urban), emphasis is being given to develop private nurseries of vegetable crops. Identification and registration of locally available germplasm

are made. Economic and nutritional values of these vegetables are identified with their botanical description. The Tenth Plan has set a target of 137,441 ha of land coverage with general vegetable program and kitchen garden minikits demonstration programs through District Agriculture Development Offices (GN/MOAC, 2002).

Fruit garden programme

This programme supports fruit gardens based on the local climate, environment and demand of the farmers to meet the household's daily requirement of fruits and nutrition as well as provides local market facilities. During Tenth Plan, 5000 ha of land will cover under this program (GN / MOAC, 2002).

Honeybee development programme

Use of honeybee in the garden helps to increase the production and productivity of the crops by increasing the pollination activity. Farmer can earn additional income as well. The bee keeping programme is focused on women, disadvantaged and pro-poor farmers. The bee keeping requires a small space and can be carried out within the homestead of farmer even by small and landless farmers.

Fish kitchen pond programme

It aims to fulfil the animal protein requirement of farming families and increase income by selling the surplus fish. Fisheries Development Directorate has been implementing a fish kitchen pond programme for family consumption purpose of farmers. Fish kitchen ponds also add beauty to the home garden.

ISSUES/CONTRADICTIONS TO AGRICULTURE AND AGRO-BIODIVERSITY IN NEPAL

- Under Government of Nepal's agricultural policy provides extension services, input and other support services for maximizing yield per unit of land. It also encourages the adoption of modern high yielding varieties, commercial farming that demands heavy use of production inputs including agro-chemicals. This practice has contributed to erosion of agro-biodiversity and degradation of natural resources. Paradoxically, conservation of agro- biodiversity is reported as incompatible with modern agriculture development initiatives.
- Transformation of agricultural system and land use pattern are costing more to resource poor farmers and people living below poverty line.
- Land use policy does not exist in Nepal. There is ample evidence to show the effect of urbanization and industrialization on agro-biodiversity. The most fertile lands are converted to residential areas and industrial estate.
- Budget allocated for agro-biodiversity conservation is not sufficient i.e. 3 million during Tenth Plan period and its program has been prioritized as a secondary priority.
- Nepal has become a member of WTO, one consequence is that the policies related to conservation, registration and utilization of agro-biodiversity has not been given utmost importance.
- Agricultural policy has yet to address the constraints and potentials of home gardening in Nepal.

CONCLUSION

Agriculture, the main source of employment, is facing three challenges namely to ensure food security, reduce poverty and promote sustainable management of natural resources. Home gardens are an important resource for food security in Nepal. The major benefits from home garden are better nutrition for the farmers; they receive income and meet socio-cultural needs. Along with these benefits, they help to reduce environmental pollution and soil erosion and to conserve the agro-biodiversity. For effective extension of home gardens,

