Agroecology in Action: Climate Change Mitigation and Plant Diversity Conservation in Tropical Homegardens

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Introduction

- **Climate Change Mitigation and Biodiversity Conservation**: Two major environmental challenges
- **Homegarden (HG) Agroforestry System**: Indigenous agroecosystem with multistory combinations of trees and crops, sometimes with domestic animals; which follows the principles of agroecology and sustains millions of rural people in the tropics (Gliessman,1990).
- **Study Objectives:** To, 1) measure the plant biodiversity of HGs, 2) measure and compare the HG SOC stocking with other land-use systems, and 3) understand the relationship between plant diversity and SOC sequestration.

Methodology

- **Location:** Thrissur, Kerala, India (Inceptisol) (Fig.1)
- **Five Land-use:** Forest, rubber and coconut plantation, rice-paddy and HGs (Fig.2, 3, and 4).
- **Four Depths:** (0–20, 20–50, 50–80, 80–100 cm).
- **HGs:** Large (>0.4ha) and Small (<0.4 ha).
- **SOC Measurement:** FLASH EA1112NC elemental analyzer.
- Measurement of plant-stand characteristics (Table 1).
- Lower case letters indicate differences at 0.05 probability level.

Fig.1: Study Location in India

Fig.2: Atypical homegarden, Kerala, India

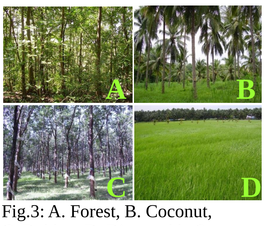

Fig.3: A. Forest, B. Coconut, C. Rubber, D. Rice-paddy Systems

Fig.4: Soil samples are being collected from an HG under the study.

Results

- Total number of economic plant species in Kerala HGs: 106
- Small HGs: Higher mean species density and tree density (Table 1).
- Higher species density – Higher SOC (Fig.5).
- Higher tree density – Higher SOC (Fig.6).
- Higher Margalef Index – Higher SOC.
- Total SOC Stocking: Forests> Small HG > Rubber > Large HG > Coconut> Rice-paddy (Fig.7).

Table 1: Homegarden, Plant-Stand Characteristics

Plant-Stand Characteristics	Large HG (>0.4 ha)	Small HG (<0.4 ha)
Total no. of Species	105	96
Mean no. of Species/ HG	37	33.5
Mean Plant Density (no. of plants 100 m^{-2})	11.14	14.42
Mean Species Density (no. of species 100 m^{-2})	0.71b‡	1.61a
Mean Tree Density (no. of trees100 m^{-2})	5.84b	7.51a
Mean Tree Species Density (species 100 m^{-2})	0.41	0.95
Mean Margalef Index	5.74	5.94
Mean Shannon Index	2.27	2.38

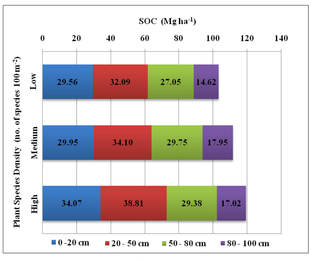

Fig.5: SOC and Plant Species Density

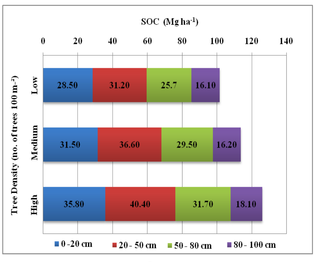

Fig.6: SOC and Tree Density

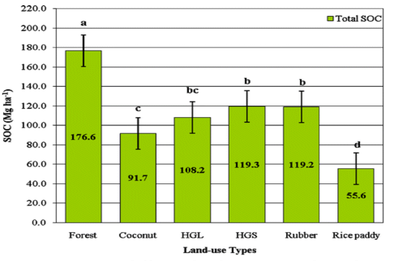

Fig.7: SOC in different land-use in Kerala, India

Discussion

- Forest-like structure and composition of HGs enable them to have high biodiversity and SOC comparable to forests.
- High species assemblage in HGs results better resources-utilization (Tilman et al., 1997) and greater NPP (Vandermeer, 1989), which may contribute to higher SOC sequestration.

Conclusions

- The principles of agroecology: Predominant in tropical homegardens.
- The plant species assemblage in HGs: Biodiversity conservation.
- Food crops in HGs: Food security.
- HG SOC stocking: High climate change mitigation potential.
- Agroecological significance: Plant biodiversity and climate change mitigation, a mutually beneficial relationship.

References

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