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STUDY THE POTENTIAL OF HOME GARDEN IN THE BIODIVERSITY CONSERVATION AND LIVELIHOOD

Pramila Rana*, S. K.Tewari and Ankush Singh

College of Agriculture, G.B. Pant University of Agriculture and Technology, U. S. Nagar, Rudrapur, Uttarakhand
*Corresponding author: pramilarana788@gmail.com and pramilarana283@gmail.com

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ABSTRACT

The present investigation was carried out with the aim how trees help in biodiversity conservation in Rudraprayag (Malkhi and Khumera villages) and Uttarkashi district (Kurura and Panchan gaun villages) in Uttarakhand. The study was based on by using semi structure interview, field observation and simple preference scoring method in selected site. Three stage sampling technique was employed for constructing sampling plan of the study. The first stage of sampling plan was the selection of blocks from the selected districts, followed by selection of villages (second stage) and selection of respondents (third stage) from the selected villages. The homegardens are the sites for conservation of a large diversity of trees, because of their uses to the households. Data were analyzed using preference ranking method. A total of 35 species of trees (forest trees+ fruit trees), 18 species of agriculture crops, 13 species of vegetable crops, 7 species of grasses and 13 species of shrub were identified in the study area. Thus the homegardens were found to be complex systems due to plant diversity conservation through their multiple uses**.**

Introduction

Homegarden agroforestry systems have been proven to be an intermediary for biodiversity conservation. Selection of intercrop depends mainly on edapho-climatic condition of the area, farmer's need and resource availability (Saroj and Dadhwal, 1997). In the Himalayan region a number of traditional agroforestry system have been documented from Himachal Pradesh and Uttarakhand (Atul *et al.,* 1990). Out of which agrisilviculture, agrihorticulture and agrihortisilviculture practices are very common. Traditional homegardens in Garhwal region have been important multipurpose agroforestry systems that combine ecological and socio-economical sustainability. One of the salient features of homestead forests is that they tend to be small-scale enterprises aimed at subsistence production and income generation. Personal preferences and attitudes, socio-economic status and culture often reflect the appearance, structure and function of the homegardens (Christanty, 1985).

The high diversity of species in home gardens plays wide socio-economic and ecological roles. because it is related to the production of food and other products such as fuelwood, fodders, spices, medicinal plants and ornamentals (Christanty, 1985), prevention of environmental

deterioration commonly associated with monoculture production systems, income generating sites (Hoogerbuugge and Fresco, 1993) and *in situ* conservation of agrobiodiversty (Watson and Eyzaguirre, 2002). Generally, homegardens serve as refuge to a number of plant species, particularly those not widely grown in the larger agro ecosystems.

Materials and Methods

Ethnobotanical data were collected by using semi structured interviews, field observations, ranking and scoring methods. Interviews and discussions were conducted in Garhwali (the local language) using a checklist of topics. Simple preference ranking was calculated for ten multipurpose tree species in order to assess their number in the study site. Based on their personal preference of efficacy, selected informants were asked to assign their preference to Highest score (1), was assigned to most preferred species was given the lowest score (10). The numbers are summed for all respondents, giving an overall ranking for the items by the selected group of respondents.

Name of trees species

It includes type of trees species grown by the farmers, i.e., Bhemal *(Grewia optiva)*, Khadik *(Celtis australis)*, Malta *(Citrus sinensis)* etc.

Numbers of trees species

It includes total number of different trees species grown by farmer on their field.

Measurements on Tree species:

Just to have an idea about the preference of tree species by the farmers in each village a minimum of 12 trees were resulted in 3 categories on the basis girth measurements, i.e., large, medium and small and rate of growth.

Frequency of tree species

Frequency of trees species are calculated by the help of dominant trees species prevalent in the given region. Those tree species which are more prevalent have more frequency.

Fodder and Fuel-wood sources

It refers to types of homegarden trees species, grasses and shrubs are grown traditionally in farmer's field.

Forest products

It includes fuel, fodder, fiber, fruit, furniture, timber, medicinal uses etc of various trees in the study area.

Agriculture products

It refers to amount of food grain, vegetable, fruits, livestock product etc which are marketable and sold by farmer to improve its livelihood. It also includes the agency which help in transport and the nearest place distance where farmer sell the products.

Amount of fodder use by livestock

It includes different livestock, *viz*; buffalo, cow, sheep, bullock and horses and also refers to how much amount of fodders was consumed by different livestock in different seasons.

Research Methodology

Various tools of participatory data collection were used to gather the field data. Opinion of the individual farmer as well as group regarding home garden practices was collected from formal and informal discussion. Different literature including books, project reports, etc. was reviewed to identify the current scenarios of home garden. Pre-testing of tool is also an important phase of research work, as it suggests incorporation of appropriate modifications. Pre-testing of the tool was done by selection of 24 family in each village namely of Rudraprayag & Uttarakashi district. Data collection was done in month of June 2013 by using schedule as tool for personal interview.

Result and discussion

Homegardens usually exhibit high diversity. Average number of species per homegarden varies with the size of the homegardens. A survey of 72 families in selected village indicated that the very few households practices home gardening. The position of homegardens is traditional type. The size and diversity of species in the study area have positive correlations. With an increase in holding size, more variations in species composition were encountered. Homegardens in the study area were composed of trees, shrubs, agriculture crops, herbs and climbing plants in different strata.
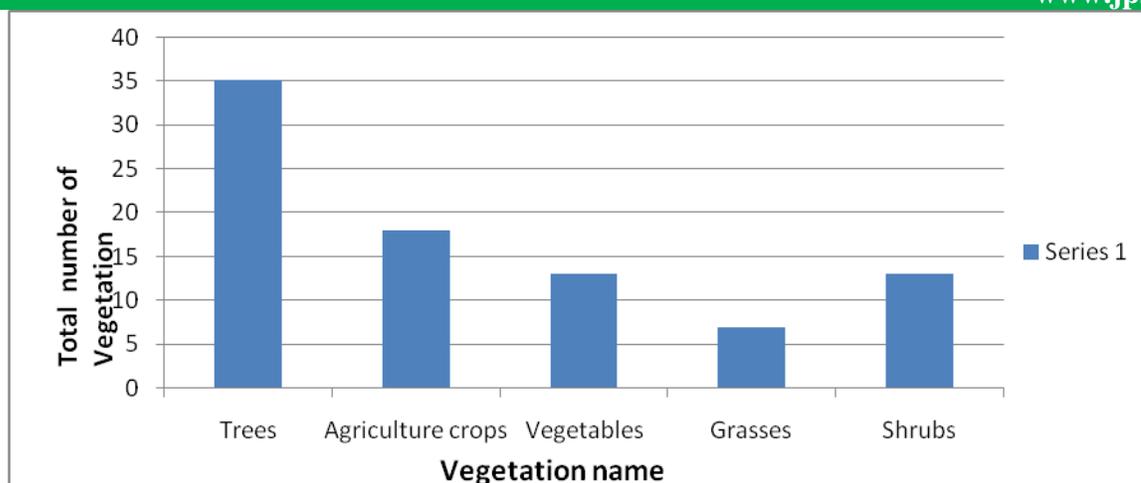
Figure1: Total number of vegetation in existing homegardens

A total of 35 species of trees (forest trees+ fruit trees), 18 species of agriculture crops, 13 species of vegetable crops, 9 species of grasses and 13 species of shrub were identified and documented from the study area. *Grewia optiva* was observed as dominant tree species and *Celtis australis* and *Citrus sinensis* as co-dominant species in the study site. *Grewia optiva* (36%) was the most preferred species, followed by *Celtis australis* (33%). These results indicated that homegardens play a vital role in *in situ* conservation of agribiodiversity The commonly represented families of trees species were Tiliaceae, Rutaceae, Ulmaceae etc.

Homegardens exhibit complex structure, both vertically and horizontally. The vertical structure of homegardens was composed of 3–4 canopy layers. In the present study, four to five vertical canopy layers were identified in homegardens – the emergent layer, the canopy, the understory, the shrub and the herb layer. The emergent layer had a height of 15 m or more and was composed of multipurpose tree species represented in the canopy layer such as *Quercus leucotrichophora, Toona ciliata, Bombex ceiba and Celtis australis.* The canopy layer was between 10-15m with species such as *Juglans regia, Pinus roxburghii, Cedrus deodara* etc.The understory layer was between 5 and 10 m with species such as *Grewia optiva, Citrus sinensis, Ficus spp, Melia azedarach*, *etc.* The shrub layer had the height of 1–5 m and was composed of shrubs like *Rhus oarviflora, Rosa brunonii, Rubus niveus, Berberis asiatica*. Whereas the herb layer was less than 1 m and was mainly composed of vegetables and grass species like *Lycopersicum esculentum, Allium sativum, Andropogon munroi, Cynodon dactylon.*

All the five layers were not present in all homegardens. The canopy, shrub and herb layers were common in all homegardens. The shade provided by the upper layers supports a large number of shade-loving plants like *Colocasia esculenta and Curcuma longa.* In the study report, I found that there was no separate zone for fruit trees, these trees species were usually grown scattered in the boundary of the homegarden or grown mixed. Also majority of the trees with multipurpose uses such as timber, fuelwood, etc. were usually grown in the forest zones. The multi-layered, forest like vegetation structure of the studied homegarden in the area contributes substantially to the agro-ecological sustainability through reducing soil erosion. Research findings from homegarden of Meghalaya, North-east India also confirms that, multilayered vegetation structure prevents soil erosion, provides habitat to soil micro-organisms and promote a favourable microclimate for the household (Tynsong and Tiwari 2010). Similarly, only 28% of such products were sold in South African homegardens, the remainder being used for household consumption. The net income generated from homegardens was also correspondingly variable. For example, in Indonesia it ranged from 6.6% to 55.7% of total income with an average of 21.1% depending on the size of the gardens, family needs and species composition (Soemarwoto, 1987).

Plant diversity and composition of home garden in study site

The diversity and species composition of homegardens depend on requirements of the families, preferences and knowledge about use of the species.The Homegardens flora are composed of both food and non-food plants. Among the food crops 32%, 19% were fruit species, 7% species were vegetables and 6% pulses & cereals ranked 1st in that order. On the other hand, non-food components of the garden grown include fuel, fodder and medicinal plants.
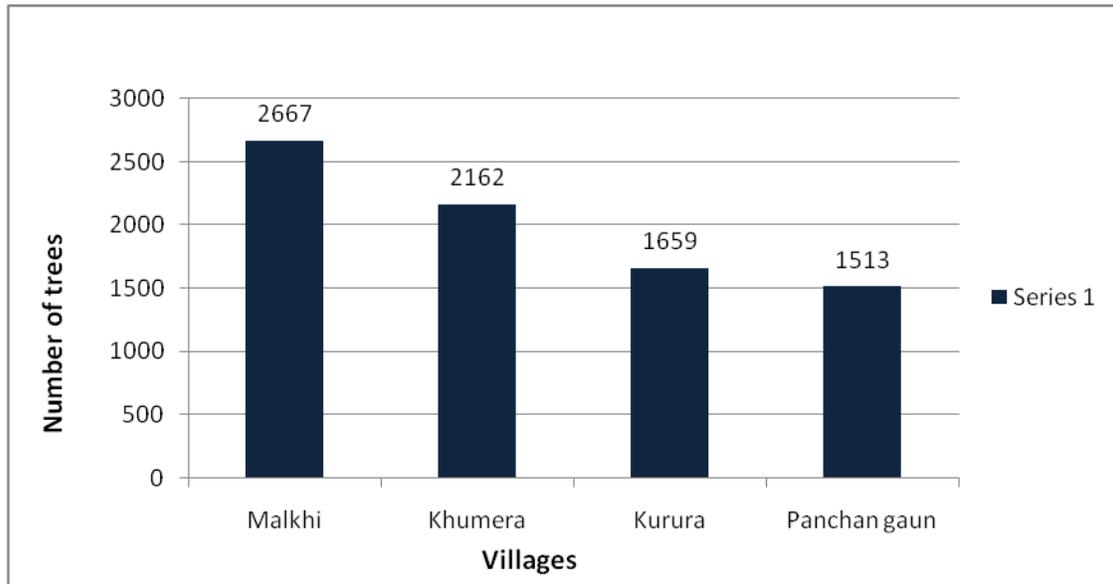
Figure 2: Total number of trees in selected villages

Total number of trees recorded in the study area of Malkhi, khumera, Kurura and Panchan gaun villages were 2667, 2162, 1659 and 1513. Average number of species per homegarden varies with the size of the homegardens. The high diversity and complexity in the structure of homegardens fulfil a range of social, economic and ecological functions.

Out of the total trees in the study site, ten trees were selected according to simple Preference ranking to determine the relative diversity. This technique was employed to rank some selected homegarden species according to their number. Based on their personal preference of efficacy, selected respondents were asked to assign values for each plant. Highest score (1) for maximum diversity, least diversity was given the lowest score (10). The results of trees diversity using simple preferences ranking in the three study sites showed that tree in Malkhi village have maximum diversity, i.e., 2157 and kurura have lowest diverstity, i.e. 1034. The tree species were chosen according to the respondents consensus. Thus, *Grewia optiva* showed a total number of 2217 trees and ranked first, *Celtis australis* and *Citrus sinensis* with a total of 1512 and 543 ranked second and third positions, respectively.

Table1: Simple preferences ranking for widely used trees in home gardens

Scientific name	Study site				Total	Rank
	Malkhi	**Khumera**	**Kurura**	**Panchan gaun**		
Ficus virens	34	67	25	90	216	7
Juglans regia	102	40	35	40	217	6
Grewia optiva	875	586	356	400	2217	**1**
Ficus subincisa	55	18	25	38	136	9
Citrus lemon	75	44	40	40	199	8
Celtis australis	548	300	367	297	1512	**2**
Quercus leucotrichophora	148	201	25	30	404	4
Rhododendron arboreum	25	115	80	57	277	5
Citrus sinensis	280	115	58	90	543	**3**
Toona ciliate	15	34	23	27	99	10
Total	**2157**	**1520**	**1034**	**1109**	**5820**	

Potential of home gardens in biodiversity conservation and livelihood

A total of 35 species of trees, 18 species of agriculture crops, 13 species of vegetable crops, species of grasses and 13 species of shrubs were identified.Among the all trees *Grewia optiva* showed a total number of 1817 trees and rank 1st.Total numbers of trees in Malkhi, Khumera, kurura and Panchan gaun villages were 2667, 2162, 1659 and 1513 trees. Highest homegarden biodiversity present in Malkhi village and lowest were observed in Panchan gaun village.By the study report, major contribution of the agroforestry trees and horticulture trees was around 55-70% and 30-45% in selected site.

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