Home Gardens in Nepal

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

Resham Gautam, Bhuwon Sthapit, Pratap Shrestha, editors

LI-BIRD

Bioversity International

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Citation:

Gautam, R, BR Sthapit and PK Shrestha (eds.) 2006. Home Gardens in Nepal: Proceeding of a workshop on "Enhancing the contribution of home garden to on-farm management of plant genetic resources and to improve the livelihoods of Nepalese farmers: Lessons learned and policy implications", 6-7 August 2004, Pokhara, Nepal. LI-BIRD, Bioversity International and SDC.

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Table of Contents

Chapter I: Status of homegardens in Nepal

The value of Home Gardens to small farmers (*Bhuwon Sthapit, Resham Gautam and Pablo Eyzaguirre)*……..*8*

Home Garden's Contribution to Livelihoods of Nepalese Farmers (*Ram P. Pulami and Deepak Poudel)*……..*18*

Homestead Food Production Program in Central and Far-Western Nepal Increases Food and Nutrition Security: An Overview of Program Achievements (*Aminuzzaman Talukder, Gopi Sapkota, Sharmila Shrestha, Saskia de Pee, Martin W Bloem)*……..*27*

Home Gardens: An Opportunity to Minimize Pressure on Slash and Burn System and Option for Improving Dietary Diversity on Chepang Households (*Bimal R Regmi, Kamal P. Aryal, Bir B. Tamang and Pratap K. Shrestha)*……..*35*

Home gardening as a household nutrient garden *(Krishna G.C)*……..*48*

Farmer's experience in home garden improvement *(Surya Adhikari)*……..*53*

Chapter II: Understanding diversity of homegarden

Status of Home Gardens of Nepal: Findings of Baseline Survey Conducted in Four Sites of Home Garden Project (*Resham Gautam, Rojee Suwal and Pratap K. Shrestha)*……..*54*

Does Shannon-Weaver Index Explain the Species Diversity in Home Gardens? (*Sharmila Sunwar)*……..*66*

Staus and composition of Plant Genetic Diversity in Nepalese Home Gardens (*Abishkar Subedi, Rojee Suwal, Resham Gautam, Sharmila Sunwar, Pratap K. Shrestha)*……..*72*

The Role of Gender in the Home Garden Management and Benefit-Sharing from Home Gardens in Different Productction System of Nepal (*Anu Adhikari, Deepa Singh, Rojee Suwal, Pratap K. Shrestha and Resham Gautam.*……..*84*

Assessment of Dietary Diversity: A Basis for Promoting Plant Genetic Species in Home Gardens (*Resham Gautam, Rojee Suwal and B.R. Sthapit)*……..*99*

Chapter III: Enabling and empowering homegarden farmers

Enabling and Empowering the community through Collective Learning Process: Lessons Learnt from Farmers' Traveling and Learning Workshop (*Rojee Suwal, Resham Gautam and B.R. Sthapit)*……..*105*

Policy Supportive Issues in Home Gardening with Respect to Agricultural Bio-diversity and Improving Rural Livelihood (*Bharat Upadhyay)* ……..*113*

Mainstreaming findings of home garden project for on-farm biodiversity management and improving livelihoods: Policy and programme implications *(Pratap K Shrestha, Resham Gautam and Bhuwon Sthapit)*……..*119*

Annexes

A: Summary of the Meeting……126
B: Presentation of Plan Nepal…….. 130
C: List of authors ……132

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.

Acknowledgements

The publication is a product of the LI-BIRD implemented project entitled “Enhancing the contribution of home gardens to on-farm management of plant genetic resources and to improve the livelihoods of Nepalese”. The project is coordinated globally by the IPGRI and financial contribution is made by Swiss Agency for Development and Cooperation (SDC). We gratefully acknowledge the support provided by LI-BIRD, IPGRI and SDC to the project.

We are grateful to Dr. Pablo Eyzaguirre, global coordinator to the home garden project for his persistent encouragement and support provided to the project. We are thankful to the professional experts especially Dr. Timothy Jones, McGill University, Canada, Dr. RB Rana, Research Officer, International and Rural Development Department (IRDD), The University of Reading UK, contributing authors, field staff of the project and the collaborating farmers and farming community for their contribution and participation at the various stages of the project. We wish to thank national project partners' viz. National Agricultural Research Council, Department of Agriculture, National Food Nutrition Programme of Department of Food Technology and Quality Control, Plan Nepal, Care Nepal and Helen Keller International for their effective collaboration with the project.

Finally, we are thankful to Ms Smreety Dewan of Bioversity International-APO, Nepal and Mr. Shashish Maharjan for technical support provided and Ms Rachhya Shah, Ms Sita Tiwari and Ms Muna Udas of LI-BIRD for their contribution in word processing, formatting, layout and publication management of the proceedings.

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 Sciencees
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. Illam), 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).

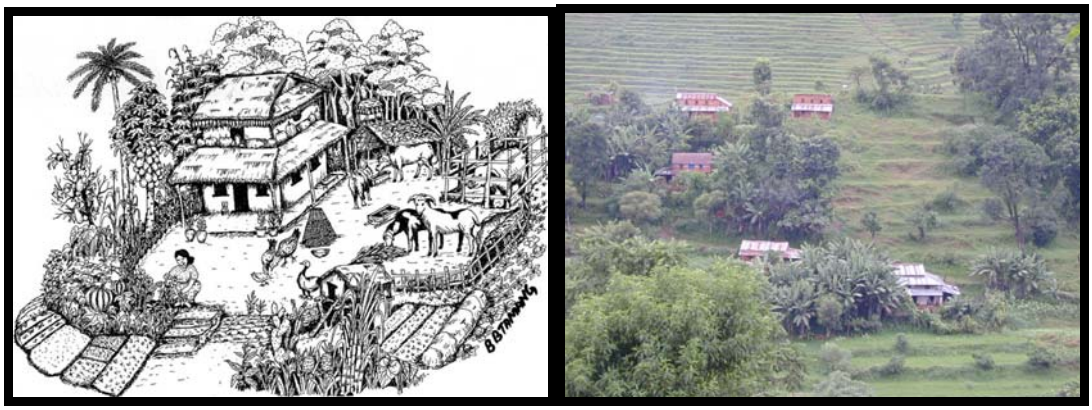

Figure 1. A typical structure of home gardens in Nepal

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 geneflow (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.

ACKNOWLEDGEMENT

We are thankful to Elizabeth O'Keeffee and Smreety Dewan for their technical support. Financial assistance from SDC, Nepal is gratefully acknowledged.

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

Characteristics	Home garden	Kitchen garden
Function	• 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	• Intensive cultivation • Surplus for commercial use • Seasonal plus off-season use • Site for introduction, and experimentation
Size	• 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	• Size determined by market and family needs • Mostly a component of a home garden
Diversity	• Species richness • Home for unique species and varieties • Site for conservation of rare species	• Intra-species richness within vegetable crops
Composition	• 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	• 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	• 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	• 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	• Food security and income • Dietary diversity and health • Quality food • Cultural, religious and spiritual significance • Aesthetic value • Ecosystem support and health	• Food and income • Supply of Vitamin A and yellow coloured vegetables

Characteristics	Home garden	Kitchen garden
	• Conservation of unique/rare species	
Ecosystem services	• 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	• Less conducive for pollinators and associated biodiversity in the ecosystems (limited species diversity and use of pesticides)
Government focus	• Not a priority area for research and development	• 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.

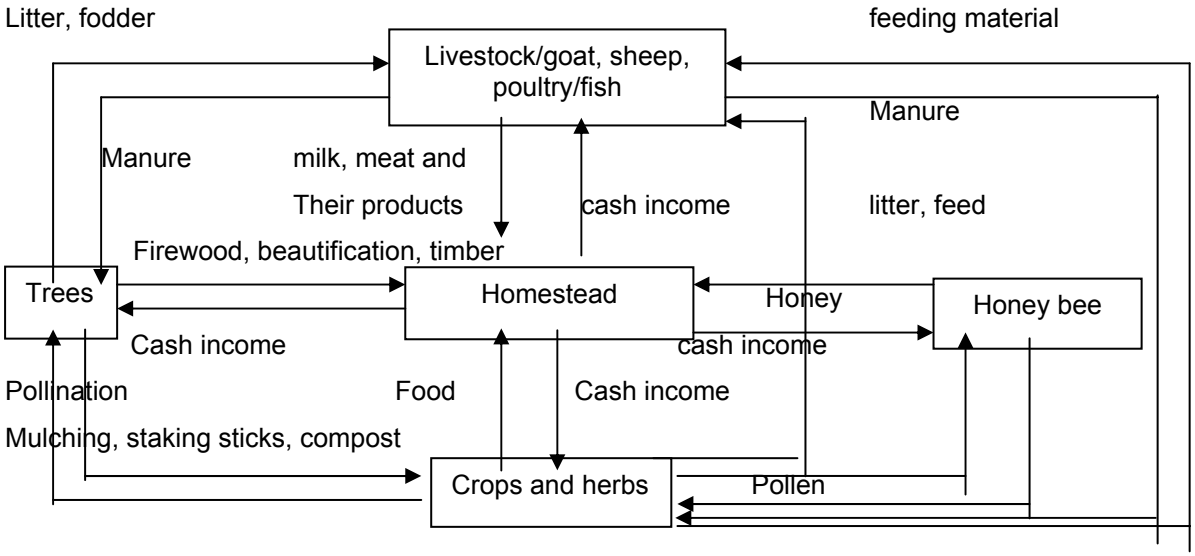


Figure1. Inter-linkage/Interrelation among various commodities in Nepalese home gardens

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.

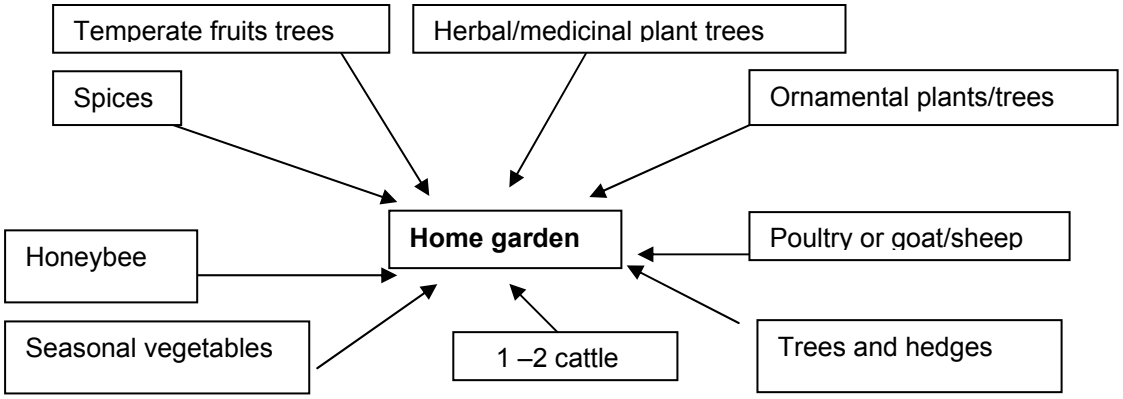
- *Socio- cultural and economic factors*: Food habit, gender, ethnicity, market, religious values and norms, gender role, structure of society (homogenous/heterogeneous), access to market , demand and supply of food materials.

- *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

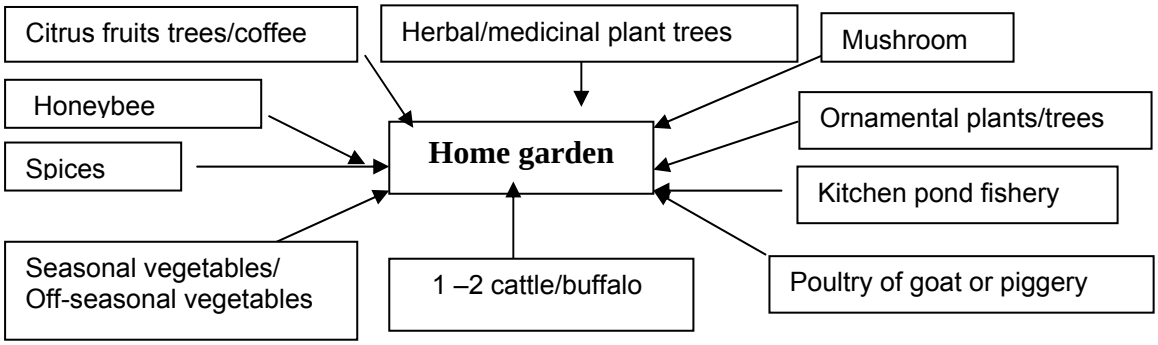
Proposed Models of home garden with various biodiversities

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,

three factors namely socio-economic factors, ecological factors and available knowledge and practice of the farmers need to be considered.

Different institutions are working to the extension of home gardens and conserving agro-biodiversity. Department of Agriculture is implementing programmes like general and vegetable kitchen garden, kitchen fish pond, fruit kitchen garden targeting the poor and dalits, women and marginal people of the remote areas. Though home garden is rich in agrobiodiversity, little work is being done by government to conserve and utilize these resources. The contradictory policy of Agriculture Perspective Plan (APP) with agro-biodiversity conservation, low level of priority in the tenth plan and introduction of hybrids and genetically modified species are serious threat towards the agro-biodiversity programme of Nepal. It may also make the opportunity to mobilize home garden resources for development of poor rural communities.

RECOMMENDATIONS

- Appropriate land use policy should be formulated and implemented.
- The agrobiodiversity conservation programme should be a higher priority and there should be sufficient budget allocated to implement these programmes.
- Protection, conservation and registration of wild relatives of crops and animal species should be carried out.
- Introduction of hybrids and genetically modified crops and animals should be carefully assessed and managed.
- Special attention should be laid on the extension needs of hill, terai and mountain regions; and poor, disadvantaged community and women.
- Many agencies including government, private, NGOs, CBOs and farmers groups should be involved in conservation, development, utilization and registration of agro- biodiversity related genetic resources.
- A clear-cut agriculture policy on home gardening should be formulated and implemented.

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Homestead Food Production Program in Central and Far-western Nepal Increases Food and Nutrition Security: An Overview of Program Achievements

Aminuzzaman Talukder, Gopi Sapkota, Sharmila Shrestha, Saskia de Pee and Martin W Bloem

ABSTRACT

Poor nutrition among pre-school children, pregnant and lactating mothers is a serious public health problem in Nepal. Vitamin A and other micronutrient deficiencies are widespread. Helen Keller International (HKI) has been implementing home gardening programs during the last seven years in Nepal. HKI, started the homestead food production program in four districts in central and far-western regions in Nepal. The aim of this evaluation is to assess the impact of HKIs' homestead gardening program on production and consumption of micronutrient rich foods by children (6-59 months) and their mothers. The data for this evaluation were collected by the monitoring round conducted during March-June and July-October 2003. The results reported relate to the comparison between the first monitoring and progress made between May 2002 and October 2003.

The average size of the garden increased between 2 visits and the majority of the households had started to practice improved and developed gardening with diversification. The proportion of pregnant and lactating mothers and the children under five that consumed fruits and vegetables increased considerably. Consumption of egg was also increased by double as compared to previous week in both the mothers and children under five. The percentage of households earned money by selling poultry and eggs in two months period increased from 18% to 58% and median amount of money earned was from NRs 188 to NRs. 322. HKI homestead food production program increased both production and consumption of micronutrient rich foods including plant and animal sources. It further helped to increase the quality of the household's diet. Homestead food production also increased family income that increases household food and nutrition security.

Key words: homestead gardening, micronutrient deficiencies, lactating mothers, households

INTRODUCTION

This project works through a model of establishing village model nursery and poultry farms (VMNPF) and individual household gardeners. The VMNPFs are owned by private farmers within the group and run as a micro-enterprise. Under this approach, each VMNPF will support two groups of 10-20 households each, depending on the area (more in the *Terai* than in the hilly area). These households will get some inputs (such as seeds/seedlings, saplings, poultry), practical training and demonstration from the VMNPF.

The overall goal of the project is to increase the availability and consumption of micro-nutrient rich foods from both plant and animal sources at the household and community levels, as well as to empower women by increasing family income and the women's control over resources. The specific objectives of the project are to:

- Increase the production of and access to micronutrient-rich animal and plant foods for daily meals to meet the nutritional needs of the people
- Increase family income through the sale of products from both animal and plant sources
- Ensure better utilization of local resources through community channels

- Empower women through an active participation at all levels of homestead food production and other income generating activities

METHODS

The monitoring system collected data from the entire village model nursery and poultry farms and 10% of households every four months. For the first round of monitoring, data were collected during March-June, 2003 and for the second round during July-Oct 2003. The HKI agricultural team conducted the monitoring with assistance from the NGOs. The NGO staff received training on conducting monitoring in the HKI office. The following sampling procedure was followed:

VMNPF

All 78 VMNPFs of four NGOs that conducted different activities during this period July October 2003 were included in the monitoring.

Household Gardens and Poultry production

Data were collected from 10% of households under each VMNPF. A total of 3,018 households were organized under 78 VMNPFs and 300 households were randomly selected for the monitoring. Two questionnaires were used for monitoring – the VMNPF Monitoring Form and the Household Garden and Poultry Monitoring Form. The VMNPF Monitoring Form collected information about the area used for the farm; the number of varieties of vegetables, seeds, seedlings and saplings and poultry present in the VMNPF, the quantity of seed/ seedlings/saplings, egg produced, sold and amount of money earned. Similarly, a large quantity of vegetables, fruits and eggs was produced and income generated during this monitoring period. The Household Monitoring Form collected information on types of gardens, the number of varieties present, quantities of vegetables, eggs produced and sold, source of seeds, the main caretaker and the consumption of fruits, vegetables and eggs.

RESULTS

Village Model Nursery and Poultry Farm (VMNPF)

Table 1 shows many improvements of the village model nursery's vegetable and fruit production between the first and the second round of monitoring. The median size of the nurseries is 1000 square meters, the minimum recommended size. While the number of vegetable varieties grown increased from 14 to 15, and the number of vitamin A rich vegetables increased from 5 to 9. Similarly, the seedling production increased from 2 to 4 varieties. As there were no fruit sapling varieties in VMN in the first round monitoring, this issue was immediately addressed, which resulted in 2 varieties of fruit sapling in second round monitoring. The amount of money earned through the sale of vegetable, seed, fruit, seedling and sapling increased by 64%.

Table 1. Status of the village model nursery (VMN)

Main indicators	1st round (n=78)	2nd round (n=78)
Median size (sq. m.) of nursery	1000	1000
Median # vegetable varieties present	14	15
Median # Vit. A rich vegetable varieties present	5	9
Median # of seedling varieties present	2	4
Median # of fruits sapling varieties present	0	2
Median # of multi-purpose tree sapling varieties present	1	2
Median # of vegetable varieties produced in last 3 months	17	18
Median # of seed crop varieties produced in last 3 months	3	5
Median # of seedling varieties produced in last 3 months	4	6
Median # of fruits sapling varieties produced in last 3 months	0	1
Median # of multi-purpose tree sapling varieties produced in last 3 months	0	2
Median money (NRs.) earned in last 3 months by selling vegetable, seed, fruit, seedling, sapling	1357	2220

Table 2 shows the data about the VMNPF's poultry rearing and consumption. The median area of poultry shed has been increased from 9 to 15 square meters and the proportion with a well-constructed poultry shed increased, an indicator of the VMNPF owners' interest to raise poultry.

Table 2. Status of Poultry production at VMNPF

Main indicators	1st round (n=78)	2nd round (n=78)
Median area (sq.m) of poultry shed	9	15
Having well constructed poultry shed	46%	65%
Median # of poultry	12	9
Median # of local poultry	2	3
Median # of improved poultry	11	7
% of VMPF produced egg in last 2 months	55%	98.7%
Median # of eggs production the last 2 months in all VMNPF	15(n=69)	170(n=78)
Median income (NRs.) from selling poultry and eggs in last 2 months	375(n=27)	1205(n=77)
% of VMPF's children that consumed eggs last week	39.7%	75.6%
% of VMPF's mothers that consumed eggs last week	42.3%	83.3%
% of VMPF's families that consumed eggs last week	52.5%	87.2%
Median # of eggs consumed by children in the last week	4 (n=31)	5(n=59)
Median # of eggs consumed by mother in the last week	2 (n=33)	2(n=65)
Median # of eggs consumed by total family in the last week	8 (n=41)	10(n=68)

Note: Data on egg production were only from 69 VMNPFs.

While the number of poultry kept decreased from 12 to 9, the production of eggs as well as the income from rearing poultry increased. There may be two reasons for the reduction of the number of poultry kept. Some of the VMNPF owners think that keeping chickens for a long time does not benefit them. And, the second round of monitoring coincided with *Dashain* (the biggest festival in Nepal) when most rural households consume chicken/meat. With regard to productivity, this increased from 55% of VMNPF producing eggs to 99%. The number of households that earned money nearly tripled and the amount earned per farmer more than tripled. The proportion of children, mothers and/or families of the VMNPF that consumed eggs the previous week increased from 40-53% to 76-87%.Table 3 shows that >95% of all VMNPFs earned money through their home garden and poultry activities.

Table 3. Percent of VMNPF earning money from garden-nursery and poultry activities, by district (data from second round of monitoring)

District (NGO)	No. of VMPF	% of HH who earned money from	
		HG	Poultry
Doti (NRCS)	20	90%(18)	100%(20)
Kanchanpur (NNSWA)	25	100%(25)	96%(24)
Makawanpur (SOLVE)	13	100%(13)	92%(12)
Nuwakot (DEPROSC)	20	100%(21)	100%(20)
Total	78	97%(77)	97%(77)

Household production and consumption

Figure 1 shows that there was only one household without a garden at the first round of monitoring and that by the second round of monitoring at least one third had upgraded their gardening practices from traditional gardens which are seasonal, with limited varieties, traditional practice and in scattered plots to improved gardens. They are fixed or scattered or mixed plots, more productive, but not throughout the year or to develop gardens which produce a wider range of vegetables in fixed plots throughout the year.

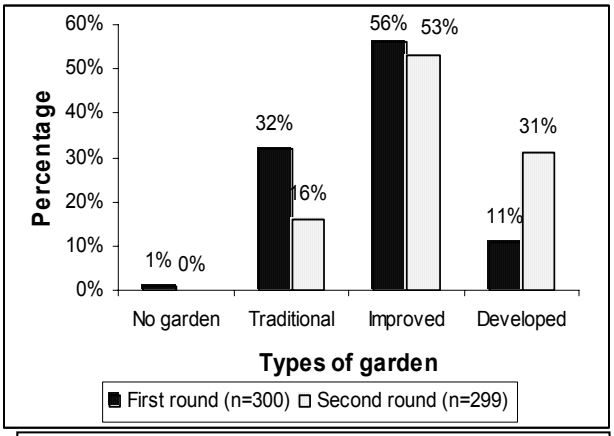

Figure 1. Change of gardening practices in first and second round monitoring.

Table 4 shows the changes in the homestead garden between first and second round monitoring. The median size increased from 62 to 90 square meters. Though the varieties of vegetables grown are the same in both rounds, the median numbers of varieties of vitamin-A rich vegetables increased from 3 to 5 and productivity has increased as well. Similarly, the number of households selling vegetables has increased, from 18% in the first to 49% in the second round and the amount earned also increased by nearly 40%. This is encouraging and shows the increase of production. The proportion of households that sold fruit increased from 4% to 11%.

Table 4. Production of vegetables and fruits in the home garden and income

Main indicators	1st round (n=298)	2nd round (n=299)
Median size (sq. m) of home garden	62	90
Median # of vegetable varieties present in HG	9	9
Median # of vitamin A rich varieties present in HG	3	5
Median weight (kg.) of vegetable produced in last 2 months from those hh who produced veg	100(n=297)	130(n=299)
% of HH sold vegetable in last 2 months (from all HH)	17.6%	49.4%
Median amount (NRs.) of money earned by selling vegetables in the last 2 months	275(n=53)	383(n=148)
Median # of fruit plants in the HG	3(n=298)	2 (n=299)
% of HH sold fruits in last 2 months (from all HH)	4%	11%
Median amount (NRs.) of money earned by selling fruits in the last 2 months	250 (n=12)	100(n=34)

Table 5 presents further information about the homestead gardens. For more than 95% of households in both rounds, their own garden was the main source of vegetables consumed, and less than 2% had selling as the main purpose for having a garden. However, the proportion of households that sold some of their productions increased by 250% and for the majority of these households, women were responsible for keeping the money earned and spending it. Most of the money was used for buying food items.

Table 5. Characteristics of home gardening

Main indicators	**1st round**	**2nd round**
Main sources of vegetable consumption in the last 2 months	**n=300**	**n=299**
Own garden	96.3%(n=289)	98%(n=293)
Market	2.3%(n=7)	1.3%(n=4)
Neighbour/gift	1.3%(n=4)	.7%(n=2)
% of hh produced vegetables in the last 2 months (from all HH)	99.3%(n=298)	100%(n=299)
Main purpose of vegetables production in the HG	**n=298**	**n=299**
Consumption	98.3%(n=293)	99.7%(n=298)
Sell	1.7%(n=5)	.3%(n=1)
Responsible person for keeping money earned from the garden (by selling veg & fruit)	**n=60**	**n=155**
Husband	15%(n=9)	7.7%(n=12)
Wife	66.7%(n=40)	88.4%(n=137)
Others (Father and mother in law and grand parents)	18.7%(n=11)	2.2%(n=6)

Table 6 shows the proportion of mothers and children that consumed vegetables and/or fruits in the last three days and for those that did on how many of those three days they did. The number of mothers and children that had consumed vegetables and fruit during the last three days had increased immensely between the two rounds, particularly for red/orange/yellow fruits and vegetables. For vegetables, the frequency during those three days had also increased, while for fruits it had decreased. The latter may be due to the availability of mango during the first round of the activities for those that consumed fruits then.

Table 6. Proportion of mothers and children under 5 years that consumed fruits or vegetables in the last 3 days

Details	**1st round (n=300)**	**2nd round (n=297)**
Mothers consumed		
DGLV	71% (2)	99% (3)
Red/Orange/Yellow vegetable	17% (1)	60% (2)
Red/Orange/Yellow fruits	12% (2)	40% (1)
Children aged 6-59 months consumed	(n= 221)	(n= 225)
DGLV	53%(2)	92% (3)
Red/Orange/Yellow vegetable	12% (1)	60% (2)
Red/Orange/Yellow fruits	10% (2)	42% (1)

Table 7 compares household poultry production between first and second rounds. Though the number of households that kept poultry had decreased somewhat, the number of chickens per household increased. This indicates that households started hatching chicks. The proportion that was reared by scavenging decreased by more than 50%, while semi-scavenging and confined to poultry shed increased.

Table 7. Change in status of poultry production in the household

Description	1st round (n=300)	2nd round (n=299)
% hh having chickens	84%	80%
Median # of chickens	4	6
Species of chicken	**N=252**	**N=239**
Local only	19%	20%
Both local and improved	81%	80%
Type of chickens rearing practice		
Scavenging	44%	19%
Semi-scavenging	45%	64%
Confined to poultry sheds always	11%	17%
Main caretaker of chicken rearing		
Husband	2%	16%
Wife	79%	75%
Children	4%	7%
Others (In laws, all family members, grand parents etc.)	15%	2%
% hh produced eggs in the last 2 months	48%	77%
Median # of egg production in last 2 months	20	61
% of hh earned money by selling poultry product in last two months	18%	58%
Median amount of money earned by selling poultry & eggs in last 2 months	187.5 (n=54)	322.5 (n=174)
Main use of money earned by poultry& eggs	**n=54**	**n=173**
Food	44%	71%
Clothing	7%	9%
Housing		6%
Education	23%	8%
Medicine	6%	1%
Saved	7%	2%
Others (Amusement, Productive work, Social activities, Loan repayment)		

During the preceding year of the program implementation, gender training was conducted with the households, in which it was discussed how the husband and wife could share the work involved in the poultry rearing activities. This gender sensitization appears to have been effective as the portion of husbands that shared the workload increased from 2% in the 1st round to 16% in the 2nd. Both the proportion of households that produced eggs as well as the number of eggs produced in the last 2 months increased markedly between the first and the second rounds (from 48% to 77% and from 20 to 61, respectively). Hence, the amount of money earned and the number of households that earned money also increased very much. The money earned was largely spent for food.

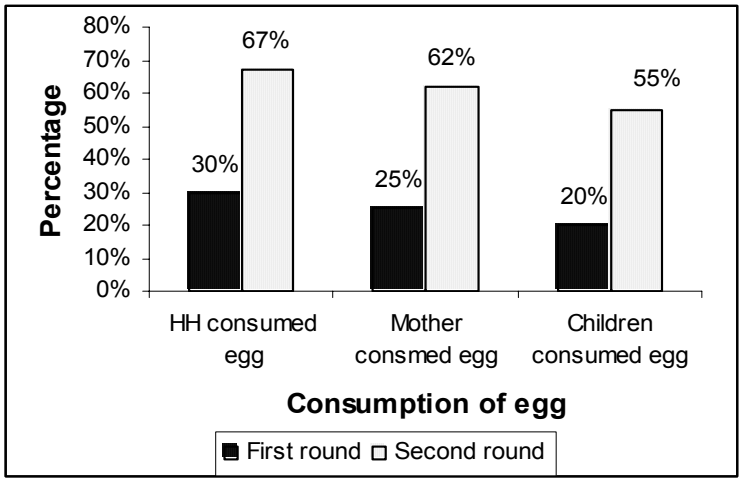

Figure 2. Percent of households, mothers and children consumed eggs in the last week.

Figure 2 shows the proportion of household members that consumed eggs in the last week and table 8 shows the number of eggs, and liver, consumed in the previous week. The number of households, mothers and children that ate eggs during the previous week more than doubled, with 55-67% having consumed the previous week during the second round. And on average, mothers and children ate 2 eggs per person per week. The proportion of households that consumed liver during the previous week increased from 26% to 39%.

Table 8. Egg and liver consumption by the household members in the last month

S.N	Description	Monitoring	
		1st round (n=300)	2nd round (n=299)
1.	Median # of eggs consumed by household in the last week	5(n=91)	6(n=200)
2.	Median # of eggs consumed by mother in the last week	2(n=75)	2(n=184)
3.	Median # of eggs consumed by children in the last week	2(n=59)	2(n=165)
4.	% of HH by consumption of liver in the last week	26%(n=78)	39%(n=113)

CONCLUSION

A great deal of progress has been made between the first and second rounds of monitoring, which was only a 3-4 month period. It needs to be mentioned that all VMNPFs and households now have access to water, which has increased productivity.

VMNPF

The production of vegetables and eggs increased and so did the amount of money earned from selling produce. This increase in income strengthens the program. The decrease in the number of poultry kept needs to be addressed, but the fact that the size and the quality of the poultry shed have improved is very positive. The production of fruit saplings and multipurpose trees has been started. The consumption of vegetables, fruit and eggs all increased markedly. For further improvement of VMNPF, knowledge and capacity for producing poultry, seeds and seedlings/saplings of fruit and multi-purpose trees need to be increased and distributed to more households. Linkages need to be made between local veterinary people and VMNPF owners in order to obtain poultry vaccines which can also be made available to households

Households

For almost all households, the garden is the main source of vegetables, and consumption is the main purpose of keeping the garden. All aspects of gardening has improved (type of the garden, its size, varieties grown, income earned) and so did the consumption, with almost doubling of the number of children that ate vegetables and fruits during the previous three days. Egg production also increased substantially. But the slight decrease of the number of households that kept poultry needs to be increased by establishing hatcheries at the local level and some more improved breed supplied where necessary. For the better egg production, technical guidance on poultry feed preparation and feeding frequencies needs to be provided. More technical supervision and follow-up support is needed at the household level for the year-round production of vegetables and fruits (developed garden). To increase awareness among the households, particularly focusing the women groups and to create for micronutrient rich foods, nutrition education activities need to be organized.

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Home Gardens: An Opportunity to Minimize Pressure on Slash and Burn System and Option for Improving Dietary Diversity of Chepang Households

Bimal Regmi, Kamal Aryal, Bir Tamang and Pratap Shrestha

ABSTRACT

People practicing shifting cultivation practices are now facing acute shortage of food and nutrition in the areas. Communities practicing shifting cultivation (Swidden agriculture) rely on both cultivated and gathered foods, and income from non-timber forest products. LI-BIRD with the financial support from HARP/DFID has implemented projects aimed at improving the livelihoods of Chepang households in Gorkha and Tanahun research sites. Participatory and collaborative approaches were used in designing and implementing the project activities. Based on farmers demand, various vegetables, fruit and fodder seeds and samplings were promoted for home gardening. Various training and capacity development activities were initiated to increase awareness and strengthen the capacity of farmers. A preliminary impact assessment carried out shows a positive impact of the intervention in terms of species diversity in home gardens. Farmers have now access to multiple vegetable, fruit and fodder species in their home gardens. According to the preliminary assessment, farmers have reported that their choices of products have increased and they face fewer problems with the food shortage. It was also observed that the dietary diversity and nutritional status of household have increased, which have gradually created a positive impact on the health of women and children. In the changing context, where shifting cultivators are permanent settlers or cultivators, the realization that the home garden is important for their daily food supply; and family nutrition is considered important gradually by the farmers. It can be, therefore, concluded that home gardens have potential to contribute more to household food security and dietary diversity.

Key words: Shifting cultivation, dietary diversity, home gardens, nutritional diversity, slash and burn, wild foods

INTRODUCTION

About 86% of the population in Nepal lives in rural areas and make their livelihoods solely from agriculture (CBS, 2003). Farming is largely subsistence based. The poorest households in these areas have very small landholdings. There are majority of marginalized and very poor population of ethnic minorities and certain occupational caste groups living in these hilly areas. Of these, 49 districts lie in the hills and mountains (Koirala and Thapa, 1997).

Home gardens are closely associated with the farming practice and are considered to be one of the key components of farming systems. Home gardens are considered to be one of the major contributors of rural livelihoods. It is one of the traditional farming systems adopted by majority of Nepalese farmers. Home gardens in Nepal have multiple uses: as a source of livelihood, firewood and timber, spices and medicinal plants, green manure and pesticides. In rural areas, where about 90 percent of the total population lives, home gardens are an important source of food, supplying most of the vegetables and fruits required by the family (Shrestha, *et. al.,* 2002).

Shifting cultivation, also known as slash and burn farming practice, is a traditional farming system and is found in many parts of the world. It has been in use for centuries and still remains the dominant land use practice on about 30% of the arable land of the world. Shifting cultivation is prevalent in almost 20 districts of Nepal with a large area under

cultivation in Taplejung, Sankhuwasaba, Makawanpur, Chitwan, Dhading, Gorkha, Tanahun and Nawalparasi districts. This practice is common within the indigenous tribes of Nepal, where almost all households belonging to Chepang community are involved in it (Regmi, *et. al.,* 2003a). Shifting cultivation areas are characterized by high population growth, declining productivity and high ecological risk. The decreasing fallow period and increasing pressure on land had somehow contributed to increased soil erosion and land slides, thus threatening the survival of the ethnic groups involved in the practice. It was also shown from different studies that current shifting cultivation practice is unable to support community's livelihood.

LI-BIRD study on shifting cultivation areas of Nepal clearly demonstrated that home gardens are immature and less prioritized by farmers despite, their crucial role in family nutrition and dietary diversity. The species composition in home gardens was relatively poorer. It was interesting to note that most of the population depended upon wild foods during food deficit months and home garden contributed less in terms of family nutrition and income than shifting cultivation land areas (Regmi, *et. al.,* 2003b).

Most of the Chepang households are highly disadvantaged in terms of their socio-economy, education, health and nutrition, and access to schools, markets and other service centres. Women and children are highly vulnerable to poor health, education and workload. Children suffer from malnutrition and pregnant women suffer from protein and iron deficiency that may be mainly due to the lack of vegetables, meat and eggs and partly due to lack of options and opportunities. Farming practice was also seen unsustainable although there was evidence to show that farmers' traditional knowledge is rich. Due to limited crop species and somehow mono cropping style of farming, farmers are not getting diverse products. Cash crops are grown but in limited areas. Other livelihood activities and options are almost negligible. The outcomes were, however, the products of the extreme socio-economic and demographic pressure. The majority of the Chepang households in Tanahun and Gorkha depended on wild uncultivated food crops during food deficit months, such as *Githa* (*Dioscorea bulbifera*), *Bhyakur* (*Dioscorea deltoidea)*), *Ban tarul* (*Dioscorea spps)*, *Sisnu* (*Utrica dioca*), *Tanki ko munta* (*tender leaf of Bahunea purpurea*), *Koiralo* (*Bauhinia variegate*), *Kurilo* (*Asparagas officinalis*), *Niuro* (*Thelyopteris spp*), etc. collected either from the forest, banks of the river or from their own land. It had been reported that the people of the Kholagaun area in Chimkeswori VDC of Tanahun district are dependent on an average of 3-6 days per months on wild and uncultivated food items. But according to farmers, uncultivated food and food items were gradually declining due to deforestation, slash and burn farming system, migration for seasonal work, change in food habit, mono-cropping and lack of awareness regarding its conservation and sustainable utilization (Regmi, *et. al.,* 2003b). Malnutrition, resulting largely from inadequate intake of micronutrient rich foods, is a serious problem in Nepal with negative consequences on health and economic development. Based on the evidence from several Asian countries, homestead food production activities such as home gardening increase food consumption, lower the risk of vitamin A deficiency disorders, increase household income and empower women (HKI, 2001).

There are several studies conducted by organizations involved in promoting nutritional and dietary diversity of households. Based on the RRN's experiences with kitchen garden diversity and family nutrition, it was found out that diversity increases access to nutritious vegetables and family nutrition increase with the diversity of the kitchen garden (Khatiwada, 2002). Helen Killer International (HKI) has been promoting home garden programmes in Nepal, and according to their experiences, home garden is potential for increasing the production of vegetables, increasing vitamin intake of both mothers and children and providing additional income (HKI, 2001).

LI-BIRD has implemented home garden projects that are coordinated globally by IPGRI and financially supported by SDC. Similarly, LI-BIRD in financial support from HARP/DFID and

Santi Griha has implemented projects aimed at improving the livelihoods of Chepang households in Gorkha and Tanahun research sites. Some of the project activities were focused on improving the home gardens in the area through promoting species diversity. Participatory and collaborative approaches were used in designing and implementing the project activities. Different district based organizations were involved in the collective sharing of technical expertise and resources.

ABOUT THE STUDY SITES

Chepangs also called *praja*, are one of several ethnic minorities of western hills of Central Nepal inhabiting on the sloping land in hilly landscapes of Tanahun, Chitwan, Makawanpur, Dhading and Gorkha districts. The study was mainly focused on the Chepang communities and confined to Chimkeswori and Bhumlingchowk VDCs of Tanahun and Gorkha districts respectively (Figure 1) but information from other slash and burn areas particularly of Taplejung, Sankhuwasaba, Nawalparasi and Dhading were also incorporated based on the relevance of the discussion.

MAJOR FINDINGS

Land use practices and livelihood condition

Cultivation Practices

The slash and burn system is very common type of shifting cultivation practice prevalent in Nepalese mountains. The average fallow period between two subsequent slash and burn, locally known as *Lhose*[2], has now been reduced to 1-6 years against 10-15 years about 20 years ago. These practices appear due to the population growth and decline in the new forest areas for cultivation which leads them to cultivate in short cycle.

Communities in an area clear the land, burn the area and collect the debris at the bottom of the field, which is locally called "*gujultaune*". Slash and no burn system is common in some farming communities of Tanahun. Nowadays this practice is popular in other districts like Chitwan, Gorkha and Makawanpur districts. The expansion of the community forestry

[2] Lhose refers to the fallow period

concept in these areas is regarded as one of the major causes for the shift in farmers' cultivation system. The burning is an issue under debate nowadays even among most of the shifting cultivators.

Chepang communities have a small parcel of rainfed land besides *khoriya*. The *bari* land (rainfed) is comparatively more fertile and productive than *khoria* land. Most of the farmers have strong interest to develop *khoria* into *bari* land in future. They have, however, developed a certain portion of *khoria* through terrace improvement methods. Besides *bari* land, small parcel of home garden is also prevalent in the area.

Sources of livelihood

Agriculture is the main source of livelihood for the majority of the households in these areas. However, since the farming is largely subsistence oriented, and the agricultural produces are not adequate to sustain their livelihood throughout the year, the majority of the households also depend on wage labouring for additional income as well as the collection of uncultivated wild food for maintaining their daily requirements. Few households also earn their living from services within the village, and few of them are service holders outside the country as well. The selling of homemade liquor is also a source of cash income of some of the households. Occupational enterprises like carpentry, making iron ware and masonry works (house construction) are also the cash generation activities to support their livelihood.

Food sufficiency

Based on the case study of two Chepang villages of Gorkha and Tanahun, more than 68.8% of households experience varying degrees of food deficit, which was observed up to nine months and over in a year (Figure 2). They adopted various sorts of mechanism to fulfill their food requirements during the deficit period, such as buying food with their own money that was earned from wage laboring, and selling agriculture products including livestock. Most of the households in Tanahun depend on wild foods collected from the forest during food deficit months i.e. from Falgun to Shrawan.

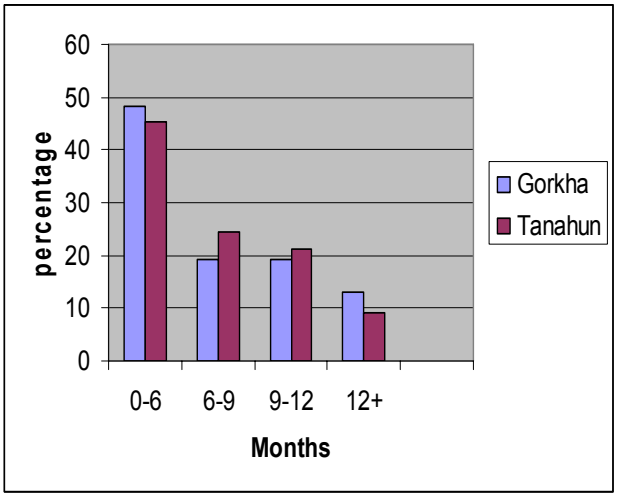

Figure 2: Distribution of households by food sufficiency categories.

Species found in Home Gardens

LI-BIRD conducted baseline studies in some parts of Gorkha and Tanahun districts. Besides, LI-BIRD also carried out a study of different shifting cultivation systems found in Nepal with financial support from International Centre for Integrated Mountain Development (ICIMOD). The study was carried out in some pocket areas of Taplejung, Sankhuwasaba, Dhading and Nawalparai based on the intensity of slash and burn system.

The findings suggest that home gardens have not been used wisely by farmers. More of the dependency was seen towards shifting land areas and wild foods. The homestead contributes less to the family nutrition and diet but is still used as a source of fodder and forage. The species composition in the homestead is relatively less compared to the other home gardens in the country. The comparative analysis of species found in home gardens of Ilam (Gautam *et. al.*, 2004) and the average species found in six different slash and burn pocket areas in Nepal (Taplejung, Sankhuwasaba, Dhading, Nawalparasi, Tanahun and

Gorkha) indicated that the species diversity was quite lower in slash and burn areas (Figure 3). The traditional practices of shifting cultivators always focused on shifting cultivation land areas with less emphasis to provide homestead. Now since most of the shifting cultivators are permanent settlers, the home garden is relatively maintained by farmers but with very few species.

The family consumption status shows that they take very minimum vegetables. The common food items include maize items, *githa, bhyakur*, millet, gravy item of sorghum, yam, colocasia, rice (seldom), rayo and radish. Mostly family prefer maize wine.

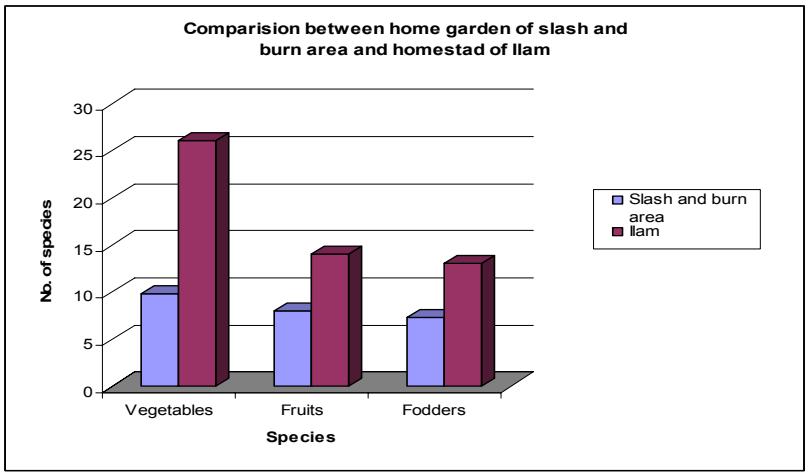

Figure 3. Comparison between home gardens of slash and burn areas and homesteads of Ilam

Wild /uncultivated food

Wild foods make an important contribution to the nutrition of the rural people in the studied areas. They also play a major role in survival strategies for these communities, especially during the period of food shortage. The majority of the households depend on wild uncultivated food crops during the food deficit months. The wild foods, such as *Ban Tarul (Dioscorea spps), Githa/Bhyakur (Doiscorea bulbifera/deltoidea), Tyaguna, Jyar, Sisnu (Urtica dioca), Tanki ko munta(Bahunea purpurea), Koiralo (Bahunea varigeta), Kurilo, Niuro (Thelyopteris spps)*, *Boke saag*, *Jaluko, Chiuri (Bassia butyraceae), Wild mushroom,* etc are collected either from their own land or near the forest providing a large bulk of food for the households. An interview with the farmers of Kholagaun in Tanahun has reported that 40% of the total food is contributed by the wild sources. The collection time starts from *Mangsir* to *Jestha* (November to June). Both male and female go to collect the foods and one person can get up to 20-25 kg in one day but it depends upon the availability of the foods. The population of wild food species in the area is believed to be gradually declining due to increased slash and burn cultivation practices, reduced areas under the forest cover and subsequently difficulty for the villagers to travel to some distance in order to locate and harvest uncultivated/wild food stuffs. In the meantime, farmers reported that harvesting wild foodstuffs is very difficult, risky, time-consuming and expensive; therefore, they tend to seek alternative ways of living.

The wide range of topographic and climatic variation provided a great diversity of wild plant species. Many wild species or plants are used as food, vegetables, fruit, medicine, pickles and spices. The plant parts used are leaves, rhizomes, roots, tubers, tender twigs and bark. It was found that the rural people of these areas consume wild vegetables throughout the year. Most of the herbaceous wild vegetable plants with tender shoots and leaves and whole plants of some species are consumed. Different parts of some tree species are collected and used as vegetable. Traditional vegetables available in these areas supply nutrition to their daily diets to the people who usually can not afford to purchase high value vegetables, fruits, meat and milk products (Table 1).

Table 1. Wild vegetables found in the uncultivated forms in the area.

Local Name	Botanical Name	Plant type	Edible parts	Uses
Sisnu	*Urtica dicica*	Herb	Young tip shoots	Vegetable/ Khole
Jaluko	*Colocassia* spp.	Herb	All parts	Vegetable
Koiralo	*Bauhinia variegata*	Herb/Tree	Flowers, buds	Vegetable
Sim sag	*Nasturtium offcinale*	Herb	Young tip shoots	Vegetable
Tama bans	*Dendrocalmus hamiltonii*	Tree	New shoots	Vegetable/pickles
Shiplican	*Crataeva religiosa*	Tree	Leaf buds	Vegetable, pickles, spice
Kabro	*Ficus infectoria*	Tree	Buds	Vegetable, pickles
Bhyakur	*Dioscorea deltoidea*	Climber	Roots	Vegetable, boiled
Tanki	*Bauhinia purpurea*	Tree	Young tip shoots	Vegetable, fruits
Neuro (jire)	*Thelyopteris* spp	Herb	Tender leaves	Vegetable, pickles
Ban tarul	*Dioscorea* spp	Climber	Roots	Vegetable
Ban lunde	*Amarathus* spp	Herb	Tender shoots and leaves	Vegetable
Ban Kurilo	*Asparagus racemose*	Herb	Tender new shoots	Vegetable, pickle, medicine
Bethe	*Chenopodium* spp	Herb	Tender aerial parts	Vegetable
Chuche karela	*Cyclanthera pedata*	Climber	Fruit	Vegetable
Wild mushroom			Fruiting body	Vegetable
Mane	*Alocasia naricularis*	Herb	All parts	Vegetable, pickles, medicine

Some of the wild foods have been domesticated by farmers. Sama (little millet) and *Mal Kaguno* (fox tail millet) are used for both food and religious purposes. *Bhyakur* is domesticated since it has both food and medicinal value. Similarly, farmers have domesticated *Kause* bean (Makuna), *Tyaguna*, and *Githa*. It was observed that farmers give more importance to use value of species.

Contribution of wild food crops in the nutritional status of households

The wild foods have been a major source of family nutrition and diet of Chepang households (Annex 1). As mentioned earlier 40% of their food supply is from wild foods. According to farmers, the wild foods are very nutritious and they provide a lot of energy. The study and research conducted by various institutions have reported that they have higher protein and fibre compared to other crops. The study carried out in *Hokoido University Japan* shows that *Githa* and *Bhyakur* contain five times as much protein and fiber as potatoes and sweet potatoes do. The study further shows that the important elements like iron, calcium and phosphorus are also available in them.

However, there are other contradictory findings to the prior statements. The study done by Mr. Megh Raj Bhandari, a PhD student of Hokoido University had reported that these wild foods contain Aukjalate, Cynozelic Alkaloids and Glucocytes like toxic chemicals which are the cause of allergy and stone formation in the kidney. The report suggested that the consumers of such wild foods should have their medical checkup once a year. It is evident from discussions with farmers that some of the wild foods consumed by households contain toxic chemicals or poisons and need processing during the cooking (Table 2).

Table 2. Toxic wild foods used by Chepang households

SN	Name of toxic wild foods	Level of poison	Remarks
1	Githa	+ve	Need processing
2	Jyar	+ve	Need processing
3	Bharlang	++ve	Need processing
4	Sumai gana	++ve	Need processing
5	Kause simi	+ve	Need processing

(Source: Regmi *et al.,* 2003b)

Despite the poison content in wild foods, farmers consume wild foods simply because they have no choices. Farmers have their own traditional knowledge on the processing of wild foods before consumption. They are really conscious of the level of poison in the foods and they have their own traditional systems and knowledge to minimize toxic contents in foods. Generally after the collection, they peel the skin of wild foods and then slice them into small pieces and boil them with ash. They do not boil the food completely so, it is often half boiled. After boiling, the product is taken to stream water for almost 24 hours depending upon the level of toxicity specific to different species of wild foods. Experienced people are involved in tasting in order to ensure that the poison is removed. The food is then ready for consumption for the whole of the family.

CURRENT INTERVENTIONS OF LI-BIRD IN SHIFTING AND SLOPING LAND AREAS

LI-BIRD with financial support from HARP/DFID and Shanti Griha, has implemented a project in these areas. A number of technological options were identified and tested by farmers in the areas. Contour hedgerows, intercropping of maize with legume crops and vegetables, home gardening, livestock production system, fodder and forage improvement and integrated IGA interventions were some of the technologies promoted.

Approaches used

Participatory planning and implementation
The project adopted participatory approaches in the entire project design and implementation. District line agencies were directly involved right from the inception of the project. The project gave more emphasis to the joint planning and implementation.

Participatory monitoring and evaluation
Participatory monitoring and evaluation was the basis for implementing the Programme. The project emphasized process-led outcomes. District stakeholders and farming communities were encouraged to monitor and evaluate the effectiveness of intervened technology and provide feedbacks and suggestions for its improvement.

Supply of seed and seedlings
Various types of improved and fast growing seeds and the seedling of crops, vegetables and other species were provided to the farmers. In home gardens based on farmers demand various vegetables such as: bitter gourd, sponge gourd, cabbage, cauliflower, bottle gourd, snake gourd, okra, chillies, capsicum, cowpea (Sarlahi tane), tomato (Bl-1131), cress, spinach, capsicum, coriander, brinjal, etc were promoted. Intercropping of vegetables with maize (tomato, sponge gourd, chilly, cucurbits, four season beans, beans, and bitter gourd) were also promoted in the area.

Farmer's participatory learning
Farmers' tour was organized for research farmers to sites, where SALTs (Sloping Agriculture Land Technologies) and other improved agriculture practices have been researched and demonstrated. Farmers were taken to ICIMOD research site at Godavari, Nepal Agro

forestry Foundation (NAF) research site at Gajuri, ICIMOD/NARC demonstration site at Paireni and Lumle Agriculture Research Station site. Farmers were taken to exposure tour to the demonstration site of eco-centre at Gaighat, organic farming centre managed by a Team Organization for Local Initiatives (TOLI) at Eklekhet Tanahun, Cooperatives of Charaudi and drip and sprinkle irrigation at Bimal Nagar managed by International Development Enterprises (IDE).

Capacity development

The farmers of Gorkha site were provided with a one week long training on horticulture and composting. At least one member of the farmer's organization was provided training on fund mobilization. Six day training on vegetable production and management was organized in Kaundiphant of Gorkha district. The training was organized by Nucleus for Empowerment Through Skill Transfer (NEST) Pokhara. Motivators from each site were provided with one week long field based training on nursery management. LI-BIRD also organized a one week long training specific to the women group of Kaudiphant on mushroom farming.

Health and nutrition camp

A health and nutrition camp was organized in Thumka village of Gorkha district. This activity was organized in close coordination with Gorkha Milan Samaj and the farmers' organization. The main objective of the health camp was to increase awareness of farmers towards the importance of health and nutrition for their life and to encourage farmers to be conscious of regular health check ups and other hygienic matters. Health check ups and other awareness raising activities were carried out. Short sessions and skits were carried out in order to orient farmers about the role of home gardens, particularly the vegetables and fruits in the nutrition and health of women and children.

Livestock and fodder/forage production support

Breed improvement, vaccination, drenching and other veterinary services integrated with fodder production are carried out in these areas. DLSO Tanahun and Gorkha have provided fodder and forage seedling for livestock production. In this year, DLSO Gorkha has given PPR vaccination to goats in Thumka village.

Initial impact/effect of intervention

Diversity in crops

The baseline report indicates that farmers in the past did not have much of diversity in crops and the choice was also limited. Only the maize based production system and associated local varieties were found in the area. After the intervention, there had been increase in crop choices like many new and locally adopted and preferred varieties were introduced in the area. Figure 4 below clearly shows comparatively more diversity in vegetables and fodder and forage species than other crop varieties or species.

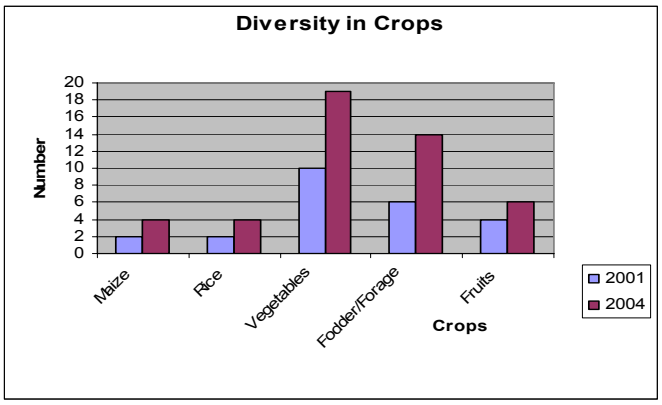

Figure 4 . Diversity in Crops

Changes in Cropping Pattern

Due to intervention, new cropping patterns and species have emerged. The slash and burn system was gradually reduced due to technological options. Varieties of vegetables were promoted in the home gardens of Chepang households in order to increase the dietary diversity. The findings suggested that there was reduction of dependency on wild foods after the intervention (Annex 2). An integrated approach was used where the livestock rearing

system and bee keeping were promoted. Fodder and forage plantations around homesteads was prioritized.

Improvements in income status and livelihoods
Although there is no concrete data to support, the income status and livelihoods of Chepang had increased due to intervention. There is a lot of evidence to indicate the initial impact of the technology. Due to the introduction of diversified cash crops and legumes, farmers had expressed that their income had increased. The choice of crops had increased, thus making them busier on farm work and often selling some of the products to nearby markets.

Future scope of home gardens in the area

Home gardens are one of the most important sources of food, fodder, fuel, medicines, spices, construction materials and income. Though home gardens are integral part of the Nepalese farming systems, and play an important role in the livelihood of the community, they have not been really utilized in the study area. Farmers seem to have concentrated more on sloping land rather than their homestead.

Chepang communities are dependent on wild and uncultivated foods for their livelihood. There are some potential wild crops which can be domesticated. Domestication could be one of the solutions for food shortage in the area. Home gardens have a lot of scope and potential since they can be a valuable reserve for a wide diversity of plant species through their intensive and multiple uses for food, fiber, timber, fuel, fodder, medicine, ornamentals, cultural and aesthetic values and other household requirements. They also provide a means to link conservation with food security and diversity within farming systems. Home gardens could be also a source of biodiversity, income and food and nutritional security for the poor in future.

Marginal farmers in Nepal are facing socio-economic and ecological problems. Most of the slash and burn areas are under social and ecological threats. Farmers are having a hard time to survive and often seek other ways to supplement their requirements. Since most the shifting cultivators are now permanent settlers or cultivators, it is very difficult for farmers to maintain a longer fallow period. Intensification on the other hand has a negative impact on soil and biodiversity. Since home gardens are at an immature stage and have not been properly used, intervention on promoting home gardens could be the best option for decreasing pressure on slash and burn systems and provide option for improving nutrition of households. Nevertheless, it could also be a source of income for rural households.

Future research and development needs

- Research on domestication potential of wild relatives. Particularly the inventory of species, documentation of indigenous knowledge on use and processing and nutritional analysis of the domesticated wild foods like *Githa, Byakur,* etc should be carried out.
- Improvement on quality of wild crops. Some studies show that some of the wild crops have toxic chemicals and there is scope for cross breeding or improving the quality of wild crops so that it can be used as food crops.
- Promoting home gardens in the marginal areas. Shifting cultivation system has been reduced nowadays and farmers are practicing slash and burn agriculture. In this context, most of the farmers are now changed to permanent settlers. The pressure on shifting cultivation land can be minimized if home gardens are promoted. Home gardens can be a regular source of family food and it can improve family health as well. The good practices generated from the on-going projects must be scaled up or promoted in marginal areas.

CONCLUSION

- Chepangs are one of the most disadvantaged tribal communities in Nepal. The majority of the households practice shifting cultivation system as a major land use system. Their farming system is often characterized by low production potential, and is susceptible to soil erosion and land degradation. The dependency of farmers in the slash and burn practice is higher. People depend more on wild food during food deficit months. The major food supply source is wild and uncultivated foods. It is evident that less contribution is made from home gardens. Home gardens have not been properly used or exploited by farmers.
- The study shows that the species diversity in home gardens is less compared to other home gardens in the areas.
- Most of the Chepang households suffer from acute shortage of food and nutrition. Women and children suffer from malnutrition and other nutrient deficiencies. The family consumption status shows that they take minimum vegetables.
- LI-BIRD with the financial support of HARP and Shanti Griha has implemented projects targeting the Chepang households. Participatory approaches have been used in identifying potential agriculture and forest based technologies that have potential to improve the socio-economic and ecological condition of the area. One of the focuses was on improving the species diversity in homesteads.
- Home gardens are a potential source and reservoir of nutrients during food deficit months, ample support was provided in improving kitchen gardening, plantation of fruits, fodder and forage saplings around the homestead, particularly targeting the off seasonal vegetable production.
- The initial findings clearly suggest that the improvement of home gardens is a viable option for improving the nutritional status and dietary diversity of households.
- Farmers have clearly mentioned that their choices of crops and species have increased, thus offering them more opportunities to fulfil their family requirements. Some of the farmers have even benefited economically from the off seasonal vegetable production. This has also slightly reduced the dependency of households on wild foods despite the fact that there are other reasons too for the decrease.
- These marginal areas have greater potential to be exploited for home gardening. It is basically true that if home gardens are properly used, they can be a source of regular food and nutrient supply for family households and the surplus for increasing the income status, which supports various studies and research outcomes conducted by research institutions like LI-BIRD, HKI, RRN and others. There is ample evidence to show that the expansion of home gardens has every scope to improve the health and nutrition of women and children, improve food security and improve the family income.
- Greater choices and opportunities will to some extent reduce the pressure on the slash and burn system, thus encouraging farmers to more sustainable practices. Using these kinds of approaches and strategies is one of the hopes of sustaining the farming system in shifting and sloping land areas.

ACKNOWLEDGEMENT

The authors would like to acknowledge various people and institutions that helped in gathering information and giving the initial thought a shape. The sincere appreciation goes particularly to all LI-BIRD staff and to Chepang people of different locations who were a source of inspirations as well as reservoir of knowledge and thoughts. Dr. B.R. Sthapit, A. Subedi and R. Gautam deserve appreciation for their inspiration and support. We are also deeply indebted to HARP, ICIMOD and IFAD for financially supporting this study.

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Annex 1. Seasonal calendar showing the dependency of Chepang households in wild foods (Tanahun)

Wild food	Baishak 16Apr-15 May	Jestha 16 May-15 Jun	Ashar 16 Jun-15 Jul	Srawan 16 Jul-15 Aug	Bhadra 16 Aug-15 Sep	Ashoj 16 Sep-15 Oct	Kartik 16 Oct-15 Nov	Mansir 16 Nov-15 Dec	Poush 16 Dec-15 Jan	Magh 16 Jan-15 Feb	Falgun 16 Feb-15 Mar	Chaitra 16 Mar-15 Apr
Bhyakur								C	C			
Githa												
Ban Tarul												
Tyaguna												
Jyar												
Bharlang												
Samai gana												
Sisnu												
Jaluka												
Chiuri (Fruit/Ghee)												
Kholegan												
Sipligan												
Khole sag (sim sag)												
Tanki (young leaf)												
Tanki tata (seeds)												
Koiralao (flower)												
Kause bean												

Annex 2. Showing the dependency on wild foods after intervention

Wild foods	Baishak 16Apr-15 May	Jestha 16 May-15 Jun	Ashar 16 Jun-15 Jul	Srawan 16 Jul-15 Aug	Bhadra 16 Aug-15 Sep	Ashoj 16 Sep-15 Oct	Kartik 16 Oct-15 Nov	Mansir 16 Nov-15 Dec	Poush 16 Dec-15 Jan	Magh 16 Jan-15 Feb	Falgun 16 Feb-15 Mar	Chaitra 16 Mar-15 Apr
Bhyakur												
Githa												
Ban Tarul												
Tyaguna												
Jyar												
Bharlang												
Samai gana												
Sisnu												
Jaluka												
Chiuri (Fruit and Ghee)												
Kholegan												
Sipligan												
Khole sag (sim sag)												
Tanki Munta (young shoot)												
Tanki tata (seeds)												
Koiralao (flower)												
Kause bean												

Home Gardening as a Household Nutrient Garden

Krishna G.C.

ABSTRACT

Home garden is an integrated system which comprises different things in its small area: the family house, a living/playing area, a kitchen garden, a mixed garden, a fish pond, stores, an animal house and people. Demographic Health Survey, 2001 shows that 50.5 percent of below five children are stunted, 48.3 percent are under weight and 9.6 percent are wasted. The consumption of pulses (mainly lentils, beans and peas), meat, fish and milk were very low providing only 9% of total energy. Home gardening can improve nutritional status more specifically on micronutrients status of women and children and poverty reduction, which is one of the appropriate Food-based approaches, could be an essential part of the long-term global strategy to alleviate vitamin A and iron deficiencies but their real potential is still need to be explored.

Keywords: Demographic, nutritional status, micronutrients, integrated

INTRODUCTION

The home garden is an integrated system which comprises different things in its small area: the family house, a living/playing area, a kitchen garden, a mixed garden, a fish pond, stores, an animal house and people. It produces a variety of foods and agricultural products, including staple crops, vegetables, fruits, medicinal plants, livestock and fish both for home consumption or use and for income.

FOOD PRODUCTION AND CONSUMPTION

A nation-wide survey on food consumption carried out in Nepal in 1970 (FAO, 1974), showed that the national daily per capita consumption of energy was 2,126 kcal, 83% of which consisted of cereals, mainly rice, wheat and maize.(Table 1) The consumption of pulses (mainly lentils, beans and peas), meat, fish and milk were very low providing only 9% of total energy. Consumption of fats and oils was particularly low, providing 2% of energy intake. Considering the food consumption pattern of Nepalese, per capita consumption of fruits (3.49%) and vegetables (17.38%) is very low. (Table 1).

Table 1. Food Consumption pattern, Kg/caput/year Nepal, 2000/2001

Ecological belt	**Mountain**		**Hill**		**Terai**		**Nepal**	
Food groups	**Quantity**	**%**	**Quantity**	**%**	**Quantity**	**%**	**Quantity**	**%**
Cereals	199.51	58.87	202.93	57.40	204.46	49.96	202.3	55.09
Pulses, and beans	10.71	3.16	13.43	3.80	17.88	4.37	14.01	3.82
Oilseeds	0.24	0.07	3.77	1.07	5.96	1.46	3.32	0.90
Oils and ghee	6.82	2.01	6.76	1.91	8.21	2.01	7.26	1.98
Vegetables	48.28	14.25	54.45	15.40	88.75	21.68	63.83	17.38
Fruits	9.47	2.79	9.8	2.77	19.18	4.69	12.82	3.49
Tuber	22.97	6.78	6.13	1.73	11.6	2.83	13.57	3.70
Milk	29.01	8.56	43.45	12.29	36.24	8.85	36.23	9.87
Meat	7.1	2.10	7.14	2.02	9.37	2.29	7.87	2.14
Sugar	4.79	1.41	5.66	1.60	7.62	1.86	6.02	1.64
Total	**338.9**	**100.00**	**353.52**	**100.00**	**409.27**	**100.00**	**367.23**	**100.00**

(Source: Agriculture Statistics, 2000/200, MoAC, HMGN,Kathmandu)

SITUATION OF MALNUTRITION IN NEPAL

Demographic Health Survey, 2001 shows that 50.5 percent of below five children are stunted, 48.3 percent are under weight and 9.6 percent are wasted. The prevalence of under nutrition is higher in the rural areas than in the urban areas. Iron deficiency Anemia (IDA), Vitamin A Deficiency, and Iodine Deficiency Disorder (IDD) are major micronutrient problems are major public health problem in Nepal.

CAUSES OF MALNUTRITION

Nepal Multiple Indicators Surveillance (NMIS) carried out a survey in1995 (NPC, 1996) and the Family Health Survey conducted in 1996 (MoH, 1997) revealed that the problem of malnutrition still exists throughout Nepal. The extent, causes, and consequences of poor nutritional are now clearly understood, and so are the ways to prevent and manage it. Low food intake and infections are immediate causes of malnutrition. Addressing nutritional needs offers a primary rationale for the preservation of traditional knowledge and life styles, the conservation of wild and cultivated resources, and the sustainable use of the environments in where they are lived.

Protein-energy malnutrition (PEM) is a common nutrition problem which occurs if children do not eat enough to supply their energy and nutrient needs. Infants and preschoolers are the groups most vulnerable to malnutrition. Pregnant and lactating women are the next most vulnerable group, together with elderly people and those who are just recovering from illness.

MICRONUTRIENT DEFICIENCIES

Human body needs only small amounts of vitamins and minerals. These nutrients must be obtained from foods, since the human body cannot develop them itself. A lack of sufficient micronutrients in the diet will result in deficiency diseases, which may even endanger people's lives. Most children with micronutrient deficiencies usually also lack energy and protein.

Vitamin A deficiency is one of the most important nutritional diseases among young children. It causes night-blindness, in more serious cases, may damage the eyes, cause blindness and increase the risk of infection and death. The best way of preventing vitamin A deficiency is to encourage families to grow and eat plenty of foods that are rich in vitamin A. These include plant foods such as green leafy vegetables, mangoes and papayas; among animal foods, liver is an especially rich source of vitamin A. Breast milk is the only source of vitamin A for infants, and lactating mothers should therefore eat plenty of foods rich in vitamin A as well.

Anemia is the most widespread nutritional disorder with the commonest cause of nutritional anemia is iron deficiency or a lack of iron in the diet. Other causes of anemia are parasitic infections, such as hookworm, and the loss of blood during menstruation and childbirth. Iron is an important mineral, which is needed to form red blood cells and transport oxygen in the blood. Nutritional anemia can be prevented by ensuring that women and children eat enough iron containing foods, i.e. small amounts of liver, meat and fish, and more foods containing vitamin C so as to increase iron absorption, such as citrus, guava and some green vegetables. Iodine deficiency is caused by a lack of iodine in food and in the soils on which food is grown. Sea food is a good source of iodine, thus iodine deficiency is often found in mountainous areas with leached soils and where sea fish is scarce. The thyroid gland at the front of the neck stores and needs iodine for hormone production but, if there is insufficient iodine in the diet, the gland stops producing thyroid hormones and signs of deficiency appear, called iodine deficiency disorders (IDD). Iodine deficiency disorders include goiter,

which is indicated by a swelling of the thyroid gland. IDD also contributes to low birth weight, inhibits body growth in children and impairs mental development. In severe cases, brain damage can result. To prevent IDD, the use of iodized salt is highly recommended.

ROLE OF NUTRIENTS FROM HOME GARDEN

Considering the problems discussed earlier, home garden can serve as nutritional garden for family needs. A diversified home garden with at least 8 to 12 diverse species can contribute nutritional requirement , particulary, leafy vegetable rich in iron, vitamin A, vitamin C, vegetable protein, and dietary fiber,. Moreover, food grown at home garden is culturally preferred and valued for safe and fresh for home consumption. Home gardening can be combined with neglected and under-utlised traditional crops for providing variety of food and fruits.

Table 2 illustrates how home garden provides varieties of nutritious foods for family daily needs Daily consumption of dark green leaves, and yellow fruit and vegetables together with variety of fruit may provide wide range of Vitamins and minerals (Table 3).

Table 2. Sources of nutrients from home garden species

Energy	Protein	Fat	Vitamin A	Vitamin C
Avocado	Cashew nut	Avocado	Fruit	Cashew fruit
Banana	Cowpea	Cashew nut	Banana	
Breadfruit	Eggs	Coconut milk	Bitter cucumber	Custard apple
Canna root	Fish	Coconut oil	Canistel	Guava
Cashew nut	Groundnut	Groundnut	Mango (ripe)	Litchi
Cassava	Koro bean	Milk	Papaya (ripe)	Longan
Coconut flesh	Long bean	Butter (ghee, etc.)	Pumpkin	Mango
Coconut oil	Meat			Papaya (ripe)
Groundnut	Milk		Leaves	Pineapple
Jackfruit	Mung bean		Amaranth	Rambutan
Maize	Pigeon pea		Bitter cucumber	Soursop
Rice	Sesbania grandiflora		Cassava	Tomato
Sugar cane	Soybean		Drumstick tree	
Sweet potato	Wing bean		Gnetum gnemon	
Taro root			Papaya	
Yam			Pumpkin	

(Source: Food composition of Nepalese foods, National Nutrition Progamme, DFTQC, 2003/2004)

A selection of different kinds of tree within homestead garden will produce fruit at different times of the year, so the availability of food is spread out. No single food except breast milk in the first six months of life –provides all the required nutrients. Kitchen garden provides vitamin A, Iron, vitamin C, minerals, dietary fibers and some anti-nutritional factors such as phytates, oxalates (spinach), iodine availability reducing factors in Brassicae family too. The latest scientific research has shown that the plant kingdom from home garden is filled with gifts that can help fight off the ravages of chronic diseases. A large group of compounds called phytochemicals (e.g. flavonoids and indoles) found in plants ranging from garlic to cabbage to tea leaves, have shown to help fight disease by preventing the celluar damage caused by chemicals called free radicals. All colourful fruits and vegetables are good for health. Beta-carotenes, the best known as carotenoids, give colour to carrots and other oranges, red or yellow produce and are converted to Vitamin A in human bodies. Lutein and Zeaxanthin (from green vegetables) and lycopene (from tomatoes) may protect against coronary-artery disease, cataracts, mascular degeneration and cancer. Besides Vitamin A can prevent eye related problems such as night-blindness xeropthalmia, it is generally considered to have an impact of around 20-30% in reducing mortality among young children in areas where vitamin A deficiencies is endemic, possibly even among those with sub-clinical deficiency

Table 3. Contribution of foods to daily intake of selected nutrients

Vitamin A (as B-carotene)	Red /orange/yellow fruits and vegetable e.g. papaya, pumpkin, carrots, mangoes etc. Vegetables: Green leafy vegetables e.g. Spinach, coriander etc.
Riboflavin (B_2)	Soybean, nuts, milk and milk products, whole grains, green leafy vegetables, organ meats
Niacin (B_3)	Peanuts, lean meat, fish, poultry
Pyriodoxin (B_6)	Green leafy vegetables, banana, dried beans, potato etc.
Vitamin B_{12}	Organs and lean muscle, fish, dairy products etc.
Folate/folic acid	Dark green leafy vegetables, liver, amaranth, orange, peas etc.
Vitamin C	Citrus fruits, tomato, peppers, leafy green vegetables, potato, papaya, lyche etc.
Vitamin D	Fatty fish, liver, egg yolk, liver
Vitamin E	Vegetable oils, nuts, wheat germ, whole grain cereals, green vegetables, seeds, dried beans
Vitamin K	Broccoli, cabbage, vegetables oils, leafy green vegetables, curd, egg yolk, liver, soybeans, potato
Iron	Meat, liver, blood, green vegetables, cereals, pulses
Calcium	Milk, cheese, legumes, pulses, green leaves
Phosphorous	Milk, cheese, cereal, meat
Potassium	Root vegetables, green vegetables, banana
Zinc	Red meats, cheese, milk, pulses, legumes
Magnesium	Green vegetables, cereals
Copper	Liver, green vegetables
Selenium	Cereals, fish, meat, eggs
Chromium	Red meats, whole cereal products, pulses, spices
Molybdenum	Legumes and pulses
Boron	Vegetables
Non Nutrients (Plant foods) Flavonoids (Carotenoids, poluphenols, bioflavonoids) and salicylate (acetylesalicylic acid; asprin)	Fruits (health benefits associated with prevention of cardiovascular diseases and gastrointestinal cancers) Dark green leafy vegetables, Lycopene in tomato Carotenoids: antioxidant properties Poly phenols: Antioxidants Phyto-estrogen-plant foods-cancer and diabetic retionopathy

(Source: Food composition of Nepalese foods, National Nutrition Progamme, DFTQC, 2003/2004)

DISCUSSION AND CONCLUSION

More than 840 millions people remains hungry around the world and still more suffer from micronutrients deficiencies. Food is source of all nutrients except Vitamin D formation and a few minerals. Fruits and vegetable groups are actually very widely in their nutrient contents. Dark, yellow or orange vegetables or fruits are good source of vitamin-A and Iron. Calcium and magnesium are extremely good at absorbing free radicals and they are essential for strong bones. To achieve this ratio would require eating a very large serving of high calcium greens with almost every meal.

Balanced diets are not accessible for a large proportion of Nepalese population, particularly those who live in rural areas. Many populations subsist on staple plant-based diets that often lack diversity (and also quantity and quantity), which may result in energy and deficiencies. Home gardening can improve nutritional status more specifically on micronutrients status of women and children and poverty reduction, which is one of the appropriate Food-based approaches, could be an essential part of the long-term global strategy to alleviate vitamin A and iron deficiencies but their real potential is still need to be explored. In the context of Nepal, the government should promote home garden as a nutritional garden which can

supply most of a family's nutrition requirements in a sustainable manner.The value of organic food is well appreciated by consumers and home gardening could be good source of healthy fruits and vegetables free from pesticides, fertilizer and genetically modified products.

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Farmer's Experience on Homegarden Improvement

Surya Adhikari

Home garden is a land surrounding the home of a farmer where he gets his daily requirement of fruits, vegetables, fodder, medicinal plants and some plants with religious or cultural value. This land should be utilised by the family to fulfil atleast 20-30% of family requirement due to which same land is used for growing variety of species eg. vegetables, fodder, medicinal plant etc. and the farmer should be aware of these knowledge of his home garden.

Benefits of home garden from farmer's perspective

- Vegetables can be grown in areas facing water scarcity by re-utilizing the water coming out of washing hands, bathing and cleaning utnsils.
- Home garden can provide economic benefit by not purchasing the vegetables from the market.
- Kitchen wastes can be utilised as manure.
- Spaces around the home can be properly utilised.
- It also enhances the beauty of the surrounding.
- Various plants in the home garden can be used for making organic fertilizers, manures and pesticides.
- It also helps in soil improvement and fodder and foliage.

Home garden management is necessary for a farmer to extract these above mentioned benefits. For home garden management, the most and foremost necessary action is to fence the garden by planting green foliages or hedges to prevent from the grazing animals. To prevent the plants from disease and insects mixed cropping and crop rotation is to be done and also use organic fertilizer and pesticides. Farmer can himself make compost of the waste leaves and plants found in his garden.

The organic manure used in his home garden can yield organic fruits and vegetables which in turn can help in improvement of the health of the farmer's family, by enhancing the growth in child, provides energy to the person. THese are highly beneficial to a growing child, pregnant woman and also old people.

These all uses sums up the need and awareness in the farming community to maintain and manage home garden.

Status of Home Gardens of Nepal: Findings of Baseline Survey Conducted in Four Sites of Home Garden Project

Resham Gautam, Rojee Suwal and Pratap Shrestha

ABSTRACT

A baseline survey was carried out in four selected home garden sites (Durbardevisthan of Gulmi, Dudhrakshya of Rupandehi, Gaurigunj of Jhapa and Panchkanya of Ilam) during 2003-2004 to establish bench mark information on farmers' perceived value and existing status (composition, structure, management practices, etc.) of home gardens. We randomly sampled the households of six different strata in a proportionate basis and collected the information. The study was focused on three aspects; factors affecting the home garden species composition/diversity, management practices and the marketing system of home garden produces/products. The result showed that the home garden occupies only a small proportion (2-4%) of the total land possessed by a farmer. The size of these gardens varied from 0.0017 ha to 0.5 ha, where the species diversity was high. We found that species diversity was largely affected by ecological factors like climatic parameters, soil and abiotic stresses, the correlation between them was significantly ($p<0.05$) high. Thus, species composition of home gardens varies with respect to eco-zones. Species diversity was higher in eastern parts than in western parts and in hills than in *Terai* (plain areas in southern parts of country) regions of Nepal. Maximum species diversity (87) was reported in an individual home garden of Ilam. Socio-economic factors like ethnic composition, food culture, migration, commercialization and wealth status influenced species diversity to some extent but not significantly ($p>0.05$). Home gardens without fencing were common. However, this is practiced more in *Terai* regions than in hills. In all the sites, we found farmers primarily using organic manure. The application of chemical fertilizers and insecticides/pesticides was limited to a few selected species in a small amount only. Domestication of various wild plant species was found in home garden that has contributed to increase species diversity and supporting livelihoods. Home consumption was the principal purpose of home gardening and on an average, 60% of the total family consumption of fruits and vegetable was from their own home garden. Marketing of home garden products and surplus was not a very common practice in surveyed sites except in Ilam.

Key words: Home garden, size and composition of homegarden, domestication, diversity, uncultivated species

INTRODUCTION

Home gardens are an integral part of traditional farming systems. Multipurpose species are cultivated to fulfil daily requirements of households in the home gardens and are managed by family members (Shrestha *et al.* 2004). Thus, home gardens play a crucial role for the livelihoods of the communities. Generally, annual and perennial crops are planted, and livestock are raised together in a small space. These gardens have not only been important sources of food, fodder, fuel, medicines, spices, construction materials and income but they have also been an important means for the on-farm management of a wide range of plant genetic resources (Gessler *et al.*, 1996; Hodel *et al*., 1999). Home gardens are dynamic in their evolution, composition and uses. Their structure composition, species and varietal diversity have been influenced by the changes in socio-economic circumstances and cultural values of the users. Furthermore, farmers often use home gardens as site of experimentation, introduction and domestication of plants that farmers like (Engels, 2002; Shrestha *et al.,* 2002; Shrestha *et al.,* 2004).

Despite being an integral part of the Nepalese farming systems and playing an important role in the livelihood of the community, a scientific investigation on the status, roles, and dynamics of home gardens is lacking (Shrestha *et al.,* 2002). Home gardens, therefore, have seldom been treated as important contributors to food security and welfare of farming communities and to the on-farm management of genetic resources by agricultural research and development policies and programmes.

In order to explore roles, importance, and diversity of home gardens in Nepalese farming systems, trace historical changes and/or transformation in these gardens and to understand the effects of ecological and social factors on the structure, composition and dynamics of home gardens, LI-BIRD is implementing a project "Enhancing the Contribution of Home Gardens on On-farm Management of Plant Genetic Resources and to improve the Livelihoods of Nepalese Farmers" in Durbardevisthan of Gulmi, Dudhrakshya of Rupandehi, Gaurigunj of Jhapa and Panchkanya of Ilam.

To establish benchmark information on agro-ecology, socio-economics and plant diversity of home gardens for monitoring changes due to project interventions, a baseline survey was done in all four project sites with the following specific objectives;

- To document species composition of home gardens (species inventory)
- To know about the forms of home gardens and their management activities
- To understand the perception of farmers about home gardens (importance)
- To find out the market status of home garden produces/products
- To provide guidelines for the development of future programme of the project

This paper presents major findings of the baseline studies carried out in those four home garden sites during 2003-2004.

METHODS

The study sites

The study was carried out in Durbar Devisthan (Gulmi), Dudrakshya (Rupandehi) of Western region, and Gauriganj (Jhapa) and Panchakanya (Ilam) of Eastern region (table 1) to provide adequate contrasts in terms of agro-ecosystems and socio-cultural settings.

Table 1. Salient features of the sites selected

Location / Features	Gauriganj-5, Jhapa	Panchkanya 4,5 and 6, Ilam	Dudrakshya 1,8 Rupandehi	Durbardevisthan 2,3 and 5-Gulmi
Eco-zones	Eastern *Terai*	Eastern high hill	Western *Terai*	Western mid hill
Altitude	80 m	1640 m	100 m	800-1500 m
Major Ethnic groups	Mixed: Brahmin, Tajpuria, Subba, Chhetri, Miya, Rajbanshi, Giri,	Mixed: Chhetri, Brahmin, Tamang, Rai	Mixed: Tharu, Newar, Brahmin, Chhetri,	Mixed: Brahmin, Chhetri, KDS
Market access	Medium	Medium	High	Low

(Source: Gautam *et al.*, 2004)

Sample size and Sampling methods

We identified six major strata and selected 90 households proportionately from those strata randomly. Households (HH) were identified as a sampling unit for the survey. As major strata, three categories of economic and resource endowment (rich, medium and poor) and two categories of ethnic composition (*Pahadi*-the hill people and *Terai* community in case of *Terai* Region, *Brahmin/Chhetri* and *Newar/Magar/Rai/Limbu/Gurung/Kami/Damai/Sarki* in

case of Hill region) were considered for the purpose. These strata were defined by the project based on the premise that, economic and social factors influence the use and management of plant genetic resources. Wealth ranking was done prior to the base line survey during the PRA studies of the selected sites based on farmers own criteria. The sampling structure and sample size of different strata are presented in table below (Table 2)

Table 2. Sample HHs from different categories in 4 sites of the home garden project

Wealth category	Ethnic category	Gulmi		Rupandehi		Jhapa		Ilam	
		Total HH	Sampled HH	Total HH	Sampled HH	Total HH	Sampled HH	Total HH	Sampled HH
A	1	181	39	100	14	57	16	42	10
	2	4	1	14	2	32	8	42	11
B	1	107	22	186	26	51	14	42	10
	2	10	3	69	10	25	6	65	16
C	1	87	19	230	32	30	8	30	8
	2	26	6	35	6	140	38	145	35
Total		**415**	**90**	**634**	**90**	**335**	**90**	**366**	**90**

Note: The ethnic categories: For *Terai* region (Rupandehi and Jhapa), 1 is for Pahadia (hill migrants) and 2 for *Terai* community. For Ilam and Gulmi, 1 is for Brahmin/Chhetris and 2 for Rai/Magar/Limbu in Ilam and Kami/Damai/Sarki in Gulmi

Field administration of questionnaires

The staffs involved in the field survey were briefed on the objectives of the baseline study. Tips on data collection and effective data maintenance with appropriate cross checking were given to the staff for the consistency of the data. Each staff was provided with the name lists of the sampled household and social map (indicated with the sampled households) to collect information effectively. Questionnaires were finalized after pre testing in Jhapa and Ilam.

The actual respondent of the household was identified as the one who was involved in most of the decision making in agriculture related matters. Therefore, in some instances, the household head was not necessarily involved in the survey process. In some cases, the interview was conducted with more than one member as well. In order to get more effective, consistent and qualitative data, generally four to five questionnaires were filled per day by an individual. At the end of the day, the filled questionnaires were checked to confirm the completeness and the quality of the information collected.

Data cleaning, editing, and analysis

The filled questionnaires were thoroughly checked by the responsible field staff and the team members. Numeric coding of the filled questionnaires for the data entry was done. Measurements taken in local units were converted to standard units before coding and entering the data. SPSS-DOS data entry module was used for the data entry and SPSS/PC was used for the statistical analysis. Descriptive statistics, chi-square tests and ANOVA were applied for the data analysis.

RESULTS AND DISCUSSIONS

Size of home gardens

We found the home garden size ranging from 17m^2 (0.0017 ha) to 5000m^2 (0.5 ha) and generally larger in the Eastern region than in the western part of the country irrespective of the hills and *Terai* (Table 3). (Sunwar 2003) has reported the average size of home gardens as 434m^2 and 402m^2 in the western *Terai* and mid-hill regions of Nepal respectively. The size of the home gardens is generally small in other countries as well (Eyzaguirre and Linares, 2004). Home garden size ranges from 0.16-0.59 ha in Ghana (Owusu *et al*., 1994),

0.015-0.5 ha in Vietnam (Trinh *et al.,* 2002), 0.01-0.5 ha in Ethiopia (Asfaw, 2002) and less than 0.5 ha in Kerala, India (KSLUB, 1995).

Table 3. Home garden size across different regions

Eco-zones	Size of HG	% of Respondents	
		Ilam	Gulmi
Hills	<250m^2 (<0.5 *Ropani)*	10	88
	250-500m^2 (0.5-1 *Ropani)*	5	10
	>500m^2 (>1 *Ropani)*	85	2
Terai		Jhapa	Rupandehi
	<167m^2 (<0.5 *Kattha)*	31	90
	167-333m^2 (0.5-1 *Kattha)*	24	9
	>333m^2 (>1 *Kattha)*	45	1

Note: *Ropani* and *Kattha* is the locally used land unit in Nepalese hills and Terai respectively.

Only a small proportion, (2-4%) of the total agricultural land was found under home gardens except in Ilam, where it was found 12%. The finding is very similar to that in Vietnam, 4% (Trinh *et al.* 2002) and smaller than in Java, Indonesia, where it occupies 20% of the total arable land (Jensen 1993).

Species composition in home garden

We found a maximum of 87 plant species in a single home garden. More than 80% households have 11-50 species in their home gardens. It was found that species diversity was comparatively high in eastern parts than in western parts and in hills than in the *Terai* region. There was a significant ($p<0.05$) relationship between total species diversity and ecological region. Ecological factors such as temperature, soil type, stresses and other climatic parameters influence the species diversity. Species in home gardens are generally affected by ecological factors, ethnic composition, migration, area of home gardens and wealth status (Shrestha *et al.,* 2002; Sunwar, 2003). We found that the home gardens of Ilam were rich in diversity as more than 60% of the home gardens had more than 30 species whereas in Rupandehi, more than 60% of home gardens had less than 20 species (Table 4).

Table 4. No. of species found in home gardens across agro-ecosite

Total no. of species	Gulmi (%)	Ilam (%)	Jhapa (%)	Rupandehi (%)
1-10	5.6	2.2	8.9	21.1
11-20	32.2	5.6	36.7	40.0
21-30	25.6	32.2	22.2	24.4
31-40	21.1	24.4	18.9	10.0
41-50	10.0	26.7	10.0	4.4
51-60	3.3	4.4	1.1	1.1
61-70	1.1	3.3	1.1	
71-80	1.1	1.1		
81-90		1.1		

Though the correlation between the home garden area, ethnic composition, wealth status and total species diversity was found to be statistically non-significant ($p>0.05$), the general trend shows that there is a higher species diversity in the home gardens of migrants (BC is *Brahmin* and *Chhetris*) than that of indigenous community in *terai*, in resource-rich than resource poor and in large home gardens than in small gardens.

Religiously important plant species like cotton, *tulasi (Ocimum sanctum), Bar (Ficus bengalensis)* and *Pipal (F. religiosa)* were found comparatively higher (14%) in home gardens of Gulmi than in other sites as there is dominance of *Brahmin/Chhetri* communities in the sampled households. Similar findings were reported by Sunwar (2003) in her study. Farmers of Ilam have maintained both the organic-based home garden for home

consumption as well as high input-based commercial gardens focused on a few crops for marketing purposes. There were no significant differences ($p>0.05$) in home gardens of different ethnicity as only a very few species were found linked with distinct culture and food habits. Species like *Pindar (Trewia nudiflora), Kundruk (Coccinea grandis), Lafa (Malva verticillata)* and *oal* (*Amorphophallus campanulatus*) were exclusively found in the home gardens of the *Terai* community in the *Terai* area. Several studies have also reported that many species are maintained in the home garden for their socio-cultural and religious importance (Soemarwoto and Conway, 1992; Hodel *et al.,* 1999; Shrestha *et al.,* 2002; Sunwar, 2003).

The study showed that Nepalese home gardens are vegetable-based, vegetables account for 30-47% of the total species composition (Fig 1). (Sunwar, 2003) has also reported vegetables as a main component of home gardens (47-52%).The home gardens in eastern Nepal contain comparatively a higher number of ornamental plant species than in western regions. Fodder/forage species were higher in hills than in *Terai* regions. Fruit species were found to be comparatively lower in home gardens of Ilam than in other sites.

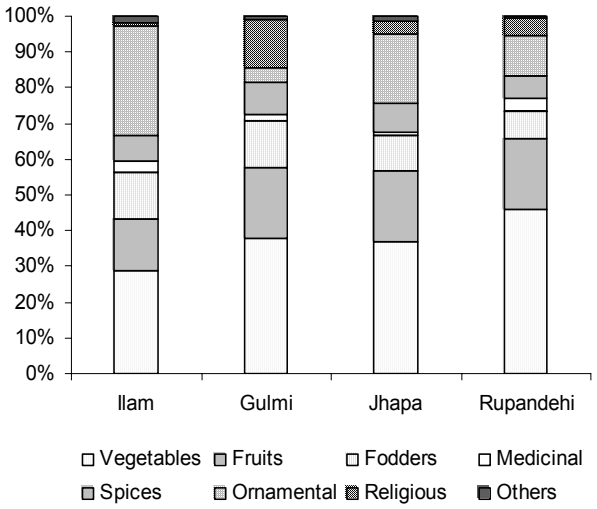

Fig 1. home garden species by use type

The study showed that farmers grow both annual (53-61%) and perennial (37-41%) plants in home gardens.

The most common species of home gardens throughout the sites were radish, broadleaf mustard (BLM), pumpkin, beans and chilli. Site-specific species variation is described below (Table 5).

Table 5. Ten most common species reported in home gardens of different sites

Hill Site				***Terai* Site**			
Gulmi		**Ilam**		**Jhapa**		**Rupandehi**	
Species	Frequency	Species	Frequency	Species	Frequency	Species	Frequency
Potato	67	Chayote	86	Mango	75	Spongegourd	73
BLM	66	Cucumber	81	Spongegourd	74	Cowpea	57
Radish	62	Radish	74	*Kadam*	69	Mango	53
Chili	56	*Dudhilo*	66	BLM	68	Papaya	52
Banana	53	Taro	62	Potato	64	Ridge gourd	52
Beans	49	*Binyee*	62	*Bakaino*	64	Okra	50
Chayote	48	*Akhabare*	55	Banana	59	*Tulasi*	49
Peach	46	Pumpkin	54	Radish	59	Chili,	47
Nimaro	43	Tree tomato	54	Garlic	56	Egg plant,	45
Pumpkin	39	*Nimaro*	53	*Tulasi*	53	Bittergourd	45

Nimaro (Ficus roxburghii), Dudhilo (F. nemoralis), Binyee (Solanum anguivi), Akabare (Capsicum spp*), Kadam (Anthocephalus cadamba), Bakaino (Melia azadiracht)*

Sources of Seeds/planting materials

Home gardeners maintain and keep seeds of 52-70% of the total number of species grown on their home gardens. Rana *et al* (1998) and Shrestha (1998) has also reported that the seed and planting materials of home garden species are maintained by the owners of the home garden themselves. Sunwar (2003) has reported that more than 77% of the planting materials are saved by the farmers themselves. The rest of the required seeds or the planting materials were either purchased from the market or exchanged within the community. They purchased mostly seeds of improved and hybrid varieties, crops of commercial values and those which can not be maintained by the farmers themselves (e.g., onion, carrot etc.). In Ilam where the marketing of home garden produce was common, the seed/planting materials of the marketable species like chayote, *Akabare Khursani, Biyee* etc. were maintained by farmers themselves. Ilam was also rich in ornamental plant species. Seeds and planting materials of ornamental plant species were mostly exchanged among friends and neighbours.

Domestication of wild species

A considerable numbers of species (Rupanedi -11, Jhapa and Gulmi 16 each and Ilam-31) are either already domesticated or are in the process of domestication in home gardens from forest and waste lands for home consumption (Annex 1). Mostly, the species having the medicinal and cultural/religious value are domesticated in the home gardens of hill area and plant species used for vegetable and fruit purposes are domesticated in the home gardens of the *Terai* area. As home garden plants typically have better access to water, an organic based production system is possible providing protection against predators (Harlan, 1975), close monitoring of plant physiology, pest resistance, and adaptation by the household members, the cultivation and domestication of useful wild species results in the garden. Experimentation with growing new species and varieties is a well-known aspect of home gardens and is, in fact, an important contribution to crop improvement and evolution (Engels 2002; Shrestha *et al.* 2002). The present study was limited to the identification of sources of seeds/planting materials and their use values only. However, a detailed study on the status of cultivation and domestication processes followed by the farmers needs to be carried out.

Uncultivated species

Farmers have been using several uncultivated species (species naturally grown around the home gardens the seeds of which are not maintained by the farmers but management is done) for the food supply (Table 5). Most of those species were used as vegetables. *Poi sag* (*Basella rubra), Karmisag* (*Ipomoea* spp.), *Bethe* (*Chenopodium* spp.), Amaranthus, *Jaluka* (wild taro), *Kholesag* (*Rorippa nasturtium*) and *Niuro* (*Diplazium* spp.) are few examples of uncultivated species in home gardens fulfilling the vegetable demands during different seasons. The survey found that uncultivated species contribute about 4% (in Gulmi) to 8% (in Rupandehi) of the total vegetable supply.

Table 6. Number of uncultivated species used for consumption in different sites

	Ilam	**Gulmi**	**Jhapa**	**Rupandehi**
Vegetable species	11	32	25	14
Fruit species	1	4	0	0
Total	12	36	25	14

Management practices of home gardens

Fencing status

Home gardens without fencing are reported as the most common in all study sites. However, fencing was found more in *Terai* regions (49-53%) than in the hills (9-14%). The most commonly used fencing materials were the live fence, wooden stakes and bamboos. Sunwar (2003) has also reported similar results of using fencing materials in the home garden. Generally, fencing was done to protect home garden species from predators (wild animals, domestic animals and thieves) as well as to provide support to creepers. Open grazing practice is common in the *Terai* regions; therefore, we found the fencing of home gardens more common in the *Terai* region (Jhapa and Rupandehi).

Fertilizer and Pesticide application

The use of chemical fertilizers and pesticides/insecticides was limited in home gardens (fig 2). In all surveyed sites, heavy application of organic fertilizer was reported by 100% of the farmers in home gardens. However, supplementary application of chemical fertilizers to the organic fertilizers is common to those species/varieties which were cultivated for the market, these include hybrid varieties of crops like cauliflower, cabbage, tomato, potato, cucumber, aubergine, okra, etc. Use of locally available pest control techniques and materials such as ash, tobacco decoction, kerosene, soap water, cattle urine and *Titepati (Artimisia vulgaris)* were common in home gardens.

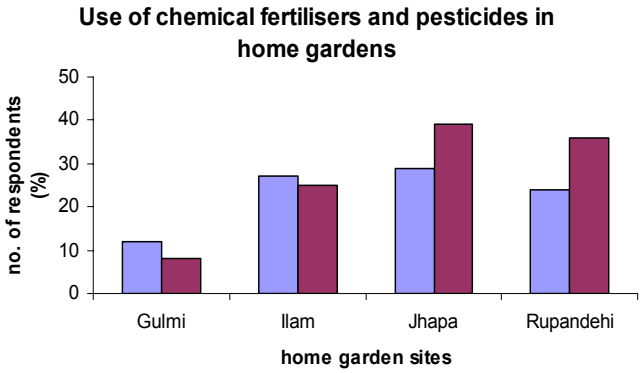

Fig. 2 Use of chemicals in home gardens

Marketing system of home garden species

Home consumption was the principal purpose of home gardening as 60% of total fruits and vegetable consumption comes from the home garden. Marketing the home garden surplus produce was reported to be common only in Ilam site, where more than 80% farmers sell their home garden produce in the market. Only 25%, 10% and 5% of farmers sell their produce in market of Jhapa, Rupandehi and Gulmi respectively. In Ilam, farmers maintained both organic based home gardens for home consumption and market gardens with application of chemical fertilizers and pesticides for market specific species.

The local market (*Haat* bazaar/*Hatiya*) was found to be a dominant market of home garden produce particularly in Jhapa. However, in Rupandehi, the system of marketing home garden produce in *Hatiya* is limited to the farmers from the *Terai* community only. In Ilam, home garden produce are directly collected from their village by the local traders. In Gulmi, there was no system of marketing home garden produce. Lack of market infrastructures and transportation limits the scope of marketing home garden produce in Gulmi.

While marketing of home garden, product is a desirable goal. Besides supporting in family nutrition by supplying fresh vegetables/fruits and dietary diversity, home gardens also contribute to fulfil the basic needs of families by selling the surplus produce.

CONCLUSION

Home gardens are an integral part of Nepalese farming systems. Very rich species diversity is found in home gardens, which merely occupies 2-4% of the total cultivable land. The

species diversity in home garden is affected greatly by the ecological factor. Though the variation in the number of species in home gardens is observed among the different socio-economic categories, the differences are statistically non-significant ($p>0.05$). Home gardens are the major sources of family nutrition as they supply 60% of the total vegetable and fruit demand of the family. Home gardens are mostly organic-based farming system, which utilizes locally available resources for its management. Many species are either already domesticated or are in the process of domestication in the home gardens. This indicates that farmers perceive home gardens as an experimenting site for their own research and also take them as the avenue for adopting/adapting new species/varieties.

Home gardens are never been treated as a production unit and contributors to the national food security by the formal systems as the information related to home gardens have never been the part of national agriculture census despite their importance. Information related to home gardens is available in the publications of Central Bureau of Statistics. There is an urgent need of formulating/reforming the policy considering home gardens as a unit of on-farm management of highly diversified plant genetic resources and also considering home gardens as an integral and important part of the farming systems, which contribute to the food security of particularly the resource poor farmers.

ACKNOWLEDGEMENT

We are greatly indebted to the farmers of different project sites, who provided the information to the study team. The professional team members Dr. Anil Subedi, Dr. Ram Rana and Dr. Pratap Shrestha deserve our acknowledgement for their contribution and suggestions during the development of the survey methodology. We are very grateful to Dr. Bhuwon R. Sthapit IPGRI-APO, Regional Coordinator for the home garden project) for his kind support and guidance in conducting this study. We also thank Mr. Bir Bahadur Tamang, Mr. Balabhadra Poudel, Ms. Durga Gautam, Ms. Bhim K Rai and Ms. Kunta Shrestha for providing field supports during the survey. Mr. S. Basnet deserves special thanks for his outstanding contribution in arranging the field survey and also contributing in the data management. We thank Mr. Parshu BK for his support in data analysis. We would like to express our sincere thanks to Mr. Sanjaya Gyawali for reviewing this paper.

The study is a part of global home garden project, which is coordinated by Biodversity International. The financial support for the Nepal home garden project is provided by SDC. The authors are highly thankful to both of the organisations.

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Annex 1 Domestication of wild species in home gardens

SN	Nepali name	Common Name	Botanical Name	Use value	Parts used	Propagation	Plant type
1. Durbar Devisthan, Gulmi							
1	Marathi		*Spilanthes clava*	spices, medicine	root, branch	vegetative	herb
2	Timoor		*Xanthoxylum armatum*	spices	fruit	seed	shrub
3	Barma Dhaniya	Wild coriander		vegetable, salad	leaf	seed	herb
4	Pudina	Mints	*Mentha* spp	pickle, medicine	leaf	seed	herb
5	Bael	Wood apple	*Aegle marmelos*	religious, medicine	leaf, fruit	seed	tree
6	Ghiu kumari	Indian aloe	*Aloe barbadensis*	medicine	stem	seed	herb
7	Tarwale			medicine	leaf	Veg/seed	herb
8	Ban Tarul	Wild yam	*Dioscorea* spp	vegetable	corm	vegetative	herb
9	Pipla	Long pepper	*Piper longum*	medicine	fruit	vegetative	herb
10	Siplican	Crateva	*Crateva unilocularis*	vegetable, pickle	leaf	seed	tree
11	Kimbu	Mulberry	*Morus alba*	fodder, fruit	leaf, fruit	vegetative	tree
12	Githi	Boehmeria	*Boehmeria rugulosa*	forage, fuel wood	leaf, branch	seed	tree
13	Bojho		*Acorus calamus*	medicine	stem	vegetative	herb
14	Guransh	Rhododendron	*Rhododendron* spp	medicine, decoration	flower, whole plant	seed	tree
15	Pipal		*Ficus religiosa*	religious	whole plant	seed	tree
16	Chakamake			vegetable, pickle	fruit	seed	shrub
2. dudrakshya, rupandehi							
1	Bael	Wood apple	*Aegle marmelos*	religious, fruit	leaf, fruit, stem	seed	tree
2	Pipla	Long pepper	*Piper longum*	medicine, spice	fruit	seed/vegetative	herb
3	Khanyu		*Ficus cunia*	fodder	branch, fruit, timber	seed	tree
4	Chattel		*Momordica cochinchinensis*	vegetable	fruit	Vegetative	creeper
5	Kewa			vegetable	stem	vegetative	herb
6	Pidar		*Trewia nudiflora*	vegetable, medicine	fruit	seed	tree
7	Bayer	Jujube	*Ziziphus* spp	fruit, medicine	fruit	seed	tree
8	Kurilo	Wild Asparagus	*Asparagus* spp	vegetable, medicine	root	seed/vegetative	herb
9	Amrishu	Broom grass	*Thysanolaens maxima*	forage	leaf		herb
10	Koiralo/Tanki		*Bauhinia* spp	Forage, vegetable	branch	seed	tree
11	Jangali parwar	Wild pointed		vegetable	fruit	vegetative	creeper

SN	Nepali name	Common Name	Botanical Name	Use value	Parts used	Propagation	Plant type
		gourd					
12	Kusum	Ceylon tree	*Schleichera oleosa*	forage, fruit	leaf, fruit	seed	tree
13	Amaro	Golden apple	*Spondias pinnata*	Fruit, fuel wood	fruit	seed	tree
14	Amala		*Emblica officinalis*	fruit	fruit	seed	tree
15	Jamun	Surinam cherry	*Eugenia jambolana*	Fruit, fodder/fuelwood	fruit, stem, branch	seed	tree
16	Siplikan	Crateva	*Crateva unilocularis*	vegetable, forage	soft branch, leaf	seed	tree
3. Gauriganj, Jhapa							
1	Pidar		*Trewia nudiflora*	vegetable	fruit	seed	tree
2	Chattel		*Momordica cochinchinensis*	vegetable	fruit	vegetative/seed	creeper
3	Bankhira	Wild cucumber	*Solena heterophylla*	vegetable, pickle	fruit	seed	creeper
4	Badhar		*Artocarpus lakoocha*	fruit, pickle	fruit	seed	tree
5	Kabro		*Ficus lacor*	pickle	fruit	seed	tree
6	Mishrikan		*Pachyrhizus erosus*	fruit	corm	vegetative	creeper
7	Jamun	Surinam cherry	*Eugenia jambolana*	fruit	fruit	seed	tree
8	Ban Dhaniya	Wild coriander		spice	leaf	seed	herb
9	Kacchu	Taro	*Colocasia* spp	Vegetable, pickle	corm, leaf	vegetative	herb
10	Pudina	Mint	*Mentha* spp	pickle	leaf	creeper	herb
11	Rukh alu		*Dioscorea* spp	vegetable	fruit	seed	creeper
4. Panchakanya, Ilam							
1	Pakhanbed	Rockfoil	*Berginia ciliata*	medicine	root	vegetative	herb
2	Jaringo	Sweet belladonna	*Phytolacca acinosa*	vegetable	leaf, stem	seed	herb
3	Simrayo	Watercress	*Nasturtium officinale*	vegetable	leaf, tendril	vegetative	creeper
4	Kurilo	Wild Asparagus	*Asparagus spp*	medicine	root	vegetative	herb
5	Chinde sag			vegetable	tendril	seed	tree
6	Bojho		*Acorus calamus*	medicine	root	vegetative	shrub
7	Pudina	Mint	*Mentha* spp	medicine, vegetable	leaf	vegetative	herb
8	Dungdunge sag		*Allium* spp	vegetable	leaf	vegetative	herb
9	lekako jara			medicine	root	vegetative	shrub
10	Timoor		*Xanthoxylum armatum*	medicine	fruit/seed	seed	tree
11	Punarnama		*Boerhaavia diffusa*	medicine	root, leaf, stem	vegetative	herb
12	Jatamashi	Spike nard	*Nardostachys jatamansi*	medicine	root, leaf, stem	seed/vegetative	shrub

SN	Nepali name	Common Name	Botanical Name	Use value	Parts used	Propagation	Plant type
13	Tune hadchur		*Viscum* spp	medicine	pod/fruit	vegetative	shrub
14	Rukha hadchur		*Viscum* spp	medicine	leaf/skin	vegetative	shrub
15	Hardjoda		*Vanda* spp	medicine	leaf, root	vegetative	creeper
16	Phachayang			medicine	corm	vegetative	herb
17	Khareto jhar			medicine	leaf	seed	shrub
18	Shikari lahara			medicine	leaf, stem	seed	creeper
19	Chiraito	Chiretta	*Swertia chirata*	medicine	leaf, root, stem	seed	tree
20	Madaure aaru			fruit, medicine	fruit, leaf	seed	tree
21		Persimmon	*Diospyros virginiana*	fruit	fruit	seed	tree
22	Lahare anp	Passion fruit	*Passiflora edulis*	fruit	fruit	seed	creeper
23	Jyamire		*Citrus* spp	fruit	fruit	seed	tree
24	Bimero		*Citrus* spp	fruit	fruit	seed	tree
25	Amarbeli	Dodder	*Cuscuta reflexa*	medicine	creeper	vegetative	creeper
26	Dudhilo		*Ficus memoralis*	forage	leaf/stem	vegetative	tree
27	Amrishu	Broom grass	*Thysanolaens maxima*	forage	leaf/stem	vegetative	herb
28	Alainchi	Cardamom	*Amomum subulatum*	spice	fruit	vegetative/seed	herb
29	Betlauri	Costus	*Costus specious*	medicine	corm	vegetative	herb
30	Ghiukumari	Indian Aloe	*Aloe barbadensis*	medicine	leaf	vegetative	herb
31	Kafal		*Myrica esculenta*	medicine	fruit, skin	vegetative	tree

Does Shannon-Weaver Index Explain the Species Diversity in Home Gardens?

Sharmila Sunwar

ABSTRACT

This paper is part of MSc thesis work on home gardens studied. The home gardens of Durbar Gulmi (Mid-hill agro ecology) and Bharsa-Baikunthapur Rupendehi (*Terai* agro ecology) were studied to examine crop species/varietal diversity in home gardens. The study used the following techniques semi-structured interviews, direct observation and focus group discussions to collect primary data. The diversity indices; Shannon-Weaver index (SWI), Evenness index and Simpson's index were employed to determine the species richness, evenness and dominance of the species in the home gardens. Home gardens in the Mid-hill agro ecological zone contained significantly (p=0.001) higher species diversity, *H'*=4.41 (131 species) as compared to home gardens in the *Terai H'*= 4.25 (123 species). Similarly, the species composition in Gulmi is more evenly distributed (J=0.906) as compared to *Terai* (J=0.880). Looking at Simpson's index it was observed that there are more of few common species that have dominated in home gardens in the *Terai* (λ=0.018) than in Mid-hills (λ=0.014). The study suggested that Evenness Index and Simpson's Index helped better interpretation of SWI in explaining species diversity in home gardens in the Nepalese condition.

Key words: Species, Shannon Weaver index, Simpson's index, Evenness index

INTRODUCTION

Home gardens are well-established land use systems within the larger farming systems in Nepal, maintained very close to the homestead (Shrestha *et al.,* 2002). The history of home gardens are not well known in the Nepalese context, but previous studies from other parts of the world define home gardens as traditional farming systems which are among the oldest agro-ecosystems that exist throughout the world (Soemarwoto, 1987; Soemarwoto and Conway, 1992). Species diversity that is of immediate use in the homestead is the most prominent feature of home gardens (Soemarwoto, 1987; Hoggerbrugge and Fresco, 1993). Many home gardens in other parts of the world have been studied and are highly acknowledged for retaining high species diversity (Agelet *et al.,* 2000; Eyzaguirre and Linares, 2001; Nair, 2001 and Vogl-Lukasser *et al.,* 2002; Trinh *et.al,* 2003).

In Nepal, the home gardens play a crucial role in supplying household members with a diversity of different food crops (Rana *et al.,* 1998; Shrestha *et al.,* 2002). There is lack of in-depth knowledge and information on species diversity in Nepalese home gardens. Most of the home gardens around the world have been studied for species richness. The frequency count of individual species is the main basis used to understand species diversity in the home garden. However, Shannon-Weaver Index (SWI) has also been used in some of the study of home gardens for the species diversity (Zaldivar, *et al.* 2002). SWI is the most frequently used tool by many scientists for measuring the species diversity of plant communities, birds, fungi, etc. (Brakenhielm and QingHong, 1995; Cuenca and Meneses, 1996; Parrotta et.al., 1997 and Whitford, 1997).SWI is a numerical measurement of species and can express the diversity within the community and is generally used to compare the diversity of the species. It is one of the simplest and most extensively used diversity indices. The use of SWI to study the plant species richness in Nepalese home gardens is rare. Also Evenness and Simpson's indices are not frequently used. Therefore, the main objective of this study is to measure the crop plant species using diversity indices in home gardens of two different sites: Darbar Gulmi and Bharsa, Baikunthapur, Rupandehi.

MATERIAL AND METHODS

Study sites

The altitudinal variation was one of the major criteria for the study site selection, but the ethnicity, accessibility and community interest were also considered. Dudrakshya Village Development Committee (VDC)[3] of Rupandehi *terai,*[4] *and* Darbar Devisthan VDC of Gulmi mid-hill were selected for the study purpose.

Sampling

Individual households were the sampling units. The households were selected using a simple random sampling technique. One hundred and thirty four households were sampled using the following formula according to Shrestha et al. (1999);

$n = NZ^2 P(1-P)/[Nd^2 + Z^2 P(1-P)]$ where,
n= samples size,
N= number of households in the study village,
Z=the value of normal variable (1.64) for a reliability level of 0.90,
P= the highest possible proportion (0.5),
d= sampling error (0.1)

Table 1. Sample size of the household surveyed for home garden study in the Terai and hill sites of Nepal (n=134). 2003

Ecology	District	Study site	Population Size (HH)	Sample size (HH)	Percent
Terai (approx 100 masl)	Rupandehi	Bharsa	120	43	35
		Baikuntha-pur	140	49	35
Mid-hill (800-1200 masl)	Gulmi	Darbar Devisthan	94	42	44
	Total		***354***	***134***	***38***

The survey consisted of two sections, species information in one section and the demographic information in the other. Finalisation of the questionnaire was made after pre-testing in a village adjacent to the research site. Enumerators scheduled the interview with the respondents with the prior informed consent of two days. The inventory of plant species grown in each home garden was carried out together with the interview with the respondent simultaneously. For quality control, the surveyed questionnaires were edited and revised in different tiers, first by the enumerator himself, then through peer review and editing among enumerators and final editing by the researcher on the same date.

Measurement of crop species diversity

Crop species inventory was recorded at the household level through a household survey and validated by direct observation. Overall crop species diversity was estimated using Diversity Indices (Powers and McSorley, 2000) from the species inventory. The study excluded ornamental species, which do not relate immediately to food security. In many instances, farmers had given local names to the species they harboured in their home gardens and were difficult to identify in some cases. For such cases, the plant samples and photographs

[3] The smallest geographical political units
[4] Terai represents the extension of the fertile indo-gangetic plains extending from east to west of Nepal on the southern plains of the country. It's also known as the 'granary' of Nepal.

were taken and consulted with the taxonomist from Institute of Agriculture and Animal Sciences (IAAS). Therefore, the identification of species is based on the morpho-physiological and taxonomic studies. The current study lacks a molecular study to verify the species diversity due to time and financial limitations.

Data analysis

SPSS for windows version 10.1 was used to produce descriptive statistics of survey data. Shannon-Weaver Index was used to determine the species richness. The index is used to characterise the species diversity in community. It is calculated using the formula $H' = -\sum_{i=1}^{s} p_i \ln p_i$, where s is the number of species in the community and p_i is the proportional abundance of species *i* (= number of species *i* divided by total numbers in the community). The term pi In pi is calculated and summed for each species in the community. With this index diversity increases as: species become more evenly distributed in abundance and more species are added to the community. The maximum value that the SWI can reach depends on the number of species in the community (maximum H'= In s) Evenness index (J= H′/In s) was used to describe the diversity in terms of evenness i.e. how equally abundant the species were in the home gardens. This standardizes evenness on a scale from 0 to 1. Also, Simpson's index ($\lambda = \sum_{i=1}^{s} (p_i)^2$ was used to describe the dominance i.e. the degree that a community is dominated by one or a few common species. The index measures dominance on a 0 to 1 scale. If only one species is present in the community, Pi= λ =1 will be the maximum value. Mann-Whitney U-test was carried out to see the difference in species richness in two ecologies using MINITAB version 13.31.

RESULTS AND DISCUSSIONS

Crop species diversity

A total of 165 different crop species with a mean of 30.77±11.9 from 55 plant families were recorded in 134 home gardens from two agroecological study sites. The *Terai* had a total of 123 crop species (27.1±10.7) whereas 131 species (38.7±10.5) were recorded in the mid-hill. The species numbers was significantly (p=0.001) higher in Gulmi mid-hill than the Rupandehi *terai* ecology. Within *Terai* ecology, the total species of *Baikunthapur* (116 species) was significantly higher (p=0.001) than that of *Bharsa* (92 species). SWI in the mid-hill was higher (*H'* = 4.41) than in the *terai* (*H'* = 4.25). It indicated that the species richness of home gardens in Gulmi Mid-hill is higher than that of the *terai (Table 2)*.The dominance measured by Simpson's Index explained the *terai* ecology (λ = 0.018) home gardens had a relatively stronger dominance of a few species as compared to the mid-hill (λ = 0.014). The Evenness Index revealed the species in the Mid-hill (*J* = 0.906) were more equally abundant and evenly distributed as compared to the *terai* ecology (*J* = 0.880) (Table 2).

Table 2. Shannon-Weaver, Simpson's and Evenness indices estimated for species diversity in *Terai* and mid-hill ecology, 2003.

Ecology	Study sites	Shannon –Weaver Index (*H'*)	Simpson's Index (λ)	Evenness index (*J*)
Terai	Bharsa	4.03	0.022	0.891

	(Tibeto Burmese groups)			
	Baikunthapur (Indo-Aryan group)	4.25	0.016	0.896
	Rupandehi overall	**4.25**	**0.018**	**0.880**
Mid-hill	Gulmi (Indo-Aryan group)	**4.42**	**0.014**	**0.906**

This can be further explained by comparing the counts of the species. Out of the 131 species, 39 were most frequently grown in many of the home gardens in Mid-hill Gulmi whereas, in the *terai*, Rupandehi, out of 123 species only 18 are grown by many farmers in their home gardens (Figure 1). This indicates that only 18 species dominated the home gardens in Rupandehi as compared to 39 in Gulmi. Also the Simpson's Index is higher and Evenness Index is lower in the *terai*, which also show that home gardens of Gulmi are richer in diversity than those of *terai.*

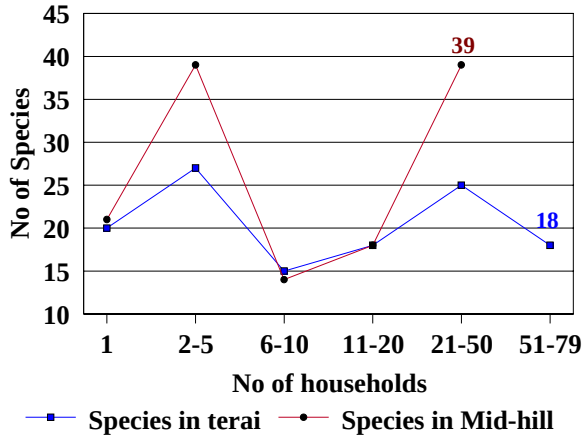

Figure 1 showing the species numbers grown by households

The most frequently reported vegetables species were *Luffa cylindrica* L. M. Roem, *Dolichos lablab* L., *Cucurbita pepo* L. and *Brassica juncea* L, in home gardens of both regions. Similarly, *Capsicum annum* L., *Coriandrum sativum* L. *Allium sativum* L.; *Carica papaya L.* and *Mangifera indica;* L. *Leucaena leucocephala* (Lamk.) de Wit. and *Morus alba* L were frequently reported spice, fruit and fodder species in both of the study sites.

The current assessment of the diversity indicated that the Shannon- Weaver can measure the species richness but it can not explain whether the species are abundant or not. But as a rule, the diversity of the particular location will be higher if the species are distributed equally or are abundant. In another scenario if there is presence of many species and if many of these are grown by few farmers, which only adds to the species richness of the home gardens, it does not explain the diversity richness of the home garden. Similarly, Simpson Index can measure the dominance of the species at a particular community and give the measurement on whether the community is dominated by few species or not. But, this tool too lacks the information on which of the species is dominant in the community. The equal abundant of the species in home gardens can be measured through Evenness Index. Zaldivar *et al*., (2002) have used both used SWI and Evenness Index to measure species diversity in home gardens of Costa Rica. Therefore, the use of all these three diversity indices together gives better measurement on species diversity of home gardens. Proper assessment of species diversity of home gardens is essential, because the species diversity in home gardens can contribute to household food security and provide dietary diversity that ultimately contributes to nutritional security at the household level. Therefore, using Simpson's and Evenness Index with SWI are extremely important in measuring and explaining the species diversity in home gardens. This measurement can help in better

planning for both developmental intervention and on-farm conservation strategies at the community level.

CONCLUSION

SWI provides useful measures of richness for home garden species. The index is used to characterise the species diversity of home gardens. However, it lacks the information on whether the reported species in the communities are distributed evenly, and it cannot explain the evenness and dominance of the species. But while we measure the species richness, it is equally important to understand the evenness and the degree of dominance of species in the community. Therefore, while measuring species richness in home gardens, it is suggested to use other indices, such as evenness index to know how equally abundant the species are in the home garden and Simpson's index to understand the degree whether a community is dominated by one or a few very common species. These three indices together give a picture on the species diversity in home gardens. The information collected on species diversity in home gardens suggested that home gardens could be used as a management and conservation unit for agrobiodiversity. Furthermore, home gardens in study sites are better understood for diversifying the nutrition of rural people through promoting home gardens in order to achieve household food security and on-farm crop conservation of agrobiodiversity.

ACKNOWLEDGEMENT

This work was made possible with the financial support from the Swedish Biodiversity Centre (CBM), Uppsala, Sweden. I gratefully acknowledge Associate Prof Dr Carl-Gustaf Thornstrom and Dr Anil Subedi for supervising me on this research work. My sincere acknowledgement also goes to the farmers of Gulmi and Rupandehi as this work would not have been possible without their support. Thanks are due to LI-BIRD and its staff for providing me an opportunity to carry out the study in its home garden project sites and for their technical, secretarial and logistical supports. I would like to appreciate the contributions and valuable suggestions from Bhuwon Sthapit, Ram Rana, Pablo Eyzaguirre and Marie Bystrom. Similarly, the statistical backstopping and taxonomic verification from Åke Berg, Sanjaya Gyawali and Dharma Dangol are highly acknowledged.

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Status and Composition of Plant Genetic Diversity in Nepalese Home Gardens

Abishkar Subedi, Rojee Suwal, Resham Gautam, Sharmila Sunwar and Pratap Shrestha

ABSTRACT

Home gardens can be considered one of the important centres of experimentation, species domestication, and crop improvements.They represent an important reservoir of diversity of plant species and have immensely contributed to the maintenance, promotion and *in situ* conservation of plant genetic resources. Being an integral part of the Nepalese farming systems and playing an important role in the livelihood of the community, scientific investigations on the states, roles, diversity and dynamics of home gardens are severely lacking. Therefore, a study on home garden diversity in two different agro-ecological zones of Nepal viz. Ilam and Gulmi district (hill) and Jhapa and Rupandehi (*terai*) were surveyed to document the diversity, local status and basic information on use/values. A total of 254 species of 197 genera belonging to 76 families have been taxonomically identified and verified. The list is excluding of the ornamental plants which were 210 species or varieties of flowers. Hill regions' home gardens are comparatively rich in plant diversity and distinct in composition to the ones in *terai* region. Several species of home gardens of Nepal have been maintained for their multiples use-values. In many home gardens across the sites, a large number of wild species have been domesticated for their unique use-values and many home garden species were cultivated in larger system to fetch their market potential. The details of inventory of home garden plant diversity, their composition, diversity, distribution and use-values have been illustrated in the present paper.

Key words: Plant diversity, home garden, conservation, extent, distribution diversity

INTRODUCTION

Home gardens are sources of food and nutrition, and therefore are important contributors to food security and livelihoods of farming communities. Home gardens have been regarded as the micro-environments within the agro ecosystem that preserve the function and resilience of the larger ecosystem. Further, home gardens are important centres of experimentation, species domestication, and crop improvements as well as refuges for unique genetic diversity (Engels 2002). Therefore, home gardens represent a dynamic, complex and multi-layered system, in which farmers can maintain levels of diversity, including cultural, genetic and agronomic diversity over many years.

In Nepal, home garden refers to the traditional land use system around a homestead, where multi-purpose trees, shrubs, herbs, annual and perennial agriculture crops, spices, medicinal, ornamental plants and livestock are managed by family members to fulfil their multiple requirements (Shrestha *et al.,* 2002). About 72% of total households of Nepal have been maintaining home–gardens occupying an area of 2-11% of total land holdings (Gautam *et al.,* 2004).

Despite being an integral part of the Nepalese farming systems and playing an important role in the livelihood of the community, scientific research on the states, roles, diversity and dynamics of home gardens is severely lacking. Due to the lack of information home gardens, have never been treated as important contributors to food security for the welfare of farming communities and to on-farm management of genetic resources by the implementers and policy makers of agricultural research and development. Realizing the contribution of home gardens to maintain biodiversity for food and nutrition security, the

global project on “Enhancing the contribution of home garden to on-farm management of plant genetic resources and to improve the livelihood of Nepalese farmers-Nepal component” was implemented by LI-BIRD/IPGRI in four different sites of Nepal representing *terai* (Jhapa and Rupandehi districts), mid-hills (Gulmi) and high-hill (Illam district) ecosystems.

In order to establish as home garden proper *in situ* conservation strategy, one of the first and essential steps to undertake is the study of the dynamics and distribution of species diversity in particular home gardens and throughout the system at large (Eyzaguirre and Linares 2001). Therefore, documentation of home garden plant diversity was carried out in 90 HHs of each research site to document the diversity, local status and basic information on use/values. In this paper we have prepared an inventory of the home garden species and analyzed their information with reference to two different contrasting agro-geographical regions *viz*. hills and *terai*.

METHODS

Selecting study unit

The house hold survey was conducted to explore information on home garden plant diversity with respect to the ecological zones and different socio-economic settings. Stratified random sampling was followed and a total of 90 households (HHs) were identified for a detailed study in each project site. As major strata, three categories of economic endowment (resource rich, resource medium and resource poor) and two categories of ethnic composition (*Pahadi* and t*erai* in case of t*erai* Region, *Brahmin/Chhetri* and *Newar/Magar/Rai/Limbu/ Gurung/KDS* in case of Hill region) were considered for the purpose. Wealth ranking was done prior to base line survey during the PRA studies of the selected sites (Suwal and Gautam, 2003). Site characteristics and details of methodology used during the selection of sample home gardens of project sites were well discussed by Gautam *et al.,* 2004.

Data collection

Sample home gardens of four sites of the project were visited to see, record and document the extent, distribution and diversity of species. For this purpose, individual interviews were taken with the research home garden farmers on the basis of the format developed by the project during the baseline study. Identification and characterization of intra-specific and inter-specific diversity including local or vernacular names and local use-values were documented on the basis of farmers’ information and field verification. Farmer named varieties were later cross checked with the standard literatures for its botanical identification (Shrestha 1998).

Data analysis

Once the data collection was completed, field data were entered using SPSS-DOS and SPSS-Version 11.0 was used for its analysis. Home garden plant diversity was measured through Shannon –Weaver index (H’) for species richness, Evenness index (J) and Simpson Index (λ).

RESULTS AND DISCUSSIONS

Amount of home garden plants diversity

Although there is a range of different approaches to describe the amount of genetic diversity present in a crop in home gardens or group of home gardens, numbers and identities of local

cultivars present in home gardens provide an obvious starting point in determining the amount of diversity (Hodgkin 2002). A total of 254 species of 197 genera belonging to 76 families have been taxonomically verified and identified as distinct species (Appendix 1) whereas, many intra-specific species or varieties belonging to families such as cucurbitaceae, compositeae, cruciferae, leguminosae and solanaceae could not be identified due to lack of relevant literatures and lack of specific voucher specimens. The above list has excluded the ornamental plants, which consisted of a total of 210 species or varieties of flowers. Therefore, in the following season more taxonomic studies will be carried out to verify the unidentified plant diversity. A complete inventory list of the species recorded from the home gardens is given in Annex 1.

The 20 most common home garden species in each site are listed in Table 1 and ranked according to the frequency of occurrence over all surveyed home gardens. However, potato, bean and pea have been maintained in home gardens can also be found in larger systems.

Table 1. The top 20 most common home garden plants in Nepal

Hill				Terai			
Gulmi	**Freq**	**Ilam**	**Freq**	**Jhapa**	**Freq**	**Rupandehi**	**Freq**
Potato	67	Chayote	86	Mango	75	Sponge gourd	73
BLM	66	Cucumber	81	Sponge gourd	74	Cowpea	57
Radish	62	Radish	74	*Kadam*	69	Mango	53
Chilli	56	*Dudhilo*	66	BLM	68	Papaya	52
Banana	53	Taro	62	Potato	64	Ridge gourd	52
Beans	49	Binyee	62	*Bakaino*	64	Okra	50
Chayote	48	*Akabare*	55	Banana	59	*Tulasi*	49
Peach	46	Pumpkin	54	Radish	59	Chilli	47
Nimaro	43	Tree tomato	54	Garlic	56	Egg plant	45
Pumpkin	39	*Nimaro*	53	*Tulasi*	53	Bitter gourd	45

The total number of species in a single home garden was found to be a maximum of 87 with more than 80% households having the species numbers up to 11-50. It was found that the number of home garden species was comparatively higher in the eastern sites representing the hill region than in western and higher in hills than in the *terai* region. There was a highly significant ($p<0.05$) relationship between total species diversity and the ecological region. The major influencing factors for species diversity are temperature, soil type, stresses and other climatic parameters (Gautam *et al.,* 2004). Thus, the home gardens of Ilam were reported to be the richest as more than 60% of the home gardens had more than 30 species per home garden and Rupandehi to be the poorest where more than 60% home gardens had less than 20 species in a home garden (Table 2) .

Composition of home garden plants diversity

Due to diverse climatic conditions, different socio-cultural settings and multiple necessities of home gardens, farmers have maintained a unique composition of home garden species diversity in their home gardens (Table 3). Across the sites vegetable plant diversity was found the highest. However, for other component of home gardens, it varies according to site specific characteristics. The richness in diversity of ornamental plants is comparatively higher in the hills in comparison to *terai* sites and the use of diverse plant species for religious-cultural purposes was found higher in the *terai* than the hills.

Table 2. No. of species found in surveyed home gardens in four different sites of Nepal

Total no. of species	Gulmi (%)	Ilam (%)	Jhapa (%)	Rupandehi (%)
1-10	5.6	2.2	8.9	21.1
11-20	32.2	5.6	36.7	40.0
21-30	25.6	32.2	22.2	24.4
31-40	21.1	24.4	18.9	10.0
41-50	10.0	26.7	10.0	4.4
51-60	3.3	4.4	1.1	1.1
61-70	1.1	3.3	1.1	
71-80	1.1	1.1		
81-90		1.1		

Table 3. Composition of home garden diversity in different agro-ecological regions of Nepal

	Hill		*Terai*	
Composition	**Gulmi**	**Ilam**	**Rupandehi**	**Jhapa**
Vegetables	65	61	64	58
Ornamental	95	165	46	42
Fruits	46	45	44	38
Fodder	47	30	43	29
Medicinal	30	12	21	20
Spices	14	13	19	14
Religious	22	9	22	14
Others	23	11	10	12
Total Species	**364**	**266**	**224**	**189**

Although the home gardens of the hill region shows comparatively a higher percentage of plant species having multiple use-values, yet, throughout the project sites, most of the home garden farmers have maintained species to meet their needs and specific (single) requirements (Table 4). We have found two different cases in the hill region. In Ilam, 90% of home garden plants are maintained for single purpose whereas in Gulmi a large number of home garden plants have still retained multiple use-values. The reasons behind this may have several factors such as access to planting materials through formal or informal sources, abundance of perennial crops and market potential of home garden plants linked with the specific socio-cultural settings and the agro-ecology. Mostly, the perennial crops like fodder tree, root-crops, spices and ornamental plants have been reported by farmers for their multiple use-values. Mulberry, *Asuro* (*Adhatoda vasica*); sugarcane, turmeric, ginger, garlic, amaranthus and yam are some of the examples of the species grown in the home gardens across the project sites for their multi-use values. The multiple use patterns of home garden species is similar to the ones reported from Southern Vietnam, where many root and tree crops have been reported for their multiple use-values (Hodel *et al.,* 1999).

Table 4. Extent of multiple-use values of home garden species

	Hill		*Terai*	
Use/Values	**Gulmi (%)**	**Ilam (%)**	**Rupandehi (%)**	**Jhapa (%)**
1	65.9	90	73.1	88.3
2	26	8	20	11.3
3	7.2	1.03	6.9	0
4	1	0	0	0.4
Total	100	100	100	100

1 = Species having a single use value only
2-4 = Species having multi use values (2-4) respectively

Genetic diversity in home garden species

The measurement of genetic diversity in home gardens of hill and *terai* sites has shown that home garden species found in hill regions have more diversity than those in the *terai* eco sites (Table 5). This was reflected due to high values of species richness (H'), evenness (J) and low values of dominances (λ). It may be due to diverse agro-geographical conditions in hill regions creating different micro-environments suitable for diverse species to maintain in the home gardens while the *terai* region represented more uniform agro-geographical conditions and limited options available for the farmers to grow different home garden species. Similarly, at individual sites level, the home garden species recorded from Ilam of the hill region and Jhapa of the *terai* region have shown comparatively more diversity than other sites of the respective regions. The easy access to the market and well institutionalized system of marketing of home garden species in both sites may have resulted high diversity in home garden species. In Rupandehi site only a few *Pahadiya* community farmers were found to be involved in selling their home garden species in the local weekly market '*Hatiya*' and in Gulmi there is no access to the market, farmers still used the home garden species for the domestic consumption only.

Table 5. Shannon-Weaver (H'), Evenness (J) and Simpson Indices (λ) estimated for home garden species diversity in two different agro-ecological zones of Nepal

Diversity indices	Hill			Terai		
	Gulmi	Ilam	Total	Rupandehi	Jhapa	Total
H	4.642892	4.933305	5.162597	4.398174	4.64889	4.788248
J	0.866763	0.847204	0.843824	0.858353	0.841359	0.823977
λ	0.013159	0.011034	0.008959	0.017158	0.014853	0.013442

Diversity in different compositions of home gardens across the sites has shown that vegetables and ornamental plants were found in the highest diversity across the regions. However, in two different agro-ecological regions the case differed (Table 6 & 7). This is also reflected in the different compositions of home garden species in two different agro ecological regions. In the hills, the great diversity was recorded in vegetables, religious plants, ornamental and fodder species while in the *terai* it was found the highest in vegetables, ornamental and fruit trees.

Extent and Distribution of home garden species diversity

Distribution and use of vegetables

In the home gardens surveyed, a total of 94 different vegetables were recorded, and it represents the major composition of Nepalese home gardens. The twenty five most common vegetables in two different agro-ecological zones were provided according to their frequency distribution in the home gardens (Table 8). This shows the distinct abundance of different species in home gardens in different agro-ecological zones. Over 50% of the total surveyed home gardens have grown radish, potato, cucumber and taro in hills whereas sponge gourd, okra, broad leaf mustard and radish have been maintained in the *terai*. Vegetables like potatoes, cowpeas and peas have been grown in larger systems and also maintained in home gardens.

Different plant parts of vegetable species such as green leaves, young shoots, petioles, flowers/inflorescence, fruits/pods and root-tubers are consumed to meet the daily food and nutrition requirements of family members.

- Green leaves: Broad leaf mustard, amaranthus, *bethe* (*Chenopodium album*), radish, spinach, fenugreek, *chamsur* (*Lepidium sativum*), *tori* (*Brassica campestris* var. *toria*), coriander, watercress, lafa sag (*Malva verticilata*), lettuce, swis-chard, *lude kanda* (*Amaranthus viridis*).

Table 6. Shannon-Weaver (H'), Evenness (J) and Simpson Indices (λ) estimated for home garden species composition diversity in hill agro-ecological zones of Nepal

Sites	Diversity indices	Vegetable	Ornmtl	Fruits	Fodder	Med. Plants	Spices	Religious	Others
Gulmi	H'	3.49212	3.26654	2.90606	3.06274	2.78751	2.23028	3.39664	1.49433
	J	0.83968	0.86321	0.78255	0.81943	0.91558	0.75746	0.85551	0.64898
	λ	0.04014	0.06744	0.07329	0.06457	0.08	0.13221	0.04714	0.39031
Ilam	H'	3.22245	4.03064	3.09426	2.99251	2.91561	1.94109	1.06653	2.7297
	J	0.78389	0.80021	0.83323	0.78612	0.87498	0.78115	0.54809	0.8831
	λ	0.05324	0.03187	0.05844	0.07576	0.07628	0.1731	0.43260	0.08780

Ornmtl-ornamental

Table 7. Shannon-Weaver (H'), Evenness (J) and Simpson Indices (λ) estimated for home garden species diversity in *terai* agro-ecological zones of Nepal

Sites	Diversity indices	Vegetable	Ornmtl	Fruits	Fodder	Med. Plants	Spices	Religious	Others
R'dehi	H'	3.38427	3.03677	2.79065	2.62232	2.43869	2.02870	2.07504	2.20479
	J	0.84452	0.82322	0.76717	0.77876	0.81405	0.76872	0.67131	0.95753
	λ	0.04301	0.07902	0.08827	0.11674	0.13301	0.18091	0.23765	0.12426
Jhapa	H'	3.45227	3.79127	2.95196	2.4335	2.34574	1.88156	1.3883	1.64366
	J	0.85763	0.83448	0.78484	0.72269	0.94399	0.73357	0.52606	0.71383
	λ	0.04271	0.03962	0.08075	0.14089	0.11	0.17993	0.43698	0.28653

R'dehi – Rupandehi, Ornmtl-ornamental

Table 8. Comparative distribution of 25 common home garden vegetables across the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			*Terai* region (Jhapa and Rupandehi)		
Botanical name	**Nepali name**	**Freq (%)**	**Botanical name**	**Nepali name**	**Freq (%)**
Raphanus sativus	Mula	76.11	*Luffa cylindrica*	Ghiraula	81.67
Solanum tuberosum	Aalu	66.67	*Hibiscus esculentus*	Bhindi	61.67
Cucumis sativus	Kakra	57.78	*Brassica juncea* var. *rugosa*	Rayo sag	60.56
Colocasia spp.	Pindalu	56.67	*Raphanus sativus*	Mula	50.56
Sechium edule	Skush	48.33	*Vigna catjang*	Bodi	47.78
Brassica juncea var. *rugosa*	Rayo sag	40.00	*Solanum tuberosum*	Aalu	46.67
	Rire	36.67	*Cucurbita maxima*	Farsi	43.89
Spinacia oleracea	Palungo	35.56	*Colocasia* spp.	Karkalo	39.44
Solanum anguivi	Bein	34.44	*Solanum melongena*	Bhanta	36.67
Cucurbita maxima	Farsi	34.44	*Brassica oleraces* var. *botrytis*	Fulcopi	31.11
Brassica rapa	Salagam	30.00	*Lycopersicum esculentum*	Tamatar	31.11
Vigna catjang	Tane bodi	29.44	*Momordica charantia*	Karela	30.56
Brassica oleraces var. *botrytis*	Cauli	28.89	*Lagenaria siceraria*	Lauka	30.00
Phaseolus vulgaris	Simi	28.33	*Brassica oleracea* var. *capitata*	Banda	28.89
Urtica dioca	Sisnu	27.78	*Luffa acutangula*	Tirahi	28.33
Foeniculum vulgare	Saup	26.67	*Dolichos lablab*	Hiude simi	26.11
	Toraya	23.89	*Dioscorea* spp.	Tarul	21.67
Vigna catjang	Bodi	23.33	*Phaseolus vulgaris*	Simi	20.00
Luffa cylindrica	Ghiraula	22.22	*Coriandrum sativum*	Dhaniya	16.67
Dioscorea spp.	Gittha	20.00	*Benincasa cerifera*	Kubhindo	16.11
Solanum melongena	Bhanta	18.33	*Allium cepa*	Pyaj	15.56
Vicia faba	Bakulla	18.33	*Capsicum* spp.	Khorsani	13.33
Cyclanthera pedata	Chuche karela	18.33	*Allium sativum*	Lasun	12.78
Lycopersicum esculentum	Tamatar	18.33	*Coccinea grandis*	Kundruk	11.67
Momordica charantia	Karela	16.11	*Cucumis sativus*	Kakra	11.11

- Young shoots: *Poi sag* (*Basella rubra*), taro, fern, asparagus, chayote, pumpkin, balsam apple, peas and j*aringo* (*Phytolacca acinosa*) are used for domestic and commercial purposes.
- Flower/inflorescence: Cauliflower, brocauli, pumpkin, *koiralo* (*Bahunia varigata*) and banana.
- Fruits and pods: Beans, peas, cucurbits (Cucumber, gourds, pumpkins,) *pindar* (*Trewia nudiflora*), *kundru* (*Coccinea grandis*), tomato, tree-tomato (*Cyphomendra betacea*), *bihi* (*Solanum anguivi*) and capscicum are used as vegetables.
- Root-tuber crops: Yam, sweet potato, potato, taro, Oal, Tree-yam, chayote.

Distribution and use of fruit plants

Nepalese home gardens consist of a large number of fruit species of both tropical and temperate origins. Nepalese fruit trees have also been used for multiple purposes such as

fodder, fuel wood, hedge and shade purposes. Fruit orchards in Nepal are known by vernacular names, '*Bagaicha*' in valleys and hills and '*phulbari*' in the *terai* region (Shrestha *et al*. 2002). In the *terai* region fruit trees are planted around the home area so that they provide a good hedge function and also protect people from extreme temperatures during summer. The present study has recorded a total of 64 different fruit species from across the sites. However, the hill region has comparatively a higher number of inter-specific diversity of fruit trees than in *terai* regions since this region is characterized by a great variation in topography. Therefore, valleys, streams, river gorges, forests, different slope aspects and agricultural landscape have created diverse micro-environments in the hills from where domestication and introduction of fruit trees may have taken place. The most common 20 fruit species in two different agro-ecological zones are given in Table 9. It shows that a distinct abundance of temperate fruits like Prunus, Pyrus, Citrus are frequently found in the hill while Mango, Banana, Jack fruits, Papaya are frequently recorded in the *terai* region. There are a few types of fruits which have shown a wide distribution across the regions; such as lemon and peach are recorded from the wider altitudes variation of study sites.

Table 9. Comparative distribution of 20 common fruit species in home gardens of the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			***Terai* region (Jhapa and Rupandehi)**		
Botanical name	**Nepali name**	**Freq (%)**	**Botanical name**	**Nepali name**	**Freq (%)**
Prunus persica	Aaru	47.22	*Mangifera indica*	Aanp	71.11
Psidium guajava	Amba	42.78	*Musa spp.*	Kera	38.33
Musa spp.	Kera	37.22	*Pachyrhizus erosus*	Misrikan	30.00
Citrus aurantifolia	Kagati	32.22	*Citrus spp.*	Amilo	27.78
Citrus reticulata	Suntala	28.33	*Psidium guajava*	Amba	26.67
Carica papaya	Mewa	26.67	*Carica papaya*	Mewa	16.11
Pyrus communis	Naspati	22.78	*Annona squamosa*	Sarifa	15.56
Prunus domestica	Aalcha	20.56	*Ananus comosus*	Bhui katahar	11.67
Mangifera indica	Aanp	20.00		Suthuni	11.67
	Amilo	20.00	*Angle marmelos*	Bel	10.56
Mallus domestica	Apple (?)	11.11	*Artocarpus heterophyllus*	Rukh katahar	10.56
Prunus domestica	Aaru bakhada	9.44	*Pithecellobium dulce*	Jilebi	6.67
	Pustakari	8.33		Kaichi	6.11
Vitis vinifera	Angur	7.78	*Citrus aurantium*	Nibuwa	6.11
Citrus limon	Jyamir	6.11	*Zizyphus jujuba*	Bayar	5.56
Pyrus pashia	Mel	6.11	*Citrus reticulata*	Suntala	5.56
Punica spp.	Darim	5.56	*Prunus persica*	Aaru	5.00
Passiflora edulis	Lahare aanp	5.00	*Phyllanthus emblica*	Amala	5.00
Citrus sinensis	Mausam	5.00	*Cicca acida*	Kansi amala	5.00
Litchi chinensis	Litchi	4.44	*Spondias cytheria*	Amaro	4.44

Distribution and use of fodder species

Nepalese home gardens are unique due to integration of fodder trees primarily for livestock purposes. A total of 62 species of fodder trees were recorded from the surveyed home gardens. The most common 15 home garden fodder species are given in Table 10. From the study it was found that *terai* region is poor in fodder species diversity in comparison to the hill region. The composition of fodder trees in the two different regions have shown that the hill region is characterized by the dominance of different species of *Ficus* while species like *Bakaino* (*Melia azederach*) and *Kadam* (*Anthocephalus cadamba*) are dominant in the terai. In the hills, where fuel wood is scarce, fodder trees are being used as a supplementary to this. Fodder species like broom grass and bamboo are planted in the home garden to protect

land from soil erosions and landslides due to extreme slope aspects (natures) of mid-hill land.

Table 10. Comparative distribution of 15 common home garden fodder species across the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			*Terai* region (Jhapa and Rupandehi)		
Botanical name	**Nepali name**	**Freq (%)**	**Botanical name**	**Nepali name**	**Freq (%)**
Ficus semicordata	Khanyu	40.56	*Melia azederach*	Bakaino	38.89
Ficus nemoralis	Dudhilo	38.33	*Anthocephalus cadamba*	Kadam	29.44
Ficus roxurghii	Nimaro	29.44	*Morus alba*	Kimbu	20.00
Thysonaleana maxima	Amriso	24.44	*Bambusa* spp.	Baans	16.67
Litsea polyantha	Kutmiro	22.22	*Leucaena* spp.	Ipil-ipil	13.89
Garuga pinnata	Dabdabe	20.00	*Dalbergia sisoo*	Sisaoo	11.11
Morus alba	Kimbu	19.44	*Euphorbia hipsida*	Tote	10.00
Prunus cerasoides	Painyu	19.44		Dhanasi	7.78
Saurauria napaulensis	Gogan	17.78	*Artocarpus lokoocha*	Badahar	5.56
Bambusa spp.	Bans	17.22	*Albizia lebbeck*	Siris	4.44
Ficus clavata	Bedulo	17.22	*Bauhinia purpurea*	Tanki	4.44
	Hamal	12.78	*Ficus semicordata*	Khanyu	3.89
Erythrina arborescens	Pahaledo	11.11	*Ficus racemosa*	Dumri	3.33
Ficus sp.	Pate bar	11.11	*Ficus lacor*	Kabro	3.33
Ficus lacor	Kabro	8.89	*Garuga pinnata*	Dabdave	2.78

Distribution and use of medicinal plants

Our study was focused on plant inventory and diversity studies, therefore, the state of local knowledge and practices on use-values including their ethno-botany of medicinal plants have yet to be carried out in depth by the project. In the survey across the four sites, a total of 52 different medicinal plants were recorded for their specific local use-values. The plants which are exclusively used for their medicinal purposes are listed in Table 11. Various parts of medicinal plants such as roots, root-tubers, rhizomes, stems, leaves, flowers, seeds and the whole plants are being used to cure different diseases and injuries. The diversity of medicinal plant is comparatively higher in Gulmi site and many medicinal plants were also found to have been maintained for their religious, spices and ornamental purposes. High-valued medicinal plants which are commercially exported from Nepal such as *Pakhanvedh, Hadchur* and *Thulo okhati* in Ilam were found grown in the home gardens, collecting the planting materials from the wild.

Distribution and use of spices

Spices are an essential component in daily food recipes of Nepalese farmers. Spices are being widely used for flavours in vegetables, meat, dal, pickle, etc. These are also used as an appetizer. A total of 20 different species of spices have been recorded from the surveyed home gardens. Out of them different varieties of chilli, ginger, garlic, onion, turmeric, perilla, and coriander are the most frequently grown spices in Nepal (Table 12). In Ilam site the sale of some indigenous varieties of chilli such as *Akbare khursani* (*Capscicum* sp.), ginger and turmeric has become one of the major sources of cash income. In the *terai* region, garlic, onion and coriander have been grown for commercial scale.

Table 11. Comparative distribution of 10 common home garden medicinal plants across the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			*Terai* region (Jhapa and Rupandehi)		
Botanical name	**Nepali name**	**Freq (%)**	**Botanical name**	**Nepali name**	**Freq (%)**
Berginia ciliata	Pakhanvedh	9.44	*Azadirachata indica*	Nim	8.89
Cannabis sativa	Gaja	6.67	*Ocimum sanctum*	Tulasi	7.22
Astilbe rivularis	Thulo okhati	5.56	*Acorus calamus*	Bojho	3.89
Artemisia vulgaris	Tite pati	5.00	*Ocimum basislicum*	Babari	3.33
Viscum articulatum	Hadchur	3.89	*Sesbania cannabina*	Dhaicha	2.22
Ocimum sanctum	Tulasi	3.89	*Artemisia vulgaris*	Tite pati	2.22
Aloe barbadesis	Ghiukumari	2.78	*Aloe barbadesis*	Ghiukumari	1.67
	Kera tarul	2.78	*Cuscuta reflexa*	Aakas beli	1.11
Urtica dioca	Sisno	2.78	*Calotropis gigantea*	Aank	1.11
Nicotiana tobacum	Kancho pat	2.22		Belchanda	1.11
Adhatoda vasica	Asuro	1.67		Biruwa	0.56

Table 12. Comparative distribution of 10 common home garden spices across the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			*Terai* region (Jhapa and Rupandehi)		
Botanical name	**Nepali name**	**Freq (%)**	**Botanical name**	**Nepali name**	**Freq (%)**
Capscicum spp.	Khorsani	50	*Capscicum* spp.	Khorsani	35.56
Zingiber officinale	Aduwa	40.56	*Curcuma longa*	Besar	33.89
Allium sativum	Lasun	39.44	*Allium sativum*	Lasun	30.56
Curcuma longa	Besar	35.00	*Allium cepa*	Pyaj	25.56
Perilla frutescens	Silam	32.22	*Coriandrum sativum*	Dhaniya	13.33
Allium cepa	Pyaj	31.67	*Zingiber officinale*	Aduwa	5.56
Coriandrum sativum	Dhaniya	9.44	*Perilla frutescens*	Silam	2.78
Allium spp	Dungdung	3.33	*Sesamum indicum*	Til	2.78
	Jojo	3.33		Ban dhaniya	1.67
Foeniculum vulgare	Saup	3.33	*Mentha* sp.	Pudina	1.67

Distribution and use of religious plants

Different socio-cultural settings of the project sites have contributed to the diversity in use of home garden plants for their religious and cultural use. A total of 32 different religious plants were recorded from the surveyed sites. Many religious plants were also being used as spices and for ornamental purposes. The 10 most-widely grown religious plants are given in Table 13. It shows distinct variation in relative dominance of different species of religious plants in hill and *terai* regions. However, *tulsi* (*Ocimum sanctum*) is the only species, which was found the most common throughout the project sites.

Distribution and use of ornamental plants

Ornamental plants are an integral part of Nepalese home gardens. A large number of exotic and indigenous ornamental plants have been planted for their aesthetic values, and many of them have been used for religious ceremonies and traditional purposes. A total of 210 species of ornamental plants have been recorded from the surveyed home gardens. The hill region retains a higher diversity of ornamental plants than the *terai* region. Ilam site is exceptionally rich in ornamental plant diversity and each household has an average of 30 different types of ornamental plants. The most frequently grown ornamental plants are given

in Table 14. In both the regions marigold, chrysanthemum and rose have been found as the most common flowers.

Table 13. Comparative distribution of different common species used as religious purposes across the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			***Terai* region (Jhapa and Rupandehi)**		
Botanical name	**Nepali name**	**Freq (%)**	**Botanical name**	**Nepali name**	**Freq (%)**
Ocimum sanctum	Tulasi	30.56	*Ocimum sanctum*	Tulasi	28.89
Curcuma longa	Besar	20.56	*Gossypium arboreum*	Kapas	14.44
Saccharum officinarum	Ukhu	17.22	*Ficus religiosa*	Pipal	7.22
	Rato pate	13.33	*Sesamum oreintale*	Til	2.22
Tagetes erecta	Thungeful	10.56	*Babusa tulda*	Baans	1.67
	Lal kori	9.44	*Ficus benghlensis*	Bar	1.11
	Keraful	8.89	*Aegle marmelos*	Bel	1.11
Dahalia sp.	Lauri ful	8.89	*Alstonia scholaris*	Chhatiban	1.11
Mentha arvensis	Babari	6.11	*Dahalia* sp.	Lahureful	1.11
Gossypium arboreum	Kapas	5.56	*Artemisia vulgaris*	Patiful	1.11

Table 14. Comparative distribution of different common species used as ornamental purposes across the two different agro-ecological regions of Nepal

Hill region (Ilam and Gulmi)			***Terai* region (Jhapa and Rupandehi)**		
Botanical name	**Nepali name**	**Freq. (%)**	**Botanical name**	**Nepali name**	**Freq. (%)**
Tagetes spp.	Sayapatri	48	*Tagetes* spp.	Sayapatri	50
Rosa sp.	Rose	41		Tiure ful	19
Chrysanthemum sp.	Godawari	34	*Rosa* sp.	Rose	19
Nephrolepsis cordata	Pani amala	26		Baramase	16
Cymbidium spp.	Orchid	23	*Gomphrena globosa*	Makhamali	14
	Tarabare	21		Bhale ful	14
Ipomea sp.	Lahare ful	17		Karotin ful	12
Fuschia sp.	Ghanti ful	17	*Fuschia* sp.	Ghanti ful	11
Gomphrena globosa	Makhmali	16	*Chrysanthemum* sp.	Godawari	11
Cupressus torulosa	Dhupi	16		Pyaje phul	11

CONCLUSION

Home gardens of two different agro-ecological zones of Nepal have retained a unique diversity in herbs, shrubs, trees, root-tuber crops and climbers' species. Diverse agro-geo climatic conditions, different socio-cultural settings and multiple necessities of home gardens farmers have found them as the major factors which have contributed to the high plant diversity in Nepalese home gardens. Hill regions home gardens are comparatively rich in plant diversity than the *terai* region. Further, they are distinct from the *terai* for being rich in diversity of vegetables, religious plants, ornamental and fodder species while *terai* home gardens are rich in vegetables, ornamental and fruit trees diversity. A several species of home gardens in Nepal are maintained for their multiple use-values. This has not only contributed for the maximum utilization of the limited space available for home gardens development but also to the minimization of the extra input requirement. Home garden species like *Pindar* (*Trweia nudiflora*) and *Kundru* (*Coccinea grandis*) were found associated with the *terai* community farmers only. In many home gardens across the sites, a large

number of wild species have been domesticated for their unique use-values such as medicinal properties, vegetables during dry seasons, etc. while a large number of home garden species were cultivated in a larger system to fetch their market potential. Therefore, home gardens can be considered as one of the most important centres of experimentation, species domestication, and crop improvements. They represent an important reservoir of diversity of plant species and have immensely contributed to the maintenance, promotion and *in situ* conservation of plant genetic resources.

ACKNOWLEDGEMENT

We extend our sincere gratitude to farmers of surveyed sites for their support and contribution during the field visit. We thank Mr. S. Basnet for the data compilation and Mr. P. Biswakarma for the data analysis. Mr. B. Paudel, Mrs. D. Gautam, Mrs. K. Shrestha, Mrs. BK. Rai are thankfully acknowledged for their field support. We are especially thankful to Mr. S. Gayawali for sharing his knowledge on statistical tools and Dr. BR Sthapit for reviewing this paper. Finally, we are grateful to SDC Nepal for their fund support to carry out this study.

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The Role of Gender in the Home Garden Management and Benefit-Sharing from Home Gardens in Different Production System of Nepal

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ABSTRACT

The maintenance and management of activities in home garden are highly gender based. The gender roles also depend on the ethnic and cultural setting of the community. However, in depth understanding of the importance and influence of gender to the management of home gardens is lacking in Nepalese context. A study was conducted in Dudrakshya village of Rupandehi district and Durbar Devisthan village of Gulmi district in order to identify the gender role under different socio-economic categories (rich, medium and poor) of farmers in management and benefit sharing from home gardens. The data was collected through Focus Group Discussions. Separate Focus Group Discussions for each categories farmer including male and female farmers in each eco site were conducted. The finding showed that in Gulmi, both male and female were equally responsible in overall home garden management in all categories but in decision making for homegarden management the role of male and female differed according to categories. It was found that male and female were equally responsible in rich and medium categories but in poor category females were more responsible for home garden management. Both genders were equally benefited in rich category whereas male in medium and children in poor category were more benefited from home garden. But male and female equally control over the benefits from home garden in rich, male controlled more in medium and female controlled more in poor category. In Rupandehi, female were more responsible and prime decision maker for home garden management in indigenous group but both gender were equally responsible in labour division as well as decision making in migrant group. Male have more access to resources and control of resources than female in both area and ethnicity. Benefit derived from home garden was higher in male in medium and poor categories of migrant group and rich and medium categories of indigenous group whereas rich migrants group and poor indigenous group female were more benefited. But the controlled of benefit from home garden was higher in male in both rich and medium category whereas female in poor category.

Key words: Decision-making, gender, Gender role, home garden

INTRODUCTION

Agriculture is predominantly women's activity in rural Nepal. Agricultural sector still shares a large portion in the national economy. Women are contributing major portion (55-88 %) compared to men (40.80 %) to the National agriculture labour (WFDD, 2001). Gender is the socially constructed roles and responsibilities assigned to men and women in a given culture/ location and the societal structures that support them. Gender roles are the assigned activities and relative position in society for men and women. Gender analysis refers to the variety of methods used to understand the relationships between men and women, their access to resources, their activities, and the constraints they face relative to each other.

From an ecological and land use perspective, home gardens involve the management of multipurpose trees, shrubs, annual and perennial agricultural crops, herbs, spices, medicinal plants, fish ponds and animals on the same land unit, in a spatial arrangement or on a temporal sequence (Eyzaguirre and Linares, 2004). In Nepal, Home garden refers to the traditional land used practices around a homestead where several species of plants are planted and maintained by member of the household and their products are intended primarily for household consumption. They are locally termed as *bari* in *terai* and *gharbari* in

the hills area of Nepal (Shrestha *et al*. 2002). The study sites comprises an area around homestead where crops (maize), vegetables, fruits, medicinal, spices, fodder, livestock and other plant species are grown on the same land units in a spatial and temporal sequence. The maintenance and management of activities in home garden are highly gender based and women are mostly responsible for home garden. Similarly, in Nepal's context women occupy an important place in terms of management and sharing of benefits from home garden, as they are involved in providing foods for household. Gender roles however depend upon the type and component of home garden too by brining new plant species from parental home (Subedi *et. al* 2003a and Shrestha *et al.* 2002). Different genders in the households have different roles and objectives. Gender tasks, needs, interests and responsibilities in agriculture; usually differ by sex and from one household to another. In most societies, men and women differ in the activities they undertake, in access and control over resources, and in participation in decision-making. Experience indicates that in many parts of the Nepal, resources, opportunities and decision-making possibilities are less available to women than men.

Women's particular responsibility for the management of home gardens has been extensively documented in other parts of the world (Boncodin and Vega, 1999 in LI-BIRD and IPGRI, 2002). It has been observed that in the hill and mountain regions of Nepal, women play an important role in the management as well as benefit sharing from home gardens, due to their responsibility in ensuring household food security. The gender role, however, also depend on the ethnic and cultural background as in the *terai* community where men have been found to play an equally important role in the management and introduction of new diversity in the home gardens (Subedi, *et al.,* 2003a). However, indepth understanding of the importance and influence of gender to the management of home gardens is lacking. Therefore, an analysis of the gender dimension, decision-making process and benefit- sharing in home garden is essential. A study was done in Rupandehi and Gulmi districts to identify the gender roles and decision making on management and benefit sharing from home garden among different categories of farmers in each site.

METHODS

For gathering the required information following methods were followed.

Literature Review

Before conducting the study, an activity protocol was prepared to understand the nature of the study and concept about the gender. During the time of protocol preparations different relevant literatures on gender roles and decision-making were reviewed. After the protocol development, checklist was prepared for the study in consultation with project staff.

Focus Group Discussions

The study was conducted separately on three categories of economic endowments (Category A for resource rich farmers, B for resource medium farmers and C for resource poor farmers) in Gulmi and in case of Rupandehi farmers were also categorised into two ethnic groups i.e. indigenous (Chaudhary) and migrants (Pahadia, migrated mostly from mid hills of the country) Farmers were categorised on the basis of farmers' own criteria in each sites through wealth ranking. At the time of Focus Group Discussions different activities and components of home gardens were listed and different gender analysis tools were used for accessing the gender role and benefit from the management of home gardens as follows:

Activity Analysis

One of the most important components of the gender analysis framework is the activity analysis. It was used for analysis of division of labour and decision making role in home

garden management activities. It is an important tool for recording the gender-based division of labour in the home garden area, which is used to gather the information of the gendered pattern of activities and responsibilities within home garden.

Resource (Access/Control) Analysis
The resources profile is a tool for identifying the resources those women and men utilise to carry out their activities. It mainly focuses on who has access to or control over resources for production and utilisation.

Benefit Analysis
Benefit analysis focuses on who benefits from each of the enterprise. It refers specifically to the one who has access to or control of the output of production. This includes all the end uses of product.

During the time of focus group discussions, the group was facilitated in doing their own gender analysis by using a checklist, by giving a pictorial set of man, woman, and child; and maize grains to indicate the magnitude of their role and decision making. While putting maize grains, the male and female were asked to put maize grains on the picture of man, woman and child to indicate their proportionate contribution (role and decision making) to different activities of home garden.

Data entry and analysis

After the data collection, the collected information were cleaned, coded and entered in to a statistical package i.e. Statistical Packages for Social Sciences (SPSS) and analysis using a simple descriptive statistics.

FINDINGS AND DISCUSSIONS

Gender Role in Home garden

Gender division of labour is the division of labour whereby roles, responsibilities and activities are assigned to women and men based on gender. It is an overall societal pattern in which women are allocated another set, for e.g. weeding and ploughing are gender roles of women and men respectively. In home garden management activities both male and female play an important role. In some activities female were more involved whereas in some activities male were more involved. Depending upon the nature of work the involvement percentage differs. By considering these, this study tries to analyse the gender role in different region and ethnicity and found the following findings (Table 1).

Vegetable Production
Most vegetable production and management activities are shared among the genders in the family. From the study it was found that in rich and medium wealth categories male and female equally shared the activities whereas female had more contribution than male in poor wealth category in Gulmi site. But in case of Rupandehi female labour was more involved than the male in all wealth categories of indigenous group and rich and poor categories of migrant group and both male and female equally involved in medium wealth category. This may be because the male of the poor category in Gulmi and indigenous group in Rupandehi were involved in activities such as carpentry, wage labouring, construction and services in India other than home garden. Among the different categories, children (26%) of poor category in Gulmi site have more contribution in Vegetable production and management activities. As Neupane *et al.* (1993) reported that male and female were almost equally involved in vegetable production activities. This study also found that, in both sites male and female were jointly involved in vegetable production and management activities within the

home garden but the contribution of females were more in vegetable production and management activities in both sites and ethnic groups.

Table 1: Gender division of labour (Percent) in different activities of home gardens by eco site

Site	Wealth	Gender	Vegetable	Fruits	Medicinal	Ornamental	Fodder/Forage	Livestock	Total
Gulmi	Rich	Male	44	64	44	22	53	47	46
		Female	43	27	50	49	41	49	43
		Children	13	9	6	29	6	4	11
	Medium	Male	42	49	41	17	43	47	40
		Female	40	35	45	40	43	42	41
		Children	18	16	14	43	14	11	19
	Poor	Male	22	60	70	18	47	39	43
		Female	52	34	30	40	44	48	41
		Children	26	6	-	42	9	13	16
Rupandehi									
Indigenous	Rich	Male	26	32	25	1	28	36	25
		Female	69	59	68	35	65	51	58
		Children	5	9	7	66	7	13	18
	Medium	Male	32	36	35	19	49	51	37
		Female	54	47	50	38	41	41	45
		Children	14	17	15	43	10	8	18
	Poor	Male	30	38	31	22	33	45	33
		Female	60	59	64	71	59	52	61
		Children	10	3	5	7	8	13	8
Migrants	Rich	Male	36	51	46	18	46	49	41
		Female	51	35	51	42	45	41	44
		Children	13	14	3	40	9	10	15
	Medium	Male	39	52	48	23	42	49	42
		Female	39	32	44	21	52	42	38
		Children	22	16	8	56	6	9	20
	Poor	Male	37	37	31	17	36	40	33
		Female	48	43	49	39	44	40	44
		Children	15	20	20	44	20	20	23

Fruit production

In Gulmi, the fruit production and management activities of home garden, male of all categories were more responsible whereas in Rupandehi, female of all categories were more responsible in indigenous group. But in case of migrant group of Rupandehi, male were more responsible in rich and medium categories and female in poor categories. In some activities like sapling purchase, weeding, irrigation, harvesting, seedling/sapling exchange and marketing, children were also contributing their labour. Overall, male were more responsible in Gulmi and migrant group of Rupandehi and female in indigenous group of Rupandehi. This may be due to involvement of the male from indigenous group in activities other than home garden i.e. wage labouring within or outside the country for

employment. This study has shown that male were more often mentioned as being responsible for the management of fruit trees in all categories in Gulmi site because fruit trees are bigger and difficult to manage by women.

Medicinal Plants production

For day-to-day household use, people grow medicinal plant in home gardens. Therefore, medicinal plants are also important component of home garden. Different member of the family were involved in management of medicinal plant. In Gulmi, female were more engaged in rich (50%) and medium (45%) wealth categories but male (70%) were more engaged in poor category. Similarly, in Rupandehi female were more engaged in all categories of indigenous group and rich (51%) and poor (49%) categories of migrant group. But male were more engaged in medium (48%) category of migrant group. Children were less involved in medicinal plant production and management activities as compared to vegetable and fruit production. This may be because the children have least knowledge about the importance of medicinal plants on one hand; on the other hand medicinal plants do not give direct and immediate benefit as vegetable and fruit plants. As the male from poor category were involved in off farm activities outside the village, they collect seedlings of medicinal plants from different areas and plant them in their home gardens. These medicinal plants do not need frequent management practices compared to other home garden species.

Ornamental plants

Ornamental plants are also included into the home garden of theses areas and a separate gender analysis for ornamental plant was done. The study shows that, female were more responsible in ornamental plant production in the home garden in all categories of Gulmi, indigenous group and rich and poor categories of migrant group of Rupandehi sites. However children were more responsible than male and female in medium and poor categories in Gulmi, migrant group in Rupandehi and rich and medium categories of indigenous group in Rupandehi sites. In Gulmi and migrant group of Rupandehi children were more involved than female and male while, in indigenous group female involvement were more. This shows that involvement of male in the management of ornamental plant is less as compared to the female and the children. . This may be because adult do not find direct benefit from ornamental plants while the children are interested in beautifying their home gardens with ornamental plants.

Fodder and Forage production

The farmers of Gulmi area reported that in management of fodder and forage plants male were more involved in rich (53%) and poor (47%) categories and both male and female were equally involved in medium categories. Similarly, farmer of Rupandehi area reported that female were more involved in rich (65%) and poor (59%) categories of indigenous group and medium (52%) and poor (42%) categories of migrant group whereas male were more involved in medium (49%) categories of indigenous group. Both male and female were equally involved in rich categories of migrant group. In both the area and irrespective of the ethnic groups, female were more involved in fodder and forage management activities. This may be due to the responsibilities of female towards the livestock production and management. Past studies done by Shrestha *et al.* (2001) indicated that a variety of trees are found integrated in a majority of the home garden in Nepal. These trees usually have multiple uses and provide food, fodder, firewood and timber for household uses. So, fodder trees have special place in home garden. In the rural households women and children are widely recognized as the primary collectors of fuel wood and fodder for household consumption and in the case of very poor women for sale (UNDP, 2002). Women have heavier responsibilities for childcare and household work, livestock care and for collecting fuel wood, so they were mainly responsible for fodder and forage production.

Livestock production

Livestock are an integral part of the farming systems and are generally kept within homestead. It is an important component of home garden. Livestock management is also a responsibility of both genders. From the analysis, it is revealed that in Gulmi, female were more responsible for livestock management activities in rich (49%) and poor (48%) categories but male were more responsible in medium (47%) category. Similarly, in Rupandehi, female were more responsible in rich (51%) and poor (52%) categories of indigenous group and rich (49%) and medium (49%) categories of migrant group while, male were more responsible in medium (51%) category of indigenous group but in case of poor categories of migrant group both gender were equally involved. In overall livestock care and management, female performed more work in Gulmi and indigenous group of Rupandehi while, male performed more work in migrant group of Rupandehi. Gender study by UNDP (2002); found that livestock and poultry in the homestead are entirely managed by women to supplement the family diet and to earn extra income.

Although the word gender reflects both male and female, more emphasis has been given to female farmers because of their social limitations. They have been neglected for a long time despite their critical role in home garden management. Women in rural Nepal have always been intimately involved in the agricultural production process. Traditionally, a broad division of labour existed, in which field based agricultural work is done by men while women are responsible for all activities carried out within the homestead. Although there have been some changes in this rigid gender division, women continue to carry out diverse activities in homestead agriculture. Past studies show that female and male have distinct, but not necessarily rigid, tasks and responsibilities, which often vary by crop or activity. Lartey *et al.,* (2002) indicated that the role-played by male and female in agricultural activities varies from region to region and between different ethnic groups within the same region. A study conducted by Hodel *et al.,* (1999) on the role of gender in home gardens of Vietnam found that, the division of labour of female and male household member for the different activities does not show great differences. Male as well as female works in all segments of the home gardens or go for wage labour. In Gulmi, both male and female were more or less equally responsible in overall home garden management, but in case of Rupandehi female were more responsible than man in indigenous group. Both male and female were more or less equally responsible in overall home garden management. This indicated that in mid hill area there are not much differences in division of labour within home garden management in all categories and in terai area there are differences in division of labour within home garden management with respect to ethnic group.

Decision making pattern

Vegetable production

Regarding decisions related to vegetable production and management within home gardens, it was evident that female take main role in decision making in rich category of Gulmi and all categories of indigenous and migrants group of Rupandehi (Table 2). In the medium category farmers of Gulmi both gender equally made decisions. Children (16%) of poor category of migrants group in Rupandehi also had limited role in decision-making regarding vegetable production and management. Acharya and Bennet, (1981) and Bajaracharya, (1994) found that in vegetable production, women take 90 per cent of decisions, whereas in fruit production men make most decision.

Fruit production

Farmers reported that in Gulmi, men are main decision maker in all wealth categories as they are responsible for management of fruit plants. Where as, female mainly decide in rich and poor categories among indigenous group of Rupandehi. In medium categories of indigenous group both male and female makes decision equally on fruit production and management. Similarly, in migrant group male makes decisions in rich (53%) and medium

(51%) categories and female makes decisions in poor (46%) category. In migrant group of Rupandehi, children of poor (22%) categories also play role in decision-making.

Medicinal plants

The decision on medicinal plant production and management in the home garden is made mainly by female in rich category in Gulmi and all categories of indigenous and medium and poor categories of migrant group in Rupandehi. Where as, in medium category of Gulmi and rich category of migrant group in Rupandehi both gender are equally responsible for making the decisions. Likewise, in poor category of Gulmi, male (90%) mainly made decisions because they are more involved in medicinal plants production and management activities.

From this study, it was evident that female mainly made decision in the production and management of medicinal plants, that may be due to the involvement of women in production and management of medicinal plants, women's responsibility of family caring and benefit from medicinal plants are obtained by children more than other members in the family. Taking care of the children and the family members is the responsibility of women, so, women have more power to decide on medicinal plants production and management.

Ornamental plants

Females are the main decision makers in production and management of ornamental plants in the home gardens. Female make decisions in all categories of Gulmi, medium (45%) and poor (71%) categories in indigenous group and rich (46%) categories of migrants group in Rupandehi. Where, in case of rich categories of indigenous decisions are made by children (47%) and in case of poor category of migrant group almost equal proportion of female and children make decisions on ornamental plants related matters.

Fodder and forages

With regard to decision making in fodder and forage production and management in home gardens, the study indicated that male were the main decision makers in all categories of Gulmi, medium (55%) category of indigenous and rich (54%) category of migrant group in Rupandehi. Whereas female were the main decision makers in rich (67%) and poor (64%) categories of indigenous. In medium category of migrants group of Rupandehi both male and female have equal role in decision making. Although male were the main decision makers in both sites and groups, female are also involved in decision-making.

Livestock Production

In livestock production and management female were responsible in making decisions in rich category of Gulmi (54%) and rich and poor categories of both groups in Rupandehi sites. Whereas, male were more responsible in making decisions in medium categories of Gulmi (52%) and migrant group (54%) in Rupandehi. In case of poor categories of Gulmi and medium categories of indigenous group and rich categories of migrant group in Rupandehi both gender were almost equally responsible in making decisions. The children of migrant group (20%) of Rupandehi also play an important role in decision-making regarding the livestock production and management.

Table 2: Decision making role (percent) on activities of home garden by eco site

Site	Wealth	Gender	Vegetable	Fruits	Medicinal	Ornamental	Fodder /Forage	Livestock	Total
Gulmi	Rich	Male	45	59	47	31	53	46	47
		Female	53	40	53	48	47	54	49
		Children	2	1	-	21	-	-	4
	Medium	Male	50	58	47	19	57	52	47
		Female	50	49	49	43	43	46	47
		Children	-	3	3	38	-	2	8
	Poor	Male	50	76	90	36	58	49	60
		Female	50	24	10	42	42	51	37
		Children	-	-	-	22	-	-	4
Rupandehi									
Indigenous	Rich	Male	34	37	25	17	33	41	31
		Female	65	59	71	36	67	55	59
		Children	1	4	4	47	-	4	10
	Medium	Male	45	48	40	23	55	48	43
		Female	50	48	53	45	45	51	49
		Children	5	4	7	32	-	1	8
	Poor	Male	30	39	27	4	34	39	29
		Female	69	61	73	71	64	61	67
		Children	1	-	-	25	2	-	5
Migrants	Rich	Male	48	53	49	18	54	48	45
		Female	51	43	51	46	46	52	48
		Children	1	4	-	36	-	-	7
	Medium	Male	45	51	45	26	48	54	45
		Female	47	42	50	25	49	41	42
		Children	8	7	5	49	3	5	13
	Poor	Male	36	33	37	25	39	36	34
		Female	48	46	43	39	41	44	44
		Children	16	21	20	36	20	20	22

Access to and control of resources

Access of resources means the freedom or permission to use the resource and control of resources means the power to decide whether and how a resource is used, how it could be allocated. In this study resources include land, labour (ones own, family and hired), capital goods, including tools and livestock for production, food, storage facilities, training; other inputs, including seed, fertilizers and pesticides; cash, knowledge on seed selection, planting, medicinal plants and market /transportation means. From the study it is evident that both male and female have access to and control over land but male has greater access to and control than female in both eco-sites and ethnicity (Table 3 and Table 4).

In most societies, men and women differ in the activities they undertake, in access and control of resources, and in participation in decision-making. Regarding the access and control of resources male and female have access of resource. In particular, male have more access to resources than female in Gulmi and both group of Rupandehi area. Similarly, male have more control over the resources than female in both site and ethnicity. Subedi *et al.* (2003b) reported that the extent of decision making role also reflect that women also have access to and control over the crop resources, particularly in the hill areas. Females of Gulmi have more access to and control over capital goods and perceived knowledge (knowledge on home garden management). While in indigenous group of Rupandehi, female have more access to capital goods, cash and perceived knowledge and control over capital goods and cash.

Access to opportunities may not be equal to men and women. For example access to production loan for Nepalese farmwomen is less as compared to the male farmers because the farmwomen normally don't own the land or house for the collateral. Similarly, women farmers have less access to agriculture extension and training activities in comparison to the male farmers.

Access to and control of benefits

Benefit analysis offers an in depth consideration of the benefits to a household and the individuals within it of the products and by products of various livelihood activities. The benefit from home garden includes social, economic, environmental benefits that can be received directly or indirectly from home garden products. Women and men do not have equal access or control over benefits. So the benefit analysis helps to identify the access to or control over benefits from the home garden between the male and the female. In this study benefits from home garden in crop, livestock, household activities, off farm enterprises, vegetable, fruit, medicinal plant, fodder / forage and flower and ornamental production and management were analysed. Male and female had equal access to and control over the benefits from home gardens in rich categories. Similarly, male in medium and children in poor categories were more benefited from home gardens in Gulmi. Whereas in Rupandehi, male were more benefited in rich and medium categories of indigenous group and medium category of migrant group and female were more benefited in poor categories of indigenous group and rich category of migrant group, and all were equally benefited in poor category of migrant group. However, in control over the benefits from home garden male and female equally controlled in rich, male controlled more in medium and female controlled more in poor categories of Gulmi area. Whereas male controlled more in rich and medium and female controlled more in both group of poor categories in Rupandehi area (Annex 1 and 2). This indicates that there are no differences regarding the benefit control by ethnicity.

Table 3: Access to resources (percent) with in home garden by eco site

Resources	Site	Gender	Land	Labour	Capital goods	Inputs	Cash	Perceived knowledge	Market/ transptn	Total
Access to resources	Gulmi	Male	57	50	45	53	60	45	30	49
		Female	43	50	47	47	25	48	30	41
		Children	-	-	8	-	15	7	40	10
	Rupandehi									
	Indigenous	Male	57	54	42	58	40	38	57	49
		Female	37	43	46	35	60	50	37	44
		Children	6	3	12	7	-	12	6	7
	Migrants	Male	57	45	43	53	60	50	45	50
		Female	33	42	40	40	30	40	40	38
		Children	10	13	17	7	10	10	15	12

Table 4: Control of resources (percent) with in home garden by eco site

Resources	Site	Gender	Land	Labour	Capital goods	Inputs	Cash	Perceived knowledge	Market/ transptn	Total
Control over resources	Gulmi	Male	57	53	48	55	60	48	70	56
		Female	43	47	52	40	40	52	30	43
		Children	-	-	-	5	-	2	-	1
	Rupandehi									
	Indigenous	Male	63	44	44	42	50	47	60	50
		Female	37	56	54	55	50	43	33	47
		Children	-	-	2	3	-	10	7	3
	Migrants	Male	60	59	49	52	57	50	35	52
		Female	33	39	41	42	37	40	60	42
		Children	7	2	10	6	6	10	5	6

The study indicated that children were more benefited from flower and ornamental, fruits and medicinal plants among the studied components of home gardens This may be because children have control over ornamental plants. Similarly, fruits and medicinal plants products are mainly used for children purpose and all kind of benefit received from fruit and medicinal plants are used by children for various purposes. In particular, benefits derived from all activities except flower and ornamental plants, are equally shared by male and female in rich category and male mostly controlled over the benefits in medium category of Gulmi. But children in both rich and medium categories had control over the benefits of ornamental plants. In poor categories benefit from livestock, household, vegetable, fruit, were controlled by female and both male and female had equal control over the benefits from crop, medicinal plant, fodder, forage and flower and ornamental production in Gulmi. In Rupandehi area, indigenous group benefit from livestock, household production, off farm enterprises, vegetable, fodder and forage in rich, from all activities except flower/ornamental in medium and from livestock in poor categories were mostly controlled by male. Whereas, benefit from fruit, medicinal plants and fodder in poor categories were mostly controlled by female and benefit from ornamental plants controlled by children in medium category. In migrant group benefit from crop and off farm enterprises in rich and from crop, off farm enterprises, vegetable, fruit, fodder and forage in medium and from off farm in poor categories were mostly controlled by men. But benefit from livestock and vegetable in rich, from flower/ornamental in medium and from vegetable, fruit, medicinal, fodder and forage and ornamental plants in poor categories were mostly controlled by female. However, most of the activities mostly controlled by male and female, in some activities children were also play an important role in control of benefits.

CONCLUSION

Different members of the households work in the home gardens. Sons and daughter, who are old enough and do not have to go to schools any more, usually assist their parents. The result shows that women are also the prime decision maker in the family and their contributions to decisions in activities related to home gardens and gender who are more involved in implementing the activities are also responsible for decision making on such activities. One major finding from the study is that, children cannot be excluded from home garden management activities as they have greater role than male and female in flower/ ornamental production and management activities in some categories, where as in other activities of home gardens they have remarkable contribution and they are also more benefited from home gardens benefits like vegetable production. From this study it can be concluded that home gardens are not the domain of one specific gender.

Evidence form the study shows that both men and women do almost equal work on home garden management. Role of men and women is based more on the situation of the family rather than on ethnic values. For instance where the family had enough male members' women did not work much in the fields, whereas where there was a lack of male members, women worked equally side by side with the male members. Therefore, research activities should be carried out after the detail analysis of the situation. It is also important to understand what motivates people's decisions about the allocation of labour and other resources to home garden production and management activities. This depends largely on who benefits from the intended use of the output of home garden produce and who is responsible for those particular activities. Therefore, trainings on home garden activities should be based on the needs of the beneficiaries and gender.

Gender is also cross cut by wealth and ecological region. Therefore, representatives and specialised expertise need to be used as criteria for distinguishing who participates in home

garden activities in the context of other variables like gender, wealth and ecological region. The issue of representatives and specialists knowledge is at the heart of the need to apply gender analysis as an integral part of any program implementing process. Gender is a basic determinant of representatives because men and women in agricultural societies fulfil such different roles and responsibilities, and gender therefore, often determines specialized domains of knowledge related to gender differentiated functions for e.g. vegetable production as a women's function,

Gender sensitisation is necessary at all levels of home garden research and development programs. It is therefore imperative to involve gender in the planning, implementation and evaluation of home garden activities. Since both male and female perform most of the home garden activities, it is appropriate for research to consider gender awareness planning in order to ensure their needs and opportunities. It is also found from the study that the children have significant contribution in the management of home gardens. Therefore, children should also be included in awareness raising programs.

ACKNOWLEDGEMENT

Authors would like to thank all who helped to make this study success. We greatly appreciate the co-operation of the farmers of the home garden area. We are also thankful to Mrs. Durga Gautam and Mr. Bal Bhadra Poudel for their support during study period as well as filed assistance. We would like to express our profound gratitude to the International Plant Genetic Resource Institute (IPGRI) for global home garden coordination and the Swiss agency for Development and Co-operation (SDC) for their financial support, which allowed us to carry out the study. The authors sincerely thank Dr. Ram Bahadur Rana for reviewing the paper.

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Annex1: Access to benefits (percent) from home garden by eco site

Site	Wealth	Gender	Crop	Livestock	Household	Off - farm	Vegetable	Fruit	Medicinal	Fodder	Forage	F/Ornamental
Gulmi	Rich	Male	30	30	30	50	30	30	40	50	30	40
		Female	30	40	40	30	30	30	40	30	50	40
		Children	40	30	30	20	40	40	20	20	20	20
	Medium	Male	50	40	50	50	40	40	50	30	60	30
		Female	30	30	30	30	40	30	30	30	30	30
		Children	20	30	20	20	20	30	20	40	10	40
	Poor	Male	20	20	20	-	20	20	30	30	20	20
		Female	60	20	20	-	20	20	30	30	40	40
		Children	20	60	60	-	60	60	40	40	40	40
Rupandehi												
Indigenous	Rich	Male	60	40	50	60	40	40	30	-	-	20
		Female	30	60	40	30	60	10	30	-	-	30
		Children	10	-	10	10	-	50	40	-	-	50
	Medium	Male	50	40	40	40	60	50	30	60	60	30
		Female	40	40	40	40	30	30	30	40	40	30
		Children	10	20	20	20	10	20	40	-	-	30
	Poor	Male	40	60	40	50	50	50	20	20	10	-
		Female	40	30	40	30	30	30	30	50	60	50
		Children	20	10	20	20	20	20	50	20	30	50
Migrants	Rich	Male	40	40	40	40	30	30	40	50	40	20
		Female	40	50	60	30	50	30	40	20	40	40
		Children	20	10	10	30	20	40	20	30	10	40
	Medium	Male	40	60	50	70	70	50	40	50	50	30
		Female	40	30	30	20	20	30	40	30	30	30
		Children	20	10	20	10	10	20	20	20	20	40
	Poor	Male	30	50	30	30	30	30	30	30	30	40
		Female	20	20	20	20	30	30	30	50	40	40
		Children	40	20	40	50	30	40	40	20	30	20

Annex 2: Control of benefits (percent) from home garden by eco site

Site	Wealth	Gender	Crop	Livestock	Household	Off - farm	Vegetable	Fruit	Medicinal	Fodder	Forage	F/Ornamental
Gulmi	Rich	Male	50	50	50	50	50	50	50	50	50	30
		Female	50	50	50	50	50	50	50	50	50	40
		Children	-	-	-	-	-	-	-	-	-	30
	Medium	Male	60	60	60	60	60	50	60	50	60	30
		Female	40	40	40	40	40	40	40	30	40	30
		Children	-	-	-	-	-	10	-	20	-	40
	Poor	Male	50	40	40	-	40	40	50	50	50	40
		Female	50	60	60	-	60	60	50	50	50	40
		Children	-	-	-	-	-	-	-	-	-	20
Rupandehi												
Indigenous	Rich	Male	50	60	60	60	60	50	50	60	60	20
		Female	20	40	40	40	40	50	50	40	40	40
		Children	-	-	-	-	-	-	-	-	-	40
	Medium	Male	80	60	80	70	50	60	60	60	60	30
		Female	20	30	20	20	40	30	40	30	40	20
		Children		10	-	10	10	10		10		50
	Poor	Male	40	40	40	-	40	30	30	30	40	40
		Female	40	30	40	-	40	50	50	50	40	40
		Children	20	30	20	-	20	20	20	20	20	20
Migrants	Rich	Male	70	40	50	60	40	-	-	-	-	-
		Female	30	60	50	40	60	-	-	-	-	-
		Children	-	-	-	-	-	-	-	-	-	-
	Medium	Male	50	40	40	50	60	50	50	50	50	30
		Female	40	40	40	30	30	30	50	30	30	40
		Children	10	20	20	20	10	20		20	20	20
	Poor	Male	50	50	50	60	40	40	30	40	40	40
		Female	50	50	50	40	60	60	70	60	60	60
		Children	-	-	-	-	-	-	-	-	-	-

Assessment of Dietary Diversity: A Basis for Promoting Plant Genetic Species in Home gardens

Resham Gautam, Rojee Suwal and Bhuwon Sthapit

ABSTRACT

Home gardens are the main source of family diet supply in Nepal. To identify the actual gap in supply of different nutrient rich species in home gardens, nutritional calendars were developed for four eco-sites (Ilam in eastern hill region, Jhapa in eastern *terai* region, Gulmi in western hill region and Rupandehi in western *terai* region) of the home garden project. Based on the information collected during baseline survey and situation analysis study, inventory of plant genetic species of home gardens was prepared. The availability of different nutrients from the species grown in the home gardens were identified through literature review. Distributions of the species throughout the year in all four sites were identified. Based on the nutrient availability and distribution of the species, the nutritional calendars were derived. In the *Terai* region, the availability of different nutrients through the species grown in home gardens was found less during the monsoon season. The situation was worse in the eastern *terai* (Jhapa) as most of the home gardens remain in the submerged and water logged conditions during the monsoon due to long and high intensity of rainfall, whereas in the western *terai* (Rupandehi) it was found that both the dry and monsoon seasons are affecting the species cultivation in home gardens. In hill conditions, the monsoon is not the problem for growing home garden species. However, the dry season, Baisakh-Jestha (early May-early June) was found as the major factor causing problem in growing plants in home gardens. Therefore, before promoting any species in the home garden, the actual understanding of the gap of existing home garden situations and farmers' actual needs should be identified. The nutritional calendar could be taken as a basis for introducing any species in home gardens of specific sites.

Key words: Home garden, nutrition, dietary diversity, nutritional calendar

INTRODUCTION

There is no universal definition of a home garden. However, the concept of home gardens refers to the intimate, multi-storey combination of various trees and crops in association with domestic animals around homesteads (Kumar and Nair 2004). Home gardens, an integral part of the Nepalese farming system, contains a high level of species and varietal diversity. These gardens are important sources of food, fodder, fuels, medicines, spices, cultural and religiously important plant species and other species of various plant genetic resources required for the daily household use. Thus, home gardens are an important avenue for on-farm management of plant genetic resources. The multiple uses and the spread harvesting time are the key criteria of the home garden.

Micronutrient deficiencies are prevalent in areas where diet lacks variety (Kennedy *et al.,* 2003). Lack of diversified diets with limited amounts of fruits, vegetables or animal source foods that contain large amounts of micronutrients deficiencies is inevitable. There are three main strategies identified for addressing micronutrient malnutrition: dietary diversification, fortification and supplementation (Kennedy *et al.,* 2003). Out of these three strategies, dietary diversifications can effectively address most of the micronutrient deficiencies in the developing world. Diversified food, which includes fruits and vegetables in the diet, increases longevity and reduces the rates of chronic degenerative diseases (Johns, 2003; Tucker 2001) and also improves the nutritional quality of the child growth in developing countries (Johns, 2003; Ruel, 2003). The use of plant genetic diversity is essential for ensuring both

an adequate and stable supply of diverse food crops as well as enhancing their nutritional quality. On-farm management of diversified agricultural plant genetic resources is a priority for increased agricultural investment in the biodiversity management as a whole (Johns and Sthapit, 2004). Home gardens offer a strategic unit for increasing and maintaining functional agricultural biodiversity. Home gardens are the major sources of family nutrition; therefore their values for household dietary diversity and health are well recognized. Home gardens combined with nutrition education can be a viable strategy for improving household nutritional security for at-risk populations, particularly women and children (Kumar and Nair, 2004). In poor households, access to nutritious foods largely depends on what they produce in home gardens (Callens and Gallagher 2003). Home gardens are significant sources of minerals and nutrients (Asfaw and Woldu, 1997) and they produce a wide variety of crops and often include micronutrient-rich vegetables and fruits, spices, medicinal plants and even animals (Callens and Gallagher 2003). A comprehensive review conducted by Torquebiau (1992) revealed that dietary supplies from home gardens accounted for 3-44% of total calorie and 4-32% of the total protein intake.

Nepal produces around 30% of the total fruits and vegetable requirements of the country (HKI, 2001). The home garden alone supplies 60% of the total fruits and vegetables consumed by the families (Gautam *et al*, 2004). Home gardens are rich in agro-biodiversity. Gautam *et al* (2004) in their survey found that up to 87 species are grown in a small home garden of 0.0017 to 0.5 ha by the farmers in Nepal. As home gardens are rich in the biodiversity and are the major sources of family nutrition supply, they should be considered viable and most functional sources of the family micronutrient and other nutrition supply. Home gardens, therefore, have been identified as the way to combat micronutrient deficiencies (HKI, 2001; Johns and Sthapit, 2004).

Many governmental and civil society organisations are promoting home gardens in Nepal in different ways. So far, the development programmes focussed on nutrition tend to promote the indiscriminate introduction of exotic and/or improved species and varieties of vegetables without reference to people's actual needs (Shrestha *et al.,* 2004). This paper is trying to identify the actual temporal and spatial gaps in the supply of diversified diets from home gardens to the family. To assess the existing situation of diet supply from the home gardens and to identify the gap periods where there is limited supply of diverse nutrition through home garden plant genetic resources, a nutritional calendar was prepared. The nutritional calendar not only explains the existing situation on the supply of different diet from home gardens but it also serves as a basis for the introduction of different plant species to improve the composition of home gardens.

METHODS

The home garden project is implemented in four contrasting (both from ecological and socio-economic settings point of view) sites, viz., Panchkanya of Ilam (Eastern high hill), Gaurigunj of Jhapa (Eastern *terai*), Durbardevisthan of Gulmi (Western mid-hills) and Dudhrakshya of Rupandehi (Western *terai*). The nutritional calendar was derived for all four sites from the data collected during the baseline survey and PRA studies so as to offer general indicators of the situation of the whole village regarding the availability of different vegetable species with their dietary values. The baseline survey revealed that there is no significant difference ($p>0.05$) on home garden species composition among the different levels of economic endowments and ethnic groups (Gautam *et al*, 2004). Therefore, we did not develop a nutritional calendar for each of the ethnic and wealth categories. The methodology followed while generating the nutrition graphs is as follows;

- Compilation of distribution of different plant species in home gardens with their time of plantation and harvest period (as many of the home garden species are multi-harvested). This gives the actual period of the availability of food for consumption.

- Identification of the plant species with different nutrient contents from secondary sources (Koirala, 1997; NNP, 2004) - a single plant species may be the major source of more than one nutrient. Therefore, the number of species shown in the graphs, if cumulated, would be more than the actual number of species available in the home garden.

- Grouping of the species depending on the type(s) of nutrients/minerals supplied by the species and counting of the number

- Plotting the data with the help from EXCEL. The frequency of the nutrient available in certain plant was counted and plotted in Y-axis against their distribution over the period of the year (determined by the seasonal calendar)

These graphs do not give an idea on the actual amount of certain nutrient supplied. However, these can clearly indicate what the lean season/time is with regard to the nutrient/diet supply in home gardens and suggest when and where to intervene.

FINDINGS

The number of species grown in home gardens varied with the ecological regions. In general, dietary diversity has a direct positive relationship with the number of species grown in the gardens. Dietary diversity varied over seasons and locations. The details of the dietary diversity available from home gardens in different locations with the distribution over a year are discussed under following separate sub- headings.

Ilam

The species diversity was the highest in Ilam among the four research sites. Comparatively, the distribution of species over the months is more even in this area. Though the total number of species found in home gardens was the highest in Ilam, the contribution of vegetable and fruit species was about 42% only. About 30% of the total species of home gardens was contributed by ornamental plant species (Gautam *et al*, 2004). The availability of different fruit and vegetable species was comparatively lower during the dry seasons (mid April-mid July) in Ilam. Limited irrigation facility coupled with the dry season affected the availability of diverse sources of nutrients during those months (Fig 1).

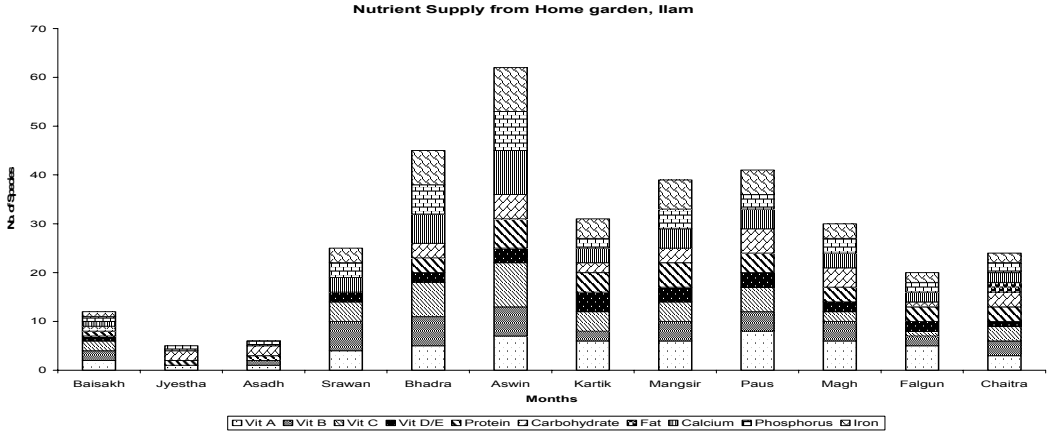


Figure 1: Nutrient Supply from Homegarden, Ilam

Jhapa

Monsoon is both earlier and heavier in the eastern region than in the western region in Nepal. The monsoon begins in late Jestha (i.e., early May) in the eastern region, which causes problems in planting many seasonal vegetables. The heavy rain also affects the vegetable farming by creating waterlogged conditions for a considerable period of time. Therefore, it has a direct effect on the availability of vegetables in the home garden. As Jhapa is flat and more prone to flooding and water stagnation, most of the field remains submerged during the monsoon season. Almost no vegetable species are available from Shrawan to Ashwin i.e., July to September (Fig 2).

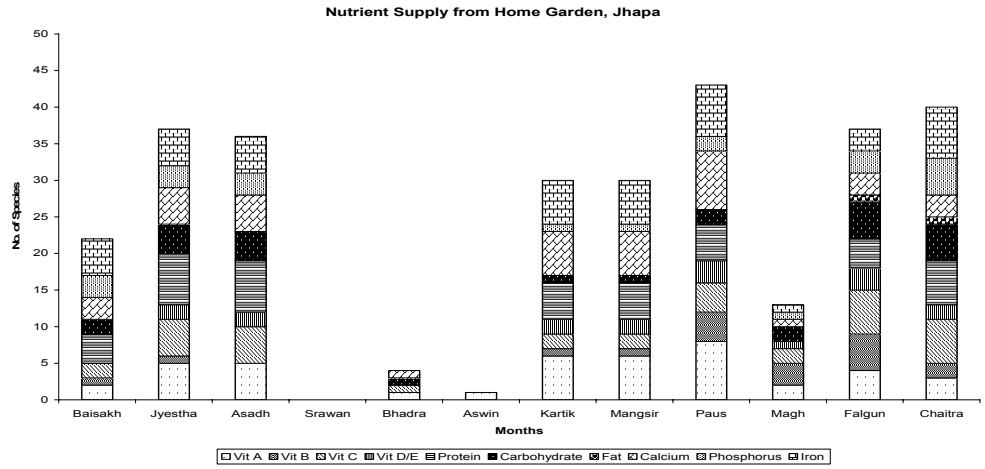


Figure 2: Nutrient Supply from Homegarden, Jhapa

Rupandehi

In contrast to eastern regions, the monsoon is received late in western regions. The intensity of the monsoon is also a bit lighter as we move to western parts in Nepal. In the home gardens site of Rupandehi, parts of the area are remain flooded during the monsoon season, while some home garden areas, particularly near to the forest area, are dry and there are no irrigation facilities. Therefore, the number of vegetable species grown in the area from Jestha to Shrawan (June – Aug) is considerably lower.

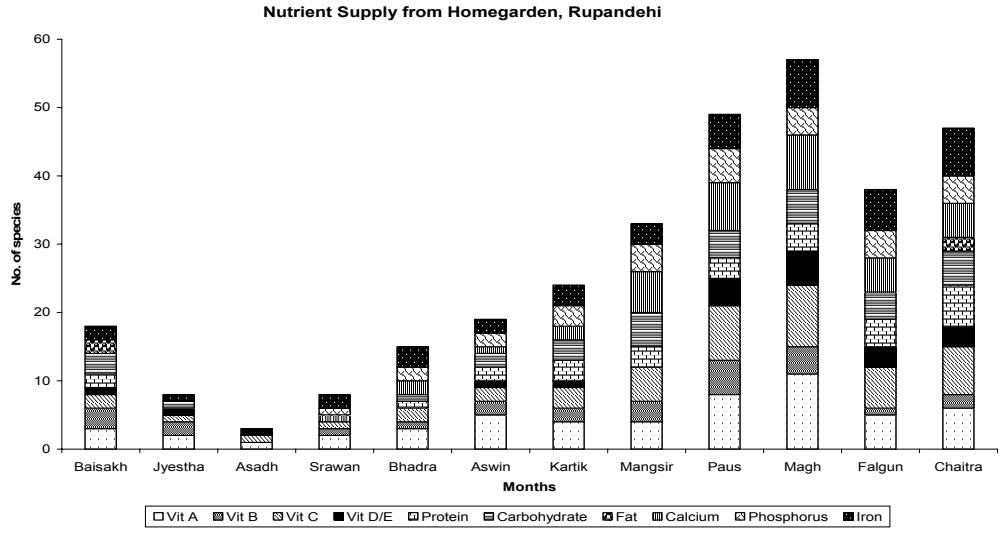
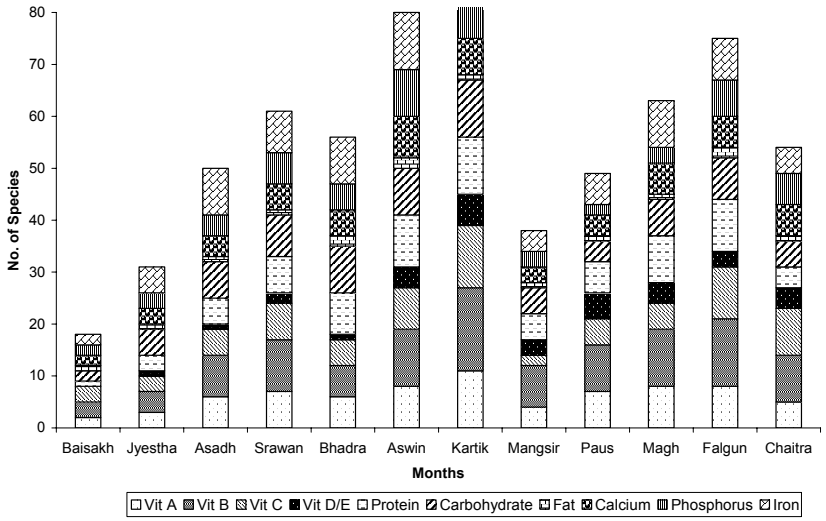


Figure 3: Nutrient Supply from Homegarden, Rupendehi

Gulmi

More than 55% of the total species reported from the home gardens in Gulmi were vegetable and fruit species. The availability of different species of vegetables and fruit were more or less regular in Gulmi. However, the number of species grown in dry seasons (Baisakh and Jestha) was comparatively lower. As there is a limited irrigation facility in the area, the number of species grown during the dry season is affected (Fig 4).

Fig 4. Nutrient Supply from Home garden, Gulmi



CONCLUSION

Home gardens are a major source of the family nutrition supply across the different ecological zones and different socio-economic settings in Nepal. Home gardens contain high levels of species diversity. The value of home gardens for household dietary diversity and health is well recognized. Many government and civil society organizations are devoted to promote home gardens in Nepal. Despite their important contribution to the family food security and nutrition security, the information related to home garden productions has never been included in the national production data by the concerned government authorities. Therefore, the scientific understanding of the home garden system and production is severely lacking. The promotion activities of home gardens have not been based on any scientific findings. Nutrition calendars are the source of basic information on the status of home gardens with respect to the availability of diversified diets in different agro-ecological and socio-economic settings. The promotion of any home garden activities should be based on the actual demand of the farmers, and it should also fulfil the actual gap of the system. The nutritional calendar clearly gives an idea on what exactly the gap is in the home gardens, if any development activities have to be promoted, and when to intervene.

ACKNOWLEDGEMENT

The authors are grateful to the farmers of the project sites, who provided necessary information to the study team. We are very grateful to Dr. Pratap Shrestha, the Executive Director of LI-BIRD for his kind support and guidance in conducting this study. We thank Mr. S. Basnet, Mr. Balabhadra Poudel, Ms. Durga Gautam, Ms. Bhim K Rai and Ms. Kunta Shrestha for providing supports during the field survey. We would like to express our sincere thanks to Dr. Timothy Johns for reviewing this paper.

The study is a part of the global home garden project, which is coordinated by IPGRI. The financial support for the Nepal home garden project is provided by SDC. The authors are highly thankful to both of the organisations.

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Enabling and Empowering the community through Collective Learning Process: Lessons Learnt from Farmers' Travelling and Learning Workshop

Rojee Suwal, Resham Gautam and Bhuwon Sthapit

ABSTRACT

In order to fill the research gap and promote home gardens as a potential source of family nutrition and dietary diversity, LI-BIRD is implementing the project entitled "Enhancing the Contribution of Home Gardens to on Farm Management of Plant Genetic Resources and to Improve the Livelihoods of Nepalese Farmers" in close collaboration with different research and development organizations and farming communities. The project has emphasized participatory approaches in planning, implementation, monitoring and evaluation. Four research sites have been identified providing adequate contrasts in terms of agro-ecosystems and socio-cultural settings. Home Garden Research and Development Committee, comprising 36-42 research farmers, was established in each site to conduct research and development interventions in home gardens. Since the species composition, structure, use-value, marketing system of surplus of home gardens as well as working approach of group, knowledge, ideas and perception of selected research farmers vary across the sites, collective learning mechanisms through exchange visits was used as potential approach to provide an opportunity to share the good practices between and among research farmers of different sites as well as expose them to resource gardens, nursery management and marketing systems.

Through a collective learning approach, farmers have identified certain good or replicable practices like group mobilization and fund generation, domestication of wild species in home gardens, nursery management, use-value of species (e.g., chayote) and the exchange of planting materials. The collective learning and sharing approach through farmers' exchange visits motivated some research farmers, and the good or replicable practices identified by farmers were assessed, and some have started to adopt it. Particularly, revitalization of groups, exchange of planting materials within the community, introduction of new species in home gardens, participatory monitoring and supervision of home garden activities are some of the good practices adopted by farmers.

Key words: Home garden, family nutrition and dietary diversity, participatory approaches, collective learning approach, good practices

INTRODUCTION

Home gardens are an integral part of traditional farming systems. Multipurpose species are cultivated to fulfil the daily requirements of the household in home gardens and managed by family members. Despite the crucial role in livelihood strategies of the farming community, farmers have not considered home gardens an important source of daily household requirements as compared to the large agro-ecosystem. The scientific investigation on the value of home gardens in Nepal is limited. It is very important to make farmers, researchers and policy makers aware of the significant contribution of home gardens on the farm management of plant genetic resources as a source of family nutrition.

LI-BIRD is implementing the project entitled "Enhancing the Contribution of Home Gardens to on Farm Management of Plant Genetic Resources and to Improve the Livelihoods of Nepalese Farmers'" in close collaboration with different research and development

organizations and farming communities with the support of Swiss Agency for Development and Co-operation (SDC) and International Plant Genetic Resources Institute (IPGRI). The main objective of the project is to enhance the contribution of home gardens to on farm management of plant genetic resources and to improve the livelihoods of Nepalese farmers. It specifically aims to create an understanding of home garden systems and its dynamic socio-economic contributions. The intervention is designed in a participatory way and mostly based on farmers' demand and interest. It ultimately aims to influence the government bodies and related institutions by documenting and demonstrating the contribution of home gardens in nutritional status and dietary diversity of rural households.

Altogether four research sites were selected representing the different agro-ecological zones and socio-economic settings of Nepal. District based stakeholders particularly the District Agricultural Development Offices (DADOs) were consulted during the site selection process. Four research sites viz.; Gauriganj in Jhapa, representing the eastern *terai*, Panchakanya in Ilam, representing the eastern high hills, Durbar Devisthan in Gulmi, representing the western mid hills and Dudrakshya in Rupandehi, representing the western Terai were selected for the purpose of the project. A Home garden Research and Development Committee comprising 36-42 farmers representing from different economic and ethnic categories was formed in each site to facilitate research and development interventions in home gardens.

The species composition, structure, use-value, marketing system for home gardens surplus as well as the working approach of group, knowledge, ideas and perception varied across the sites. For example, home gardens of Ilam were rich in species composition, and their existing marketing system was also good. Wild species like *Biyee* (*Solanum anguivi), Pakhanbed* (*Berginia ciliate*), *Jaringo* (*Phytolacca acinosa*) etc., were also domesticated in those home gardens (Suwal *et al.*, 2003). Those gardens could be taken as resource gardens. Good practices (domestication of wild species, multipurpose species, use-value of species, e.g. use of different parts of Chayote, linkage of home garden species to market, working approach of farmers group etc) practiced by the Ilam farmers could be observed and adopted by the farmers from other sites.

The farmers' travelling and learning workshop was organized in collaboration with research farmers and other collaborating partners. The main aim of the Farmers Travelling and Learning Workshop (FTLW) was to have an exposure to home gardens (species composition and selection, structure, management, use and value of species etc.), local marketing systems of home garden products/produces, home garden management system including organic farming, nursery and fruit orchard management, group mobilization, fund generation and mobilization and scaling up approach of good practices within the community.

With the expectation of farmers' increased benefit, both economically and socially, we organized an exchange visit programme. The objective of the exchange visit was also to open an avenue for the increased species diversity in home gardens, which, in turn, increased the access to the dietary diversity contributing family nutrition and also generate income by selling surplus of home garden products and unique species. On the other hand, farmers of Ilam would share their experiences of working in the group and their approaches of scaling up of the technology with other farmers. Providing an opportunity for farmers to act as resource persons would be a part of the social benefit of the community. Similarly, the workshop would also be a forum to share/exchange different home garden species from one site to another. This would also provide a market for selling their unique species and contribute as an economical benefit to the farmers of that particular site. Increased bio-diversity and adoption of organic based home gardening systems would impart the ecological benefit by discouraging the use of different forms of chemical inputs in the system.

METHODS

Adoption of participatory approaches was central to planning and implementation of research and development activities of the project. Farmers' knowledge systems and their expertise were sought and valued. They were involved in the planning and implementation of project activities. Collective experimental learning is a very important participatory learning process, in which all stakeholders have a responsibility and a role to play. Collective learning through exchange visits is one of the most important and effective mechanisms to share/exchange good practices among each other. Farmers' exchange visit is itself not a new method but making it more participatory and participant-led has made it more effective for the collective learning process.

Based on the baseline information and PRA studies, it was found that farmers' exchange visit could be one of the best options for providing farmers with more opportunities to learn from and share with each other. Ilam is rich in home garden diversity and farmers from other sites could learn good practices and cultivation methods that could be useful in the project sites other than Ilam.

The farmers' exchange visit is regarded one of the most important and effective collective learning mechanisms used in the project because "Seeing is Believing" which is more effective way to motivate the people (Shrestha, 2003). Collective learning through exchange visits provides farmers opportunity to exchange ideas, knowledge, information and technology with each other. It also helps to informally exchange the planting materials. It provides an opportunity for farmers to get exposed to many good practices of other project sites. The methodology is refined and developed as "Farmers' Travelling and Learning Workshop" to make it more Participatory, where farmers get an opportunity to learn from and share good practices with each other either formally or informally.

The farmers' travelling and learning workshop was organized from March to April, 2004 as a part of collective learning process. Research farmers' group identified this activity during annual activity planning meeting of the project in the first phase. All the members (36-42 per site) of Home Garden Research and Development Committee (HGRDC) were identified for travelling and learning workshops (Annex 2). The potential sites were finalized based on objectives and expected outputs. Farmers were involved in the selection process to make it more effective, and also build their ownership on the activity. The protocol for farmers' exposure visit was developed through a discussion among professional team members as well as incorporating suggestions from IPGRI, which was refined after collecting the inputs from research farmers. To make it more participatory and participant-led, the following approaches were used:

- Participatory planning for selecting sites to be visited
- Participatory tour coordination and management
- Joint monitoring and assessment of exchange visits
- Sharing the learnt good practices among the participants and with the community

The major differences in the methodology adopted in FTLW with those of conventional farmers exchange visits are summarized as follows:

- Setting objectives of the visit by the farmers (project team's role was more of facilitating)
- Involvement of farmers in selecting the potential sites for their visit to meet the objective
- Selection of one of the better sites managed by the farmers
- Two-way interaction with the farmers of the host group

- The visit and discussion were led by the farmers of the host group as resource persons
- Sharing of many planting materials during the visit
- Focused on farmer to farmer sharing and learning
- Group coordination by the farmers during the visit
- Sharing of learning from the visit each day in a group (forms were developed and provided to the participants each day)
- Sharing the learning of the visit to with non participants of the community through organising a village level workshop in each site

PROCESS

During the process of each FTLW, the project team had facilitated in identifying 3-4 group leaders from each sub-group of the participating farmers in order to co-ordinate the activities, facilitate them in group mobilization during the activity and to monitor and evaluate the participation of individual farmers.
At the end of each day's visit in the convenient time, farmers discussed on learnt/observed practices within the sub-group and presented them in plenary session by respective group leaders. Before this activity, they filled up the questionnaires with what they learnt and observed, and what could be done to improve the status of home gardens using the good practices learnt during the visit. Project team and group leaders guided the illiterate individuals to fill up questionnaires. Then, they shared with each other within sub-groups and concluded by incorporating each member's views. This activity had helped each participant to become more conscious to explore new areas/issues during their visit/observation/discussion. Therefore, immediate sharing of the observations made during the daytime in a group is very effective in documenting farmers' responses on the activity.

Farmers of Ilam presented different plants and planting materials grown in their home gardens (*Akabare khursani-Capsicum* spp., *Binyee*, tea, cardamom, *Jaringo*, *Chinde sag*, *Pakhanbed* and pumpkin) as a gift to farmers of Jhapa, Gulmi and Rupandehi during exposure visit (Annex 1). Planting materials are a precious gift for farmers, which was perceived helpful in enhancing the species diversity in home gardens. Farmers shared the knowledge/ideas/experiences on different aspects of home gardens (species composition, use-value of chayote, *Akabare khursani*, *Pakhanbed*, *Jaringo*, *Chinde sag*, and tree tomato along with the cultivation practices, processing and marketing of surplus) and the working approach of the groups to each other during the interaction between farmers of different sites. Farmer to farmer sharing was perceived by participants as an effective and understandable process of information dissemination. The process helped farmers to develop confidence and provided them an opportunity for sharing their own experiences.

The host farmers (Ilam) carried out a transect walk and briefed the composition of home gardens to guest farmers by dividing them in 3 sub-groups. The direct observation of farmers' practices and system helped farmers to be convinced and motivated. Poems (reflecting the importance of home garden during exposure visit) and devotional songs (*Bhajan*) were adopted as means to disseminate message to other participants during the exposure visit.

Farmers shared the experiences gained and good practices learnt through the FTLW with non-participating farmers within the community through the village level workshop after their visit. This process helped to disseminate the knowledge gained by farmers through the exercise.

Outcomes of collective learning and sharing visit

There were certain tools and approaches used in order to assess the perception and effectiveness of the farmers' exchange visits. Certain questions were given to an individual farmer to assess each day's events and activities. The perception and feedback from farmers were collected and analyzed. Based on the analysis, the following good practices have been identified and appreciated by farmers for their replication (Suwal *et al.,*2003). The good practices identified by participating farmers are the major outcomes of FTLW.

Concept of group action

Farmers of Ilam demonstrated that they possess a clear concept of group approaches, fund collection and mobilization, and they also have knowledge on the importance of sustainable development. They have identified the roles and assigned the responsibilities of different project related activities to each group member so that every one could feel their ownership and stake in the group. Monthly meeting is being conducted by the coordinator farmer to discuss new issues and review past activities in order to improve the existing status of home gardens facilitated by the project field staff. Fund is collected through seed distribution, levy, entrance fee etc. To ensure the active and regular participation of members during meeting, they also have the provision for penalty to absentees in the meetings. Farmers have identified norms and rules for an effective group mobilization.

Nursery management

The practice of having vegetable nurseries in the periphery of the houses by Ilam farmers captivated the attention of all the research farmers of other three sites. They have the clear knowledge on the requirements of a nursery; therefore, having it in and around the homestead assures a better attention and care from the family members. It also helps in the better management of an available space in the home gardens.

Exchange of planting materials

Participating farmers had brought/bought different planting materials (e.g., *Akabare khursani*, *Binyee*, tea, mango, *Jaringo*, *Pakhanbed*, passion fruit, etc.) to test their suitability in their own home gardens as an experiment from different sources (from Ilam home gardens and also from different government and private nurseries/farms).

Use value of Chayote and other home garden plant species

The exchange visit has also been helpful to exchange the knowledge on use-values of several home garden species. For example, Ilam farmers shared the knowledge regarding the use of different parts of chayote with others. The idea of using different parts of chayote (modified root, growing twigs and the fruit) has been well-appreciated and accepted by the fellow participating farmers. During the process, the cultivation practices, their use-value and the marketing of different species like vegetables, fruits, fodder and medicinal plants were also shared with each other.

Early effects of FTLW

Group formation

Before the exchange visit, there was no group structure of research farmers in Gulmi, Rupandehi and Jhapa. Two coordinating research farmers were given the responsibility to co-ordinate the implementation of all project related activities. Similarly, there was no system

of levy collection and farmers had no idea on the importance of the group mobilization. After the visit, they have reorganized the group structure and also started to raise community/group funds through saving schemes. For example, farmers of Jhapa had conflicts between indigenous and migrant communities and had the feeling that they should spilt the group based on ethnicity. After the workshop and interaction with the farmers of Ilam as well as seeing the effectiveness of the group, they have changed their views and restructured their group by offering chairmanship to one of the representative farmers from the indigenous (*Rajbanshi*) community. Participation has also been improved in the meetings of the group thereafter.

Fund generation and mobilization

The importance of the fund generation and saving schemes to sustain the group has been learnt by farmers from other research sites, especially from farmers of Ilam. The farmers of Gulmi, Jhapa and Rupandehi have now initiated to generate fund from the membership levy and selling seeds/planting materials. In Rupandehi the fund has been mobilized on welfare activities targeting to the resource poor at a low interest rate. Similarly, the farmers groups in all three sites have planned to invest a certain amount of their funds on the economically poor members of the groups during the annual project meeting planning.

Informal exchange of seeds/planting materials among research farmers

The workshop has also facilitated in exchanging materials within the groups. For example, Mr. Tika Ram Pokherel, a farmer from Rupandehi committed to provide 5 saplings of Napier grass to each member of the home garden research and development committee of Rupandehi. Similarly, other such initiatives taken by research farmers of Rupandehi are presented in table 1.

Table 1. Details of exchanged planting materials in Rupandehi

Who	What	Whom	How much
Mr. Tika Ram Pokherel	Napier grass	all members of the group	5 saplings each
Mr. Tika Ram Pokherel	Ipil-ipil	all members of the group	1-2 seeds each
Sita Upadhyay	Four season bean	all members of the group	2 each
Guna Nidhi Adhikari	Local cowpea	all members of the group	5 each
Bishnu K. Dumre	Local Bottle gourd	all members of the group	2 each
Bishnu K. Dumre	Local lime	all members of the group	1-2 seeds each

Participatory monitoring and supervision

The learning workshop has also motivated research farmers to develop participatory monitoring and supervision of each other's home gardens. Research and development committee of Rupandehi took such initiatives. After the visit, they started to monitor and supervise each other's home gardening activities to improve the species diversity every month.

Introduction of new plant species

This learning workshop also helped farmers to introduce new species in their home gardens. Planting materials of tea, cardamom and *Akabare khursani* from Ilam were offered to the farmers of Gulmi, based on their demand made during Travelling and Learning Workshop. The initiatives not only provided an opportunity to exchange good practices with each other but also economic benefits to farmers.

Documentation of medicinal plants

The collective learning workshop has also motivated the research farmers to document the medicinal plants existing in the community surroundings based on their perceived and indigenous knowledge. Farmers have agreed to document their perceived knowledge on medicinal plants of each site (with detailed descriptors of each species along with the illustrative sketches of the plant species and the parts used for specific purposes), collect and compile it from all four sites and publish it with support from the project. This activity is going to be included in the forthcoming annual activity plan of the project.

Disseminating materials

Poems (reflecting the importance of home gardens during the exposure visit) and devotional songs (*Bhajan*) were a means to disseminate the message to other participants during exposure visit. Such initiatives have been taken by LI-BIRD by publishing it in the calendar of LI-BIRD (B.S. 2061).

CONCLUSION

The farmers' exchange visit was organized with an objective to provide farmers exposures to diverse home gardens and an opportunity to share with and learn from each other. The collective learning and sharing approach has been very effective and instrumental in highlighting the significance and importance of the concept and the value of home garden. The exchange visit provided an opportunity for research farmers to interact and exchange knowledge, skills and materials with each other. It has also provided an avenue for farmers to learn innovative practices. The early impact of the exchange visit clearly demonstrates that farmers have started to diversify and systematize their home garden system. Home gardens used to be considered a less important part of farming system from a direct economic contribution point of view. This concept has been changed after the FTLW, and home gardens are now considered an important source of economic returns and a major source of dietary diversity and food security.

ACKNOWLEDGEMENT

We would like to thank the research farmers of home garden project for their active participation during Travelling and Learning Workshops. We especially thank the farmers of Panchakanya, Ilam for managing and organizing the interaction/sharing meeting and guiding the participating farmers of Jhapa, Rupandehi and Gulmi. The staffs of Horticulture Farm, Nawalpur and Kirtipur, ICIMOD's demonstration and testing site, Godawari and Organic Farm (AAA), Bhaktapur are indebted to for their valuable time and guidance during the visit. We are thankful to Dr. Pratap Shrestha, ED of LI-BIRD, Mr. Bimal Raj Regmi and other professional members of the home garden project for their kind and valuable input during the entire process. Mr Shambhu Basnet, Mr. Balabhadra Poudel, Ms. Durga Gautam, Ms. Bhim K Rai and Ms. Kunta Shrestha deserve special thanks for their support during the farmers travelling and learning workshop.

The study is a part of global home garden project, which is coordinated by IPGRI, and the financial support for the Nepal home garden project is provided by SDC. The authors are highly thankful to both of the organisations. We are thankful to Mr. Sanjaya Gyawali for providing his time and valuable inputs to improve the quality of the paper.

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Annex 1

Table 1: Seeds/saplings brought by farmers of Gulmi during the exposure visit

SN	Name of the Farmers	Particulars/Items	Remarks
1.	Mr. Chetman S Khatri	Tea, Cardamom	HGRG of Ilam
2.	Mr. Jit B Thapa	Tea, Cardamom	HGRG of Ilam
3.	Mr. Heera B Khatri	Tea, Cardamom	HGRG of Ilam
4.	Mr. Ram C Aryal	*Biyee*	HGRG of Ilam
5.	Mr. Chhatra B. Khanal	Sponge gourd	HGRG of Ilam
6.	Mrs. Dhan M Karki	Sponge gourd, *Biyee*	HGRG of Ilam
7.	Mrs. Pitambari Aryal	Sponge gourd	HGRG of Ilam
8.	Mr. Tek Raj Aryal	Sponge gourd	HGRG of Ilam
9.	Mrs. Shiva K Khatri	Sponge gourd	HGRG of Ilam
10.	Mrs. Goma Panthi	Sponge gourd	HGRG of Ilam
11.	Mr. Yuba Raj Chudali	*Akabare*, Tree tomato, Sponge gourd	HGRG of Ilam
12.	Mrs. Heera Panthi	Tea sapling	HGRG of Ilam
13.	Mr. Rikha B. Karki	Tree tomato	HGRG of Ilam
14.	Mr. Dul S Rayamajhi	Tea sapling	HGRG of Ilam
15.	Many	Areca-nut, Rose, Litchi	Yadav Bahu-udeshya farm (Pvt nursery)-Sarlahi

Table 2. Seeds/saplings brought by farmers of Jhapa during the exposure visit from different sources

SN	Names of the Farmers	Particulars/Items	Remarks
1.	Mr. Lobin P Rajbanshi	Pumpkin	from Panchakanya- free of cost
2.	Mr. Shiva S Poudel	*Binyee*, Pumpkin, Passion fruit	from Panchakanya- free of cost
	Mr. Shiva S Poudel	Cucumber	from Panchakanya free of cost
3.	Mr. Kadam L Tajpuriya	Pumpkin, Beans	from Panchakanya free of cost
4.	Mr. Lobin P Rajbanshi	*Akabare*, Chayote, Broadbean, Passion fruit	from Panchakanya free of cost
5.	Mr. Dharmendra Rajbanshi	Cucumber, Pumpkin	from Panchakanya free of cost
6.	Mr. Binod Rajbanshi	Cucumber, Pumpkin	from Panchakanya free of cost
7	Mr. Bhim Rajbanshi	Cucumber, Cardamom	from Panchakanya free of cost
8	Mr. Amrendra B.K.	Bean	from Panchakanya free of cost
9.	Mr. Suresh Dhamala	Cucumber, Pumpkin	from Panchakanya free of cost
10.	Mr. Nagendra Karki (A)	Pumpkin, Cucumber, Bean, Ornamental plant	from Panchakanya free of cost
11.	Mr. Narayan Bhandari	Pumpkin	from Panchakanya free of cost
12.	Mrs. Bhau Maya Gautam	Passion fruit, *Binyee*, Pumpkin, Cucumber, Rhododendron	from Panchakanya free of cost
13.	Mr. Suresh Dhamala	*Ajambari*	from Panchakanya free of cost
14.	Mrs. Laxmi Giri	Pumpkin, Cucumber	from Panchakanya free of cost
15.	Mrs. Sarsowati Parajuli	Pumpkin, Cucumber, *Binyee*, Chrysanthemum	

Table 3. Seeds/saplings brought by farmers of Ilam during the exposure visit

SN	Names of the Farmers	Particulars/Items	Remarks
1.	Khem Bhattarai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
2.	Mr. Mukti Nath Acharya	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
3.	Mr. Dinesh Dahal	Herbal Tea packet	Rs. 35/sapling, ICIMOD-Godawari
4.	Mr. Anshu Man Rai	Herbal tea packet	Rs. 40.00/packet from AAA Dadhikot
5.	Mr. Rabin Acharya	Kiwi saplings	Rs. 35/sapling, ICIMOD-Godawari
6.	Mrs. Dika Devi Acharya	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
7.	Mrs. Renuka Rai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
8.	Mrs. Laxmi Rai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
9.	Mrs. Khem K Bhattarai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
10.	Mrs. Leela Regmi	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
11.	Mr. Bal Bahadur Rai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
12.	Mr. Kul Bahadur Rai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
13.	Mr. Prem Bahadur Rai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
14.	Mr. Aaika Raj Adhikari	Herbal tea packet	Rs. 40/packet from AAA Dadhikot
15.	Mr. Durga Man Rai	Herbal tea packet	Rs. 40/packet from AAA Dadhikot

Table 4. Seeds/saplings brought by farmers of Rupandehi during the exposure visit

SN	Names of the Farmers	Particulars/Items	Remarks
1.	Mr. Shiva Lal Pandey	Bamboo rhizomes	Panchakanya free of cost
2.	Mr. Bhava Nath Chaudhary	Cardamom, Binyee, Chilli	Panchakanya free of cost
3.	Mr. Tika Ram Pokhrel	Akhabare, cardamom	Panchakanya free of cost
4.	Mr. Ramprasad Pandey	Chayote	Panchakanya free of cost
5.	Mrs Pana Dumre	Chayote	Panchakanya free of cost
6.	Mrs. Bishnu K Dumre	Chayote, Akabare khursani	Panchakanya free of cost
7.	Mr. Mahendra N Pokhrel	Binyee	Panchakanya free of cost
8.	Mr. Gunanidhi Adhikary	Binyee, *akabare*	Panchakanya free of cost
9.	Mr. Dadhi Ram Bhattarai	Sponge gourd	Panchakanya free of cost
10.	Mrs. Kamala Aryal	Cardamom (fruits)	Panchakanya free of cost
11.	Mrs. Kalinda Chaudhary	Cardamom(fruits)	Panchakanya free of cost
12.	Mrs. Tulasha Chaudhary	Cardamom (fruits)	Panchakanya free of cost
13.	Mrs. Shanti Chaudhary	Sponge gourd	Panchakanya free of cost
14.	Mrs. Rameshowari Chaudhary	Sponge gourd	Panchakanya free of cost
15.	Mrs. Aasha Chaudhary	Bamboo rhizomes	Panchakanya free of cost
16.	Mr. Dham Narayan Kafle	Binyee	Panchakanya free of cost

Table 5. Composition of the participants from four sites

Districts	Male	Female	Total	Remarks
Gulmi	19(63.3%)	11 (36.7%)	30 (75%)	Satisfactory active female participation
Jhapa	30 (90.9%)	3 (9.1%)	33 (91.7%)	Negligible female participation and no one from Terai community
Ilam	30 (83.3%)	6 (16.67%)	36 (92%)	Poor female participation
Rupandehi	9 (27.3%)	22 (66.7%)	31 (81.6%)	High female participation

Policy Supportive Issues in Home Gardening with Respect to Agricultural Bio-diversity and Improving Rural Livelihood

Bharat Upadhyay

ABSTRACT

The significance of home gardens in the Nepalese farming systems lies in meeting nutritional requirements of the family, providing a supplementary source of farm income, often supplementing the cash need during the gap period of cereal farming, involving women in larger proportion. Home gardening is recognized as a microcosm of agricultural bio-diversity. Unavailability of national data on home gardens is the major limitation to determine the exact contribution of the home garden in the agricultural sector. The Department of agriculture does not have any exclusive programme to promote home gardens in holistic approaches so far. Despite the focus of Tenth Five year plan on biodiversity management, the department continues to implement regular extension programs related to "kitchen gardening" covering vegetable minikits but it has not emphasized the use of local resources in the community. Therefore, the programs need to be completely reformulated in the context of home gardening. Home gardening covers the areas more than vegetables, basically focuses on the use of local resource and covers broad areas like livestock, vegetables, fruits, fodders and many other components that are of immediate use to the local community. Current agricultural policies are primarily framed within the framework of commercialization that extensively relies on external inputs, contrary to the objectives of this project. Home gardening should primarily be based on indigenous farming and mostly organic which should have more valuable commercial niches. Roles of non-governmental organizations, community based organizations and farmer groups should be strengthened as implementing organisations and the governments' role should be limited to policy formulation and facilitating tasks. Since most farm undertaking home gardening enterprises are women and subsistent, the government should have such incentives built-in, in its programmes. Can the farmer field school concept of integrated pest management program be adopted to the decision making process and strengthening farmer-to-farmer extension? Farmers have the right to protect and use such resources for their socio-economic benefit. In the WTO context, their rights need to be protected and established. Home gardening becomes the most important purview of such rights. Any promotional programs to advance home gardening in the Nepalese context will have access to sustainable financial resources. An appropriate market strategy supporting home garden as a viable enterprise should be developed rather than supporting hi-tech product marketing. Local agriculture development funds should be established in line with drinking water funds, etc. and a portion of it must be used to encourage and uplift the ongoing home garden programme.

Key word: Home garden, agricultural policy, biodiversity, kitchen gardening

INTRODUCTION

Home gardening has been an integral part of the Nepalese farming systems that have evolved from generation to generation. The farming systems are characterized by a sustainable integration of crops, livestock, fishery, herb and agro-forestry organized into small to medium farm enterprises around the homestead and neighbourhood. Traditionally, homestead farming comprises vegetables, medicinal crops, ornamental crops, livestock, fishery, agro-forestry and home-building materials producing crops such as bamboo and others that fulfil home requirements. However, meeting the nutritional need of the family has

been the prime concern of the farm family. Therefore, popularly such farming is called *karesabari* or kitchen gardening.

In recent times, this type of farming is being considered a sustainable site of *in-situ conservation* as such form of farming is very rich in agricultural biodiversity. Thus, a new term, home gardening is used to cover the holistic form of farming around a homestead. Thus, home gardening can be considered the extended form of kitchen gardening encompassing the role of such gardening in agricultural biodiversity.

Thus the significance of home gardening in the Nepalese farming systems lies in meeting nutritional requirement of the family, providing a supplementary source of farm income, often supplementing the cash need during the gap during cereal farming and involving farm women in larger proportion. More recently, home gardening is recognized as a mycocosm of agricultural bio-diversity.

Contribution of home gardening in the total Nepalese agriculture

Unavailability of data on home gardening is a serious limitation to determine its exact contribution to the agriculture sector. Even, National Sample Census of Agriculture has overlooked this aspect. In this context, LI-BIRD's initiative to generate some key baseline data will be a landmark. Experiences show hardly 2-8% of the cultivated area is used for home gardening in Nepal despite its importance in biodiversity and optimal use of natural resources. This has potential to attract tourists.

Program coverage in DoA

Unfortunately, the Department of Agriculture has no exclusive program in home gardening. There are limited programs addressing kitchen gardening under broad-based commodity programs. The objectives of such programs are, however, limited to food security and not extended to other potentials of home gardening. Programs are often linked to poverty reduction addressing disadvantaged groups.

Existing policies that have relevance to home gardening

The government in its tenth five-year plan (1993-1998) has put biodiversity as one of its top priority agenda. Under this broad-based policy, agricultural biodiversity programs function home gardening as one of the elements of this broad-based policy framework. Specific policy related to home gardening does not exist. However, home gardening is a part of the regular extension program and is implemented by district agricultural development offices in DoA and the nodal agency is not defined. Traditionally, the Directorate of Vegetable Development is responsible for the programs related to kitchen gardening at the national level. Regular extension programs related to kitchen gardening cover vegetable mini kits distribution, farm level training targeting women and the ultra poor. Materials of mini kits are composed of little quantities of vegetable seed composites of improved and synthetic varieties and external input-based production packages which have not emphasized the use of local resources in the community. They, thus, do not contain any message on natural resource management and biodiversity. Therefore, the programs need to be completely reformulated in the context of home gardening. Home gardening covers the areas more than vegetables and basically focuses on the use of local resources and covers broad areas like livestock, vegetables, fruits, fodder and many other components that are of immediate use to the local community.

Policy and program related issues

- Policy is framed within the framework of commercialization that extensively relies on external inputs, contrary to the objectives of this project. The home gardening can be commercialized but it should have or different context from the conventional thought of commercialization. Home gardening should primarily be based on indigenous farming and mostly organic fertiliser which should have more valuable commercial niches.
- Home gardening is not the priority program of the government despite the top priority given to it in its policy
- Roles of governmental organizations, non-governmental organizations, community based organizations and farmer groups are not well defined. The governmental role should be limited to policy formulation and facilitating tasks.
- Financial and program incentives are a must. Since most farms undertaking home gardening enterprises are women and subsistent, the government should have such incentives built-in in its programs.
- What are the implications of Agro-eco-zoning in home gardening? This is an issue, which is directly implied to this sector. Experiences show that the species diversity and genetic diversity is greater in hills than in the *terai* (plains).
- How should home gardening be linked to WTO? Several cases are available where indigenous products have established international markets, such as *ginseng* of Korea. Nepal has such potential.
- What priority to district agricultural extension programs should be given for home gardening? What should be the program modality? There is no manpower trained in this area.
- Institutional mechanism to operate home gardening programs in integrated way does not exist.
- Can the farmer field school concept of the integrated pest management program be adopted to achieve the goal? Nepalese experience of this program has been very rewarding, particularly in empowering farmers with respect to decision making process and strengthening farmer-to-farmer extension (horizontal extension).
- Farmers are the generators of biodiversity. They are the protectors of genetic resources. They have the right to protect and use such resources for their socio-economic benefit. In the WTO context, their rights need to be protected and established. Home gardening becomes the most important purview of such rights.
- There is controversy with regards to whether home gardening should be totally based on indigenous knowledge or it should have appropriate mix of IK based technologies and modern technologies.
- Any promotional programs to advance home gardening in the Nepalese context will have access to sustainable financial resources. Should any mechanism be not thought at the outset?

What could be the future road map?

- The scope of home gardening program should be defined. Presently, opinions vary on the definition of home gardening. Some argue on the point that home gardening is still the economic activity. Many think it is the source of biodiversity. Distance of farming from the homestead is also a point of debate.
- Timeframe should be set to achieve the goal. In the beginning, select pilot sites representing major AEZs. LIBIRD model: can this be applied? Is it feasible? A national level interaction should immediately be held on this issue and influence the policy making process.
- Generating programs to create and sustain indigenous diversity should make start.

- Appropriate vertical and horizontal integration components need to be identified to promote natural resource-based farming systems.
- Indigenous-based products should get more market incentives. Support from big trade partners is necessary by bringing small home gardeners in their network.
- Appropriate market strategy supporting home gardening as a viable enterprise should be developed rather than the strategy supporting hi-tech product marketing.
- Institutional network should be established. More roles should be given to community groups with partnership with NGOs.
- More emphasis on farmer-to-farmer extension should be given rather than agency to farmer model. In this context, LI-BIRD is also as an agency similar to a governmental agency.
- *In-situ* biodiversity plan and program, particularly establishing FPR and diversity at the genetic level should be strengthened. Use home gardening as the only primary loci for this.
- Priority fixation is necessary to develop home gardening.
- Resource generation particularly at community level is necessary. Encourage local governments such as DDC and VDCs to put some levy on commercial farm products going out of the location to create funds.
- Local agricultural-development funds should be established in line with drinking water funds etc., a portion of which must go for home gardening projects.

REMEMBER: It is the farmer's homestead that counts for agrobiodiversity.

CONCLUSION

- Farmers are the loci of home gardening, in particular to agro-diversity.
- They are creators as well as the destroyers of diversity.
- The government should now limit its role to policy and program monitoring and facilitating and encourage other partners, particularly community groups for the program implementation.
- Value addition of indigenous knowledge and access to world market.
- FS approach only should be promoted, include herbs as a component of FS.
- Sustainable resource generation and management are necessary.
- Projects can only be pilot scale work and establish program and resource norms. Other partners should take the pilot innovations made by the projects such as the home garden project of LI-BIRD.

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LIBIRD Nepal. Background materials

Mainstreaming findings of home garden project for on-farm biodiversity management and improving livelihoods: Policy and programme implications

Pratap K Shrestha, Resham Gautam and Bhuwon Sthapit

Abstract:
Home gardens in Nepal are traditionally practiced intensive production systems maintained around the homestead; often integrating crops, fruits, spices, herbs, medicinal plants, fodder trees, livestock, fisheries, and apiaries often characterized by low-input soil and water management. Despite their richness in biodiversity and major contribution to meeting family food, nutrition and income requirements, home gardens has remained as neglected and under-utilized resources for the families, communities' government and formal research sector. The paper discusses characteristic features of the Nepalese home gardens and scope, need for research and development interventions based on the experiences from the project and elsewhere. It also discusses research and development issues and implications for policy and programme interventions in Nepal

Key words: Home gardens, biodiversity, food security, nutrition, policy issues, Nepal

Background

Home gardens are an integral part of the livelihood systems, and could contribute to the family food, income and the conservation of biodiversity (Shrestha *et al*., 2004). The home garden project, implemented jointly by Local Initiatives for Biodiversity Research and Development (LI-BIRD) and International Plant Genetic Resources Institute (IPGRI now Bioversity International) with funding support from Swiss Development Corporation (SDC), has provided empirical evidences to support these claims. However, home gardens have remained neglected in terms of research and development interventions. It has not received adequate recognition as an important production system in the national policy, development plans and statistics. The papers presented and discussions organized during the first national workshop on Home gardens on 6-7 August 2004, Pokhara have explicitly identified characteristic features of the Nepalese home gardens, and development and policy implications for further research and development priorities and interventions. This paper summarizes key findings of the workshop and draws policy and development implications for mainstreaming home gardens for on-farm biodiversity management and livelihood enhancement of the people.

Characteristic features of home gardens

The home gardens in Nepal vary in shape, size, composition and structure, and are maintained for the various functions they serve. The main characteristic features of the Nepalese home gardens are summarized below.

Home garden as a defined and holistic system of production
Home gardens involve management of multipurpose trees, shrubs, annual and perennial agricultural crops, herbs, spices, medicinal plants, fish ponds, and animals on the same land unit, in a spatial arrangement or on a temporal sequence (Eyzaguirre and Linares, 2004). Almost all households grow plants of some value around their homestead and more than 72 per cent of households in Nepal maintain home garden of recognizable size (Gautam *et al*., 2004). As a distinct and functional production system, home gardens in Nepal have following features:

- It is an integrated system of production around homestead. Several species of plant are cultivated and maintained by the family members of the households primarily for their own consumption (Shrestha *et. al*., 2004).

- Mixing of different compatible species is commonly practised to maximise the utilisation of spatial (intensive use of ground and vertical space) and temporal (staggered planting and harvesting) dimensions of the home gardens.
- Home garden structures generally consist of multi-layered arrangement of plant species (Soemarowoto, 1987). Each canopy of the garden has a specific place and function.
- The structure and species composition of home gardens are influenced by agro-ecology, socio-cultural practices, economic status of the family, market and so on (Nair, 2001; Gautam *et al.,* 2006).
- Home gardens are dynamic production systems – its structure and species composition may change overtime based on the needs of the gardeners/household and, at the same time, new plan species are continuously introduced.
- Home gardens are maintained to meet multiple objectives/needs of the families, such as food, spices, medicines, livestock fodders, aesthetic purposes and so on.

Home garden as a biodiversity rich production environment/ system

Home gardens are subsets of the larger production system, and are characterized by extremely rich biodiversity of cultivated and uncultivated plant species. This is evident from the following features:

- Complex integration of plant species within a small area, with carefully exploiting the spatial and temporal niches, making home gardens biodiversity rich production systems (Gautam *et al*., 2004).
- Home gardens promote *in-situ* conservation of a wide range of plant species, especially vegetables, fruits, spices and herbs, fodder trees on-farm (Gautam *et al*., 2004).
- Home gardens have been found to maintain unique varieties and key species (Gautam *et al*., 2006).
- Home gardens have been found as viable units of on-farm biodiversity conservation of certain crops when considered at landscape and/or community scale as they are interconnected by farmers' seed system.

Home gardens as important sources of food security and livelihoods

Despite being small in area, home gardens are major source of vegetables (contributes about 60 percent of the total family consumption), fruits and spices and herbs; and it also supplement family income to meet other livelihood needs (Shrestha *et al*., 2004; Gautam *et al*., 2004). More specifically:

- Home gardens supply a variety of nutritious food – through provision of fresh and often pesticide free vegetables and fruits for healthy lives of the family members.
- Home gardens also supplement family income through sale of surplus produce in the market, especially vegetables, fruits and spices and herbs (Gautam *et al.,* 2004; Trinh *et al.,* 2003).
- Home gardens support livestock production by providing fodder and forage and help to provide goods and services of ecosystem health and human landscape.
- Home gardens meet socio-cultural and religious requirements of the family by maintenance of unique crop species.
- Home gardens provide plant species of aesthetic values and provide enrich quality of life.

Home gardens have their own management systems

The cultural practices and management of inputs in home gardens differ from the other production systems and show the following features:

- Home gardens are generally managed under intensive and integrated production system – a variety of plant species and varieties are planted together and their interactions managed accordingly. Small animals and fish, and apiary are also often included in the system.

- The sources of seeds/planting materials for home gardens are largely through self-maintenance and farmer-to-farmer exchange constitutes about 52-70 per cent of total requirements (Gautam *et al.,* 2006).
- The selection and maintenance of seeds and planting materials of plant species in the home gardens is influenced by farmers' household needs for food and income, and their knowledge and innovation. Unique plant species and varieties, often resulting from out-crossing, have been found being maintained in the home gardens (Gautam *et al.,* 2006).
- Local innovation and adaptation for perennial management of plant species that are usually produced under annual management practices in the commercial production system.
- Home gardens tend to be good in soil fertility. Soil fertility management of home gardens is largely recycling and organic based. The system is integrated with indigenous plant protection measures with minimum use of chemicals as it is used for home consumption.
- Species selection of home garden is often designed for multiple harvests to supply diverse food during lean period and linked with food processing requirements.

Home gardens as sources of family income

Home gardens also supplement family income, especially in areas with some market access, and hold great opportunity for production and marketing of health foods. This is quite evident in the Eastern Nepal where market network is well established. Chayote (*Sechium edule*), Akbare chili (*Capsicum spp.*), Rayo sag (*Brassica juncea* var. *rugosa*) and Binhee (*Solanum anguivi*) produced in the home gardens are widely marketed and provide supplementary income to the farming families. The baseline study of the project sites shows that more than 80% of the farmers of Ilam, a project site with a good market network, sell their home garden produce in the market. Home garden produces have high market demand due to their health and cultural food values.

Home garden as a site for domestication and experimentation

Home gardens have traditionally been used as sites for introduction, domestication and experimentation for new plant species/ varieties. Following feature elucidate this:

- Home gardens serve as site for domestication of wild plant species/ varieties (Gautam *et al*., 2004).
- Home gardens are safe refuge of many uncultivated and under-utilized plant species not found in the larger production systems.
- Home gardens are sites for introduction of new plant species/ varieties.
- Home gardens are often site for variety of experimentations for species selection, breeding, adaptive management and uses.

Home garden farmers have rich knowledge about species, management requirements and use value

Home gardens are largely managed by farmers themselves with much research and development interventions. All gender have their own role in management of home gardens, however, women play key role. Farmers, therefore, have rich traditional knowledge on production management and uses, especially about:

- Managing a large number species within a limited land area.
- Soil fertility and plant protection management.
- Interaction management.
- Seed/planting material management.
- Use value – both fresh and processed.

Experiences of research and development interventions in the home gardens

The current project is the first systematic effort in the research and development of home gardens in Nepal. The results so far have shown that home gardens are important production systems for food security and livelihoods of the people are viable units for biodiversity conservation, and that there is greater need and scope for further research and development. For overcoming rural poverty and addressing millennium development goals (MDGs), home garden has seen as a good entry point for intervention as the programme can reach the poorest of the poor. Some of these experiences are summarized here.

Farmers are aware of the value of home garden and keen for community management
There are good opportunities for strengthening the home garden production systems for following reasons:

- Majority of farmers maintaining home garden and this need to translated into "nutrition" garden for family health and well being not only for income.
- Farmers' keen interest in the home garden project activities.
- Initiation of community management of home gardens – establishment of "home garden research and development groups" and "community resource home gardens".
- Community actively engaged in surveillance/monitoring of biodiversity in the home gardens.
- Farmer-to-farmer exchange of information and seeds/ planting materials.
- Exposing key home gardens to new innovation and technologies from other countries.

Scope for promotion of diversity through home garden diversity kits
There is a good opportunity for promotion of diversity through home garden diversity kits as farmers have traditionally been using home gardens to test new crops and varieties. Possibly for this reason, there has been high demand for home garden diversity kits from the farming communities. Farmers' preferences, however, determine the composition of such diversity kits.

Use of participatory approach in planning and implementation of home garden activities
The use of participatory and community-based approach has been found quite useful for the management of home gardens as the empower community to develop community-driven action plans. This includes:

- Using farmers' knowledge in identifying species and associated knowledge.
- Farmers' participation in planning and implementation of the interventions.
- Mobilizing farmers' resource and capacity.

Farmers' traveling and learning workshop encourage diversity in home garden
Farmers' mobility and access to information and materials have positive impact on the home garden diversity (Shrestha *et al*., 2004). Organizing farmers' visit to different farming communities, and research and development project sites has been found to encourage home garden biodiversity because of the following reasons:

- Opportunity to see and share knowledge and seeds/ planting materials.
- Increased awareness about the value of home garden.
- Motivation for community mobilization.
- Motivation for resource and fund mobilization.

Issues of policy implications

The project findings and other experiences discussed during the workshop has identified a number of research and development issues of policy implication. These include:

- Home gardens yet to be recognized as (a) viable units for on-farm biodiversity conservation, and (b) important sources of food security and livelihoods.

- Home gardens have remained neglected and under-utilized resources, and are not reflected in national priority, programme and national statistics.
- There is a negligible investment in research and development (R&D) required for promotion of home garden.
- There is a need for policy intervention to combine conservation and livelihood goals rather than production alone.
- Distinction should be made between food security and nutrition security, with emphasis on latter, in the national policy.
- Promotion of local knowledge and on-farm conservation of home garden diversity.
- Need policy intervention to support local capacity building, especially linking home gardens with community-based approach to management of genetic resources on farms. For example, promoting community resource home gardens, community seed bank, and supporting associations of home gardeners.
- Need to orient R&D for development-oriented conservation.
- Promotion of home gardens for marginal environment.
- Consideration of intellectual property rights (IPR) issues for plant species of home garden in the context of Nepal's membership to WTO. So far, attention has largely been given to food and commercial crops grown in the larger production systems.
- Need to formulate national policy and strategies for promotion of home gardens.

Issues and implications for implementation of home garden programme

Research focus and approach to promotion of home gardens

The following measures have been suggested for addressing research needs of productive management of home gardens:

- Need to include home garden as priority area in research programmes.
- Identify research needs and priorities for home garden production system.
- Research on seed/ planting material production.
- Research on cultural operation – seeding/planting, fertility/irrigation/plant protection management.
- Perennial management of annually grown crops, especially vegetables.
- Production management for shade and mixed cropping/interaction environment.
- Scientific cataloguing of home garden species, which can also serve as database for establishing IPR.
- Need to develop technological options for large scale production of home garden crop of commercial value with emphasis on organic production.
- Research on new crop species/varieties for introduction into home gardens, especially protein-based, for example vegetable type soybean and so on.
- Establish scientific basis for nutritional value of traditional home garden species, including laboratory analysis.
- Generate information to make dietary recommendations for different vulnerable groups using traditional home garden species based on their nutrient information.

Development focus and approach

The following points have been suggested for addressing research needs of productive management of home gardens:

- Need to move from component-based kitchen garden to system-based integrated home garden approach.
- Need to combine development with conservation/ creation goals – diversifying dietary and income base.
- Adopting nutritional diversity as basis for development interventions.
- Need to integrate with nutrition and health education programmes.
- Building local capacity for community management of home garden diversity – awareness, training, exchange visits, group mobilization and so on.

- Home garden resource and knowledge management – knowledge documentation, and promotion of community resource home garden and community seed bank
- Balancing/promoting multiple components of home gardens.
- Promoting multi-stakeholder partnership for home garden development initiatives.
- Training and orientation to professional and field technicians in approaches to diversity-oriented integrated home gardens.
- Explore possible use of complementary approaches/ methods – farmers' field school (FFS), home garden for eco-tourism and so on.
- Changing development focus, emphasizing utilization of available local bio-resources in the home gardens rather than indiscriminate introduction of exotic species and displacing local biodiversity.

Resource and information management focus and approach

The following measures have been suggested to address issues of resource and information related to home gardens:

- Maintenance of database of farmers' knowledge and practices on home garden management.
- Listing of home garden species and associated local knowledge and practices.
- Maintenance of in-situ and ex-situ seed/ gene bank.
- Modeling training programmes with emphasis on enhancing home garden biodiversity for livelihoods – improved nutrition and family income.
- Integrating the concept home garden biodiversity and livelihoods in schools and academic institutions.

Conclusion

Home gardens in Nepal have not received adequate attention and priority in research and development programmes. The project has been successful in establishing the contribution and value of home gardens to the food security, income and livelihoods of the people and conservation of plant genetic resources on-farm. It has also been recognized that there is huge scope and need for policy and programme interventions for further promotion of the home gardens in Nepal. However, there is numerous challenges to translate this potential to reality. Special attention and investment is required for the promotion of home gardens as it provides excellent opportunities to reach millions of poor farmers and contribute in achieving targets of millennium development goals.

Acknowledgement

We are thankful to the workshop participants, including men and women farmers of the project sites and project staff for providing their valuable contribution to the discussion included in the paper. The financial assistance from SDC, Nepal is also gratefully acknowledged.

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ANNEX- A

SUMMARY OF THE MEETING

Two days sharing and planning workshop on "Enhancing the contribution of home gardens to on-farm management of plant genetic resources and to improve the livelihoods of Nepalese farmers" was held on 6-7 August, 2004 in Pokhara. The objectives of the workshop were:

- To advance understanding of the complex process and mechanisms for on-farm management of crop diversity and their relation with farmers' livelihoods in home garden ecosystems;
- To sensitize research, academic and development institutions on the value of home gardens for social, economic and environmental benefits to the community;
- To compare and exchange experiences in encouraging management practices and systems of home gardens for dietary diversity, on-farm management and sustainable livelihoods;
- To identify lessons learnt for policy and capacity building, and
- To share the progresses of annual activity and plan priority activities for next year (Sep 04 – Aug 05)

The forum helped in identifying issues of research and development interest in home gardens to maximize its important. The meeting also served as a venue to share the experiences of different stakeholders and attempts were made to incorporate the prioritized issue in the project planning and also to link with the programme of relevant stakeholders. The experiences of stakeholders were particularly discussed on following themes.

1. Home gardens as a source of dietary diversity
    - Ways to enhance roles of home gardens role in dietary diversity
    - Current status (gaps and strategies to link home gardens with nutrition)
    - Awareness on nutritional values of home garden species

2. Home gardens' role in on-farm diversity management
    - Current status of biodiversity in home gardens (extent, gaps, issues etc.)
    - How the diversity is being managed? (Types, composition, structure etc.)
    - Methodologies used in identifying the diversity in home gardens

3. Home gardens' contribution to livelihoods
    - Home gardens in food security
    - Home gardens and income generation
    - Home gardens in meeting socio-cultural requirements

4. Determinants of home garden diversity
    - Socio-economic factors (food culture, local knowledge, gender, ethnicity, market etc)
    - Ecological factors
    - Farmers awareness on value of home gardens

5. Good practices and lessons learned from community biodiversity management approach
    - Social, economic and environmental benefits
    - local governance
    - social inclusion and peace-building
    - scaling up and out mechanisms

The workshop programmes were categorised in three major sessions as sharing from the project, learning from the stakeholders including farmers and identifying the research and development issues to be considered in future for promoting home gardens as a source of on-farm biodiversity management and contributors to the food security and livelihoods of the farmers. The participants list is included in appendix 1.

SHARING FROM THE PROJECT

The session was chaired by Mr. Bharat Upadhyay, Regional Director, Regional Agricultural Directorate, Pokhara. A total of 11 papers (details on annex 2) including the global perspective and farmers' perception on home gardens' value (economic, social and ecological) to the farmers were presented. Details on the project status and major findings were presented. Major findings of the project are summarised here:

- Though home gardens occupy a very small proportion of the total land holdings of the family (2-4% except in Ilam where it was 12%), they are rich in biodiversity (up to 87 species recorded from the home gardens)
- Home gardens are major sources of family vegetables and fruit supplies (60% of the requirements fulfilled by home gardens)
- Nepalese home gardens are largely vegetable-based (37-48% of total species planted in home gardens are for vegetable purpose) but are richly integrated with fruits, fodders, medicinal and ornamental plants
- Home gardens have their own management systems and are mostly organic-based production system with maximum utilisation of locally available resources
- Farmers have very rich knowledge on home gardens species, managements requirements and their use values
- Home gardens are equally managed by male and female members of the family and the decision making in the home gardens are made by both male and female. Children's' role in home garden management is also significant (particularly in ornamental plant species management)
- Home gardens are the major sources of diversified diet supply to the family through diverse plant genetic resources
- Home gardens have been used as experimental sites, where farmers introduce new species/varieties of plant genetic resources and also domesticate many important plant species for their various uses
- Farmers' collective learning through exchange visits helps not only in sharing the experiences but it also helps in enhancing the biodiversity of the gardens

LEARNING FROM THE STAKEHOLDERS

The session was chaired by Dr. Bhuwon Sthapit, Scientist and regional home garden project Coordinator, IPGRI. A total of 11 papers including 5 from farmers were presented in the session (Please refer Appendix 2 for details). Experiences from both government research (NARC and National Food Nutrition Programme of Department of Foot Technology and Quality Control, DFTQC) and extension (DoA and RAD) sectors and non-governmental organisations (Helen Keller International and Plan Nepal) were shared. The importance of home gardens in livelihood enhancement of the farmers was highlighted and the gaps in home garden information and policy were elucidated during the session. Farmers' experiences on home garden and its value was also shared during the process. At the end of the presentation, Dr. PK Shrestha, Executive Director of LI-BIRD, summarised the findings of home gardens. Issues on research and development aspect of home garden including the policy implications for promotion and inclusion of home garden within the research and development agenda of the country was presented by Dr. Shrestha. The

following policy implications for mainstreaming findings of home gardens have been identified:

- Home gardens are yet to be recognised as a viable unit for on-farm biodiversity conservation and as important sources of food security and livelihoods. Home gardens are not included in national priority and information related to home gardens and its production data have not been included in national statistics
- Lack of investment in research and development activities relevant to home garden
- Home garden species are conserved largely for their different values. Therefore, conservation through utilisation is the right approach in home gardens. Policy for combining conservation and livelihood goals rather than production alone is required to promote home gardens
- Home gardens are the major sources of dietary diversity required for farming households. There should be distinction between food security and nutrition security with separate policy for later
- There should be policy for building local capacity – Community Management, Resource HG, Community seed bank
- Home garden should be promoted as a major option of livelihoods in marginal environment
- IPR issues relevant to home garden in the context of WTO
- Need to formulate national policy and strategies for home gardens
- Possible room for integrating agro-forestry in home garden system for ecosystem function

GROUP DISCUSSION SESSION

After the presentation sessions, group discussion was done in three main groups. The participants were divided in to three main groups as follows:

- Research groups
- Development groups
- Farmers groups

These groups identified key issues and prioritised them for future consideration

One more group was formed by pulling out at least one members form each three group to identify the key elements of the home garden in order to develop common framework on the concept and definition of home gardens in Nepal.

RESEARCH GROUP

Representatives from Horticulture Research Division, Khumaltar and Regional Agriculture Research Station, Lumle of NARC; National Nutrition Programme of DFTQC; and LI-BIRD were grouped in research group. The group identified and prioritised following issues for immediate consideration from research point of view.

1. HG should be the priority research area
2. Detailed understanding on home garden production system of major domains
3. Home garden as a unit of on-farm PGR management
4. Specific researchable areas in home gardens (on prioritized basis)

- Diet/product diversification
- Nutrient analysis

- Production management (seed and plant material system, combination of different crop species, culture management, perennial crop management)
- Post harvest management
- Soil nutrient management

DEVELOPMENT GROUP

The development group, comprising the representatives from DoA, RAD, DADOs and NGOs identified following issues to be considered for the promotion of home gardens:

- Identifying different HG options and information about incorporation of other elements
- Formation of Steering committee/core team (diverse stakeholder involvement)/ networking with regional initiatives
- Preparation of operating guidelines and resource manuals for the dissemination of project findings
- Policy document of home garden should be developed
- Establishment of basket fund- supporting HG institutions.
- Training for professional and front line development/extension workers.
- Develop network of resource HG farmers
- Development of farmers friendly materials to aware them on the value of nutrients and its supply from home garden
- Learning workshop
- Exposure visits to structural HG sites
- Enhance sharing with the global HG project

PLANNING SESSION

The session was chaired by Dr. R.B. Prasad, Acting Regional Director, Regional Agricultural Research Station/NARC, Lumle and facilitated by Dr. BR Sthapit, IPGRI. Farmers from each site presented their activity plan for the coming year (2004-05) for home garden project. The project leader presented the broad framework of the planned activities for the year 2004-05. The issues identified in the meeting and the planning done by the farmers in each site will be incorporated and detailed activities and task under each activity will be developed by the project team.

(Based on the main proposal document, the issues identified during the meeting and the farmers planning, detailed activities have been identified and tentative yearly plan operation (YPO) is developed by the project team with the inputs from the professional members)

ANNEX-B

Home Gardening Initiative in Plan Nepal: Presentation by Plan Nepal

Hem Poudel

Goal: **Improvement in family nutrition**

Objective: **Increase availability of fresh vegetable, fruit and meat in the diets of the participating family.**

Scheme period: 3 years

Families proposed under HGS

District	Year I (FY05)	Year II (FY06)	Year III (FY07)	Total
Morang	200	250	300	750
Sunsari	200	250	300	750
Rautahat	200	300	400	900
Bara	200	200	300	700
Makawanpur	260	300	400	960
Banke	645*	800	1000	2445
Total	1705	2100	2700	6505

*85 families will have small fish pond in the home garden

Criteria for family selection

- Holds atleast 5 Dhur of open land
- Interest to participate and contribute labour, input and time.
- At least one child below 10 years of age in the family.

Components

- Perennial vegetables; mostly creepers that demand minimum floor space.
- Multiple harvest, multiple use and perennial
- Improved or locally superior varieties
- No hybrid
- One pair of pigeon
- 2-4 booths of Banana/ Papaya
- A set of black sugarcane or passion fruit and 1-2 mango sapling

Optional

- 2-4 Muscovy duck
- Mushroom
- Fishpond-250ft2

Plan/NGO contribution

- Provide seed, sapling, input and training support for the first year
- Fruit plants at the name of a children
- Technical backstopping

Monitoring/evaluation

- Plan and implementing NGO visits twice in first six month
- 2 visits- 2nd month & last month of the 2nd year

- Evaluation in the last month of the 3rd year
- initiative will be reviewed each quarter and annually by Plan and NGO

Implementation Plan

Activity	Timeline	Responsibility	Support required
Identify participating family	Aug 04	Implementing NGO	LPC
Develop training curriculum	Mid Aug 04	same	LPC/Country LC
Training	Nov 04		
Baseline of key parameter of family nutrition, family visit	Nov-Dec 04		
Family visit	Every 3 months		
Evaluation	After every 3 year of intervention		

Implementing NGOs

SN	Programme Dsitricts	NGO partners	Partnership starting year
1	Morang	FORWARD	1999
2	Sunsari	LI-BIRD	1999
3	Rautahat	MADE AFFAN	1998 1999
4	Bara	MADE	1998
5	Makwanpur	FORWARD	2002
6	Banke	CEPREAD FORWARD AFFAN	2000 2000

Issues for discussion

- Uniform understanding
- What components to include
- Process for family selection, training
- Monitoring/indicators
- How to process inter-agency learning

ANNEX-C

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