

# Agroforestry Systems in Eastern Himalayas, Sikkim-India

Deshmukh H<sup>1</sup>. (hkdeshmukh1@rediffmail.com), Bhattacharya P<sup>2</sup>. ,  
Patnaik S<sup>3</sup>. , Dobriyal M<sup>4</sup>.



## Introduction

Sikkim a state of India located in the Eastern Himalayas region with an area of 7096 sq.km. The elevation ranged from 270 m (lower hills) to 8598m (snow bound lands) and annual rainfall ranging from 1300 mm to over 4000mm. **Out of total geographical area, approximately 44 % were forests and 0.38 % were recorded under agroforestry (Data.gov.in, 2018).** About 80% of the population depends on agricultural land for their livelihood. Trees are planted in farms along with agriculture and crops over the length and breadth of Sikkim Himalaya. The local people possessed broad knowledge on the tree-crop combination and their role in conservation of resources and in livelihood . Therefore, there is need to gather such knowledge and incorporating into our resources education system, technical training and development plan.

## Objectives

- To study the different agroforestry systems in South and West Sikkim
- To study the different components of the agroforestry systems
- To study the perception of the farmers regarding function of different agroforestry components in conservation of natural resources and role in livelihood

## Methodology

**Study area :** Sikkim is biodiversity rich beautiful state of India divided into four parts South, East, West and North. **The study was conducted in two district of Sikkim i.e. South Sikkim and West Sikkim ( Fig 1).** Further, three villages were selected from each district namely Bikmat, Borong and Kerabari in South Sikkim and Yuksum, Singling and Sankhu in West Sikkim.

Exploratory design of social research was used for the study. **The data for the study were collected by three methods; i) Secondary data collection, ii) Primary data collection and iii) Agroforestry survey:** Conducted in the study area were classified on the basis of structure (nature and arrangement) and function (role of output) of components (Nair, 1985). **Sample size: A list of 60 respondents were prepared** and data were collected using different tools such as; semi-structured interviews, group discussion, and social mapping. Agroforestry survey was conducted to identify the agroforestry systems and to understand the components and composition of the agroforestry systems in the study area through combination of participatory appraisal and structured formats and questionnaire.

## Results

Table 1 revealed that **total ten different Agroforestry systems were identified on farmers land in South and West Sikkim**, which were rich in tree-agriculture crop diversity (Table 2). The study showed that the farmer's had considerable knowledge about farming and its contribution to natural resources. Same kind of observation were recorded by White (2001) and Chauhan and Dhyani (1990).

The study showed that the **five different agroforestry components and eleven sub-components were identified in agroforestry systems of Sikkim (Fig 2).** In total **96 species i.e. functional unit** were recorded in agroforestry systems of Sikkim Himalayas ( Fig. 2 ) of which 85 per cent plants species were native (Table 3). Similar finding were recorded by Chauhan and Dhyani (1990).

The data in Fig 2 showed that, **out of 96 different functional units of agroforestry components the maximum 35 species were recorded in multipurpose trees** category followed by vegetables (22) and fruit trees 17, where as the **minimum species each (1) were recorded in spices and honeybee** category.

Further, the data revealed that the agroforestry system in Sikkim were biodiversity rich.

As per the perception of farmer, **the Agroforestry systems plays both productive and protective role (Fig 3).** The study revealed that the functional unit like agricultural crops, vegetable, fodder crops, fruit trees played productive role where as spices (Large cardamom), multipurpose tree species, pastures, fruit trees and apiculture played both productive as well as protective role for the farmer. Moreover, **the Agrisilvipasture, agrihorticulture, agrihortipasture, livestock based mixed farming systems, apiculture and kitchen garden** were more beneficial and mostly preferred by farmers.

**Fig. 1 Location map of study area**



**Fig. 2 Status of functional unit of agroforestry components in Sikkim**

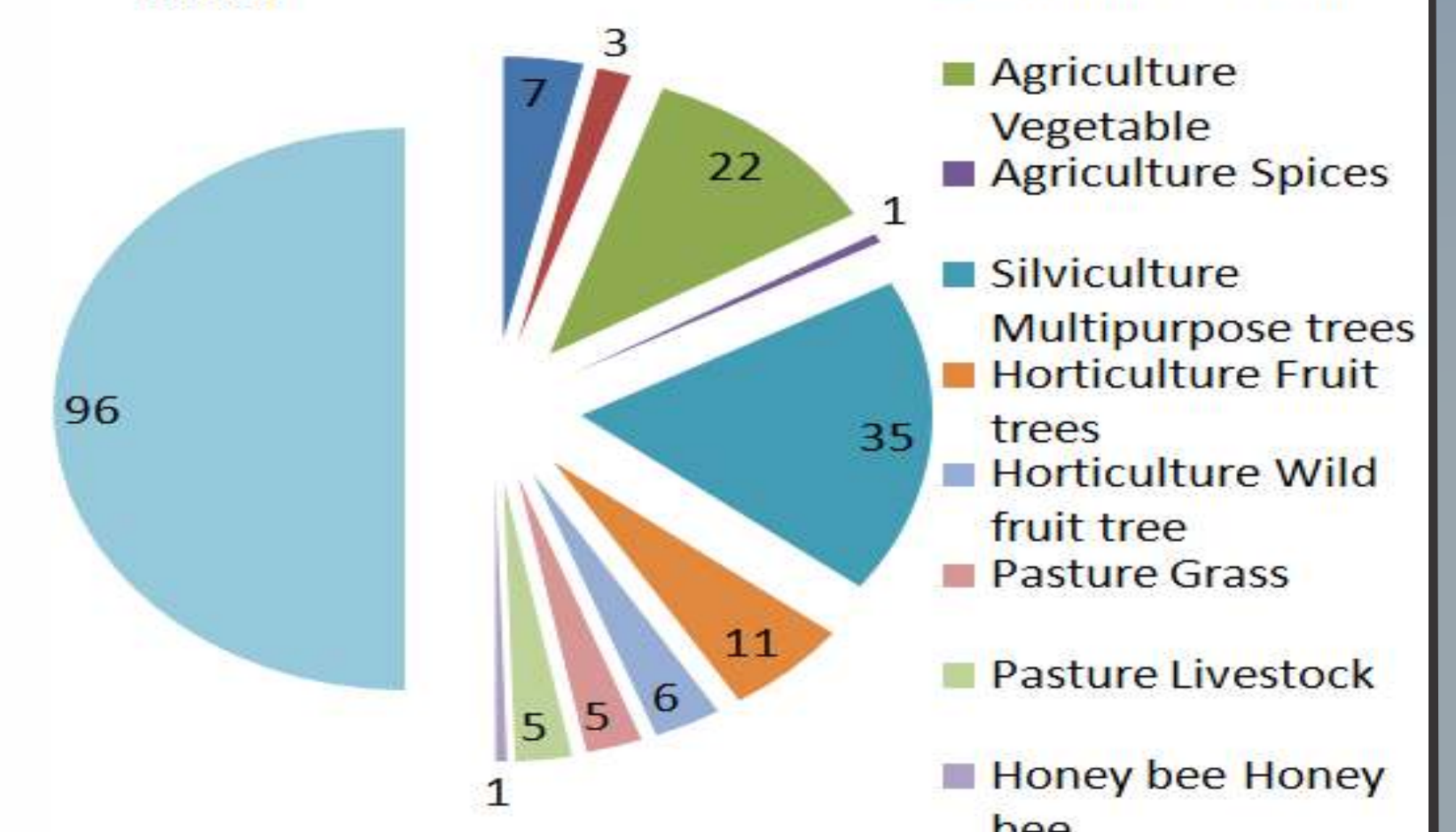
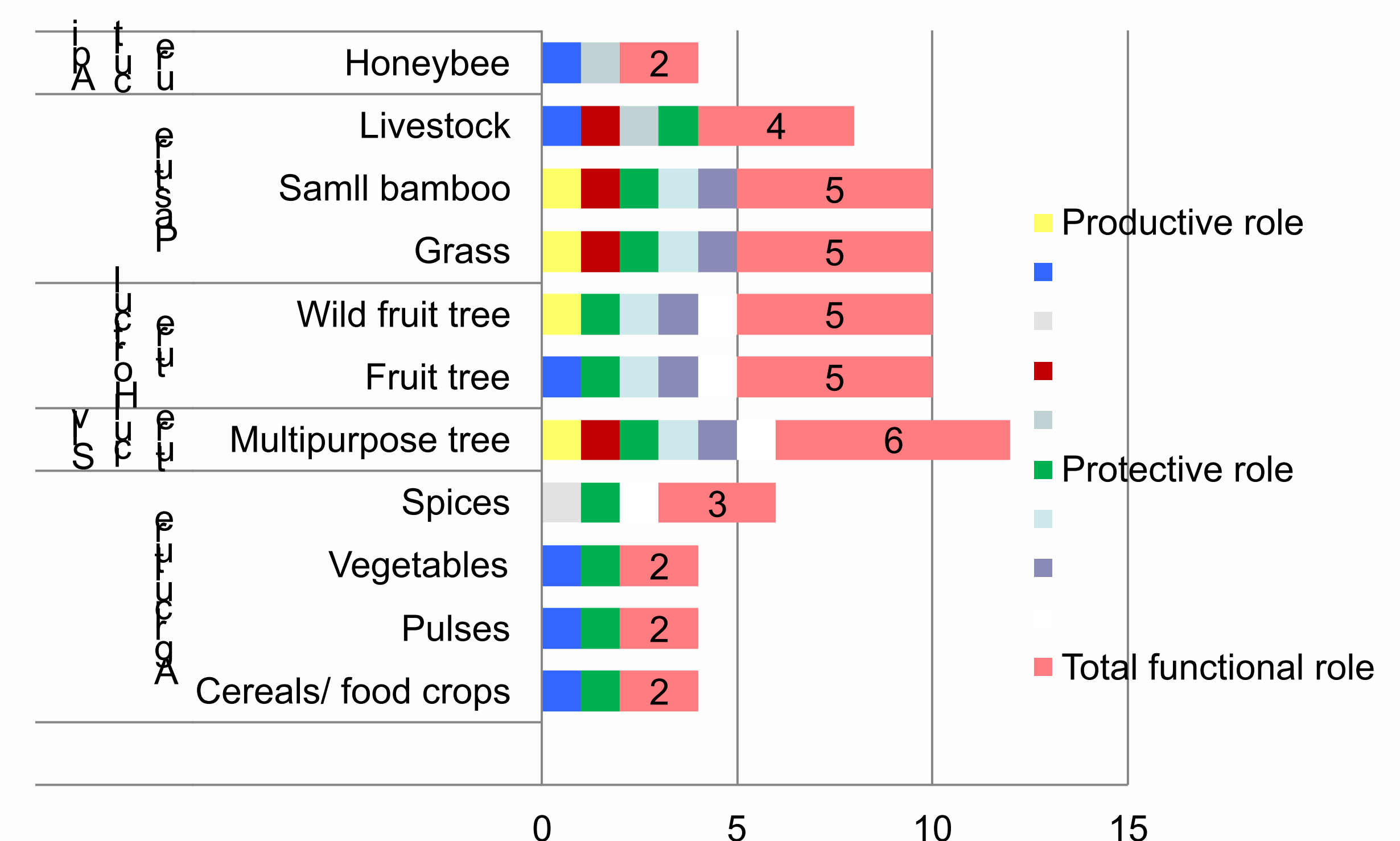


Table 1 Agroforestry system identified on farmers field in Sikkim, India		
Sr. No.	Agroforestry system identified on farmers field in South and West Sikkim their Components	
1.	Agrisilviculture	Agriculture / Vegetable / Spices + Silviculture (Trees)
2.	Agrisilvipasture:	Agriculture/ Vegetable / Spices/ Small bamboo + Silviculture (Trees) + Pasture / Grass
3.	Agrihorticulture:	Agriculture/ Vegetable / Spices + Horticulture (fruit trees)
4.	Agrisilvihorticulture	Agriculture/ Vegetable / Spices + Silviculture (Trees) + Horticulture (fruit trees)
5.	Agrihortipasture:	Agriculture/ Vegetable / Spices + Horticulture (fruit trees) + Pasture / Grass/ Small bamboo
6.	Silvipasture :	Silviculture(Trees) + Pasture/ Small bamboo
7.	Boundary plantation:	Silviculture (Trees)+ Horticulture (fruit trees)
8.	Livestock based (Piggery/ poultry) mixed farming systems:	Silviculture (Trees)+ Pasture and /or Livestock rearing
9.	Agrisilviapiculture	Agriculture / Vegetable / Spices + Silviculture (Trees) + Horticulture (Fruit trees) + Honey bee
10.	Kitchen garden:	Silviculture (Trees)+ Horticulture (Fruit trees) + Vegetables+ Spices

**Fig 3. Functional role of each components perceived by farmers in Sikkimzz**



## Conclusion

The study revealed that the agroforestry was an age old practice in Sikkim, which had been way of life and livelihood for centuries. **The farmers of South and West Sikkim presently were practicing ten traditional agroforestry systems which were biodiversity rich and played a both productive and protective role to farmers' subsistence and intermediate level. In total 96 local species were conserved through agroforestry systems in Sikkim and by that the farmers were contributing to the conservation of local germ plasma.** However, Research on choice of species, tree crop interaction, spatio temporal dynamics needed to be undertaken to maximize the socio-economic and ecological benefits of the Agroforestry systems.

## References

- Chauhan, D.S. and Dhyani, S.K. (1990). Indian J. Dryland Agric. Res. & Dev., 4(2): 73-81.
- Data.gov.in. (2018). Accessed on 10th Dec 2018.
- Nair, P.K.R.1985. Agroforestry systems.3:92-128
- White, J.C. 2001. Agriculture. In: The Gazetteer of Sikkim, Risley, S.S, Low price publications, Delhi.pp.74-79.

## Acknowledgement:

Sincere thanks to IUCN - Himal project for providing financial assistance to conduct the study, supervisor of my research and Director, IIFM, Bhopal for providing facility to conduct the study.