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Plant Bioresources and Diversity of Home Gardens in Thanga Village, Manipur: Landscape Connected to Loktak Lake, a Ramsar Site

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ABSTRACT

A study was conducted during August–November, 2024 at Thanga village in Bishnupur district of Manipur, India to study the plant bioresources and species diversity of home gardens in Thanga village which is a community closely tied to Loktak Lake's ecological and cultural landscape. Home gardens play a very significant role in reservoirs of plant diversity and have been contributing immensely to biodiversity conservation, food security, and preservation of traditional knowledge. Given the rising vulnerability of forests to climate change and human disturbances, home gardens can be seen as a sustainable alternative for conserving plant diversity while supporting local livelihoods. A total of 70 plant species and 38 families were documented, with Zingiberaceae being the most dominant. The species were categorized into edible, medicinal, ornamental, fuelwood and construction uses. Species richness ranged from 8.71 to 12.56, with edible plants dominating. Diversity indices, such as Shannon-Wiener index and Simpson's diversity index, indicated considerable biodiversity and evenness, and hence, the necessity of home gardens in maintaining ecological stability, ensuring food security, and preserving traditional knowledge. The study further emphasizes the home garden composition in relation to the surrounding environment, especially the impact of Loktak Lake. Loktak Lake provides much-needed ecological support, which influences plant growth and species selection in home gardens. The reliance of the villagers on these gardens for subsistence and livelihood security indicates the cultural and economic importance of home garden bioresources. It brought forward the imperative necessity of maintaining sustainable management practices to preserve biodiversity while challenging emerging changes.

KEYWORDS: Loktak lake, home gardens, diversity, bioresourses, livelihood

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1. INTRODUCTION

Home gardens are traditional agroecosystems which play an important role in conserving biodiversity and supporting rural livelihoods. One of the distinguishing features of home gardens is the rich bioresources consisting of a diversified range of species with multiple usages. The term plant bioresources encompasses all plant species growing in a specific ecosystem naturally used for food, medicine, timber, fodder, fuel, fibre, and so on for sustaining human well-being. Bioresources are very significant in home gardens as they furnish sustenance, economic benefits, and ecological stability. These gardens often contain a mix of annuals, perennials, shrubs, climbers, and trees, making them highly diverse and productive ecosystems. In such multifunctional systems, they are integrating various plant species in relatively small spaces that provide important resources such as food, medicine, timber, and cultural materials (Kefale, 2020; Zerbe, 2022). The importance of home gardens goes beyond the provision of resources. These small-scale agroecosystems are widely practiced across rural and semi-urban areas, offering sustainable solutions for meeting household needs while maintaining ecological balance. (Mohan, 2004). They are a reflection of the complex relationship between people and their environment, encapsulating centuries of traditional knowledge and practices. Home gardens are an important component of food security, in situ conservation of plant genetic resources, and cultural heritage. Such systems are usually neglected in conservation and agricultural research, making studies on their biodiversity and socio-economic value of great importance. In the todays' context, forests are more vulnerable to climate change (Langlentombi and Kumar, 2021; Esperon-Rodriguez et al., 2022). Therefore, efforts should be placed on greening initiatives in home gardens as an alternative for the conservation of biodiversity and ecological balance. Earlier studies pointed out that home gardens contribute significantly to plant genetic diversity, especially in regions with declining forests (Doody et al., 2010; Salako et al., 2014). Species richness and diversity indices are essential measures used to assess the ecological significance of home gardens (Smith et al., 2006; Surat and Yaman, 2017; Thangjam et al., 2022). Thanga village, in Bishnupur district, Manipur, lies on the western side of Loktak Lake, the largest freshwater lake in northeastern India. The hillocks and islands landscape of the village supports traditional livelihoods such as fishing, agriculture, and home gardening, which are closely related to the ecological and cultural significance of the lake. Thanga village is a typical example of an area known for its cultural and ecological richness, which provides an excellent context to study home garden bioresources. Revealing the provenance of these systems toward livelihoods and biodiversity by village tradition, where home gardens form a basic part of the household management, are plant species in these gardens range from edible and medicinal plants to ornamental and culturally significant species. Despite that, socio-economic changes, urbanization, and land-use modifications threaten the sustainability of such conventional systems (Kangabam et al., 2018;). This paper will discuss the biodiversity of home gardens in Thanga village with species richness, diversity indices, and document the plant resource importance to the community. By recording the plant species and their utility, this study hoped to contribute a little towards the understanding of home gardens in terms of ecological as well as cultural importance. The findings reveal the importance of home gardens in biodiversity conservation and emphasize the importance of sustainable management practices to maintain these valuable systems against emerging challenges.

2. MATERIALS AND METHODS

2.1. Study area

The study was conducted during August–November, 2024 at Thanga village in Bishnupur district of Manipur, India. Thanga village is situated on the periphery of island in Loktak Lake (24°53'N and 93°83'E), a Ramsar site. The region is characterized by a sub-tropical monsoon climate with distinct seasons. The summer season is warm and humid with temperatures ranging between 20°C and 30°C, whereas the winter season is cool, with temperatures that go as low as 5°C to 15°C. The region experiences heavy falls during the monsoon season, generally May to October, averaging around 1,500 to 2,000 mm of rain year^{-1}, which adds to the greenness and agricultural output of the region.

2.2. Data collection and analysis

A survey from August, 2024 to November, 2024 was carried out on 30 randomly selected home gardens. Purposive sampling technique of about 25% of households was conducted resulting in the selection of a total of 30 households (Shrivastava and Heinen, 2007). The following methods were applied in data collection:

2.2.1. Structured interviews

These were carried with the local gardeners to elicit information about the uses of various plant species within the gardens. These interviews were conducted in a structured way through a standardized questionnaire to ensure consistency and comprehensiveness in data collection.

2.2.2. Direct observation

The species of plants in every garden were recorded. The number of each species was recorded and qualitative data regarding the state and location of the plants. Vegetable

crops were excluded from the study to focus on other types of plant species and their uses in the selected home gardens.

2.2.3. Herbarium preparation

Samples of the plant specimens from the gardens were prepared for identification and classification. The standard taxonomic keys were used for the identification of each species. Herbarium specimens were also prepared for long-term storage and reference.

2.2.4. Vegetation study

To study the floristic composition of Thanga Village, community analysis was carried out. In each selected home garden, one quadrate of size 31.62×31.62 m^2 for trees was laid out randomly. Within each quadrate two sub-quadrates of size 5×5 m^2 for shrubs and three 1×1 m^2 of sub-quadrates for herbs were laid out. Density of trees, shrubs and herbs were calculated by counting in each sample plot. Diameter of each tree and shrubs in the sample plot was determined by using tree calliper. Every species was analyzed quantitatively for a number of parameters such as density, percent frequency, and basal area. The importance value index (IVI) for each species was calculated by following the method of Dombois and Ellenberg (1974) and Curtis and McIntosh (1950). The diversity indices were calculated using Shannon-Weiner Index (Shannon and Weiner, 1963), Simpson's diversity index (Simpson, 1949) and Species richness (Margalef, 1958).

3. RESULTS AND DISCUSSION

The survey identified several plant species utilized by the residents of Thanga village for a variety of purposes, highlighting the significance of plant bioresources in their daily lives. A total of 70 plant species were recorded, belonging to 38 different plant families in the home gardens of Thanga village. The most represented families included Zingiberacea, Mimosaceae and Solanaceae. These species were classified into five major use categories: medicinal (Table 1), edible (excluding vegetable crops) (table 2), ornamental (table 3), fuelwood (table 4), and construction uses (table 5). Edible plants represented the largest group, comprising 36.27% of the total recorded species, primarily consisting of fruits, nuts, and other non-vegetable food plants. Medicinal plants accounted for 32.35%, reflecting the community's reliance on traditional medicine for healthcare. Ornamental plants, valued for their aesthetic contribution, made up 14.71% of the species, while fuelwood plants and plant used for construction contributed 9.81% and 6.86%, respectively. Structured interviews revealed that knowledge of plant uses is deeply embedded in the community's cultural practices and often passed down through generations. This emphasizes the critical role of traditional ecological knowledge in sustaining plant bioresources in Thanga village. The plant diversity in Thanga's home gardens underlines the ecological and socioeconomic importance of such gardens. As microhabitats, these gardens conserve not only native species but also those introduced to an area. Results of this study underline the role of plant bioresources in the livelihoods of people of Thanga village, underscoring interlinked biodiversity and traditional knowledge. Diversity and utility of the various plant species present in home gardens point toward importance in fulfilling needs for subsistence, medicine, cultural, and aesthetics, similar to previous research on the subject indicating the relevance of these home gardens within rural areas as reserves of biodiversity as well as resource centers for local traditional ecological knowledge (Turner et al., 2011; Reyes-García et al., 2014; Suwardi et al., 2023). Findings from this study indicated that most of the plant species present in home gardens of Thanga village were edible plants. A high proportion suggests that the edible plants are fundamental to the day-to-day living of the people, a direct reflection of reliance on resources harvested from the homes for food and nutrition. Edible plants consist of fruits, nuts, and other consumable species, with the exception of vegetable crop, as a cornerstone of the local subsistence economy; this is well supported by studies that have documented the significance of home gardens for food security and dietary diversity (Remans et al., 2011; Castañeda-Navarrete, 2021; Pradhan et al., 2021; Mallick et al., 2024). Furthermore, the good proportion of medicinal plants documented by this study shows the reliance on traditional medicine as a major source of primary health care, especially in areas where access to modern healthcare facilities is limited. Medicinal species illustrate the richness of the community knowledge about their therapeutic properties. That ties with other observations, which explain that rural groups mainly rely on plants available at the local context for health-related needs because it is easily available and culturally appropriate (Costanza, 2010; Alonso, 2015). But with higher rates of modernization and rapid urbanization in this world, without proper documentation or inclusion in integrated conservation efforts, the traditional understanding might be at a risk.

Data in Table 6 demonstrates that Thanga Village is comprised of 38 herbs species, which has total density of 69.90 tiller m^{-2} and basal area of 1055.46 cm^2 m^{-2}. The maximum values of density (10.90 tiller m^{-2}), basal area (186.93 cm^2 m^{-2}) and IVI (26.09) were exhibited in *Polygonum barbatum*, *Phragmites australis* and *Zizania latifolia*, respectively. The minimum value of density (0.10 tiller m^{-2}) was recorded in *Dendrobium chrysotoxum*, *Ocimum tenuiflorum* and *Vanda coerulea*. Whereas, minimum basal area (0.03 cm^2 m^{-2}) was recorded in *Vanda coerulea*, and the minimum IVI (1.10) were exhibited in *Dendrobium*

Table 1: Edibles plant species in Thanga village

Sl. No.	Scientific name	Family	Local name
1.	*Alocasia macrorrizos* (L.) G. Don	Araceae	Pangkhok
2.	*Alpinia nigra* (Gaertn) Burtt.	Zingiberaceae	Pullei
3.	*Artocarpus heterophyllus* Lam.	Moraceae	Theibong
4.	*Bambusa nutan* Wall. ex *Munro*	Poaceae	Watangkhoi
5.	*Centella asiatica*	Apiaceae	Peruk
6.	*Citrus limon* Linn.	Rutaceae	Champra
7.	*Citrus maxima* (Burm.) Merr.	Rutaceae	Nobab
8.	*Emblica officinalis* Gaertn.	Euphorbiaceae	Heikru
9.	*Eryngium foetidum* Linn.	Apiaceae	Awaphadigom
10.	*Euryale ferox* Salisb.	Nymphaeceae	Thangjing
11.	*Hedychium flavum* Robx.	Zingiberaceae	Loklei
12.	*Ipomoea aquatica* Forsk.	Convolvulaceae	Kolamni
13.	*Houttuynia cordata* Thunb.	Saururaceae	Toningkhok
14.	*Jussiaea repens* Linn.	Onagraceae.	Ishing kundo
15.	*Leucaena leucocephala* (Lam.) de Wit	Mimosaceae	Chigong-lei-angouba
16.	*Lysinachia ovovata* Z.D.H.	Primulaceae	Kengoi
17.	*Magnifera indica* Linn.	Anacardiaceae	Heinou
18.	*Musa paradisiaca* Linn.	Musaceae	Laphu
19.	*Nelumbo nucifera* Gaertn.	Nymphaeceae	Thambou
20.	*Neptunia oleracea* Lour.	Mimosaceae	Lam ekaithabi
21.	*Oenanthe javanica* (Bleune) D.C.	Amaranthaceae	Komprek
22.	*Oxalis corniculata* Linn.	Oxalidaceae	Yensin
23.	*Parkia javanica* Merr.	Mimosaceae	Youngchak
24.	*Persicaria lapathifolia* L.	Polygonaceae	Yenguman
25.	*Polygonum barbatum* Linn.	Polygonaeceae	Yelang
26.	*Polygonum perfolistum* Linn.	Polygonaceae	Lilhar
27.	*Portulaca oleracea* Linn.	Portulacaceae	Leibak kundo
28.	*Psidium guajava* Linn.	Myrtaceae	Pungdon
29.	*Punica granatum* Linn.	Onagraceae	Kamphoi
30.	*Sesbania sesban* Linn.	Fabaceae	Chu Chu rangmei
31.	*Spondias pinnata* (Linn.f.) Kurz	Anacardiaceae	Heining
32.	*Syzygium cuminii* (Linn.) Skeel.	Myrtaceae	Jam
33.	*Tamarindus indica* Linn.	Caesalpiniaceae	Mange
34.	*Trapa natans* Linn.	Trapaceae	Heikrak yelli
35.	*Zanthoxylum acanthopodium* DC.	Rutaceae	Mukthrubi
36.	*Zingiber officinale* Rosc.	Zingiberaceae	Sing
37.	*Zizania latifolia* (Griseb.)	Poaceae	Ishing Kambong

Table 2: Medicinal plant species in Thanga village

Sl. No.	Scientific name	Family	Local name
1.	*Alocasia macrorrizos* (L.) G. Don	Araceae	Pangkhok
2.	*Aloe barbadensis* Mill.	Liliaceae	Ghrita-kumar
3.	*Alternanthera sessilis* D.C.	Amaranthaceae	Phakchet
4.	*Amaranthus viridis* Linn.	Amaranthaceae	Chengkruk
5.	*Centella asiatica*	Apiaceae	Peruk
6.	*Adhatoda vasica* Nees	Acanthaceae	Nongmangkha angouba
7.	*Curcuma caesia* Roxb.	Zingiberaceae	Yaimu
8.	*Euphorbia hirta* Linn.	Euphorbiaceae	Pakhang leiton
9.	*Euryale ferox* Salisb.	Nymphaeceae	Thangjing
10.	*Gynura cusimbua* (D. Don) Moore.	Asteraceae	Terapaibi
11.	*Hedychium flavum* Robx.	Zingiberaceae	Loklei
12.	*Ipomoea aquatica* Forsk.	Convolvulaceae	Kolamni manton
13.	*Jussiaea repens* Linn.	Onagraceae.	Ishing kundo
14.	*Kalanchoe pinnata* (Lam.) Pres.	Crassulaceae	Mana hidak
15.	*Lysinachia ovovata* Z.D.H.	Primulaceae	Kengoi
16.	*Phlogacanthus thyrsiflorus* Nees.	Acanthaceae	Nongmangkha angangba
17.	*Nelumbo nucifera* Gaertn.	Nymphaeceae	Thambal
18.	*Nicotiana tabacum* Linn.	Solanaceae	Hidak mana
19.	*Solanum torvum* Swartz.	Solanaceae	Sing Khanga
20.	*Zingiber officinale* Rosc.	Zingiberaceae	Sing
21.	*Cedrela toona* Roxb.	Meliaceae	Tairen
22.	*Ocimum sanctum* Linn.	Lamiaceae	Tulsi
23.	*Oenanthe javanica* (Bleune) D.C.	Amaranthaceae	Komprek
24.	*Oxalis corniculata* Linn.	Oxalidaceae	Yensin
25.	*Persicaria lapathifolia* L.	Polygonaceae	Yenguman
26.	*Parkia javanica* Merr.	Mimosaceae	Youngchak
27.	*Polygonum barbatum* Linn.	Polygonaeceae	Yelang
28.	*Polygonum perfolistum* Linn.	Polygonaceae	Lilhar
29.	*Portulaca oleracea* Linn.	Portulacaceae	Leibak kundo
30.	*Solanum xanthocarpum* Linn.	Solanaceae	Leipungkhanga
31.	*Trapa natans Linn.*	Trapaceae	Heikrak yelli
32.	*Zanthoxylum acanthopodium DC.*	Rutaceae	Mukthrubi mana

chrysotoxum, *Ocimum tenuiflorum* and *Vanda coerulea*. This village recorded 16 shrubs species (Table 7), which has a total density of 1320.00 N ha^{-1} and basal area of 6.64 m^2 ha^{-1}. The maximum values of density (280.00 N ha^{-1})was recorded in *Lantana camara* while both basal area (1.12 m^2 ha^{-1}) and IVI (37.44) were recorded in *Citrus limon*. On the other hand, the minimum values of density (39 N ha^{-1}) was recorded in *Bougainvillea glabra*, while basal area (0.04 m^2 ha^{-1}) and IVI (7.48) were recorded in *Solanum xanthocarpum*.

A total of 16 tree species (Table 8) were recorded in this village with total density of 55.08 N ha^{-1} and basal area of 16.58 m^2 ha^{-1}. The maximum values of density (11.02 N ha^{-1}) was recorded in *Parkia javanica* while both basal area (15.10 m^2 ha^{-1}) and IVI (106.19) were recorded in *Bambusa nutan*. Whereas, the minimum values of density (1.00 N ha^{-1}) and IVI (4.00) were recorded in *Syzygium cuminii* and *Tamarindus indica,* respectively. However, the minimum value of basal area (0.02 m^2 ha^{-1}) was exhibited in both

Table 3: Ornamental plant species in Thanga village

Sl. No.	Scientific name	Family	Local name
1.	*Bougain villea* glabra	Nyctaginaceae	Cherei
2.	*Cestrum nocturnum* L.	Solanaceae	Thabal lei
3.	*Clitoria ternatea* Linn.	Fabaceae	Aparajita
4.	*Dendrobium chrysotoxum* Lindl.	Orchidaceae	Khonggumilai
5.	*Hedychium spicatum* Buch.- Ham.	Zingiberaceae	Takheilei
6.	*Hibiscus rosa-sinensis* L.	Malvaceae	Jaba Kusum
7.	*Jasminum jambec* (Linn.) Ait.	Oleaceae	Kundo
8.	*Gardenia jasminoides* Ellis.	Rubiaceae	Kaboklei
9.	*Jussiaea repens* Linn.	Onagraceae.	Ishing kundo
10.	*Michelia champaca* Linn.	Magnoliaceae	Leihao
11.	*Nymphaea nouchali* Burm.f.	Nymphaeaceae	Tharo
12.	*Nelumbo nucifera* Gaertn.	Nymphaeceae	Thambal
13.	*Rosa chinensis* Jacq.	Rosaceae	Ador gulab
14.	*Tagetes erecta* L.	Asteraceae	Sanarei
15.	*Vanda coerulea* Griff. ex Lindl.	Orchidaceae	Kwak lei

Table 4: Fuelwood plant species in Thanga village

Sl. No.	Scientific name	Family	Local name
1.	*Albizia stipulata* (Roxb.) Boivin	Mimosaceae	Khok
2.	*Artocarpus heterophyllus* Lam.	Moraceae	Theibong
3.	*Cedrela toona* Roxb.	Meliaceae	Tairen
4.	*Emblica officinalis* Gaertn.	Euphorbiaceae	Heikru
5.	*Eucalyptus* spp.	Myrtaceae	Nasik
6.	*Grevillea robusta* A. C. ex. R. Br.	Proteaceae	Koubilla
7.	*Lantana camara* Linn.	Verbenaceae	Nongban lei
8.	*Leucaena leucocephala* (Lam.)de Wit	Mimosaceae	Chigong-lei-angouba
9.	*Phragmites australis* (Cav.) Trin. ex Steud.	Poaceae	Tou
10.	*Pinus roxburghii* Sarg.	Pinaceae	Uchan

Table 5: Plant species used in construction in Thanga village

Sl.No.	Scientific name	Family	Local name
1.	*Bambusa nutan* Wall. ex Munro	Poaceae	Watangkhoi
2.	*Cedrela toona* Roxb.	Meliaceae	Tairen
3.	*Eucalyptus* spp.	Myrtaceae	Nasik
4.	*Leucaena leucocephala* (Lam.) de Wit.	Mimosaceae	Chigong-lei-angouba
5.	*Phragmites australis* (Cav.) Trin. ex Steud.	Poaceae	Tou
6.	*Pinus roxburghii* Sarg.	Pinaceae	Uchan
7.	*Zizania latifolia* (Griseb.)	Poaceae	Ishing Kambong

Table 6: Floristic composition of herbs in Thanga village

Sl. No.	Scientific name	Density (tiller m^{-2})	Basal area (cm^2 m^{-2})	Relative density	Relative frequency	Relative dominance	IVI
1.	*Alocasia macrorrizos* (L.) G. Don	2.60	14.35	3.72	7.62	1.36	12.70
2.	*Aloe barbadensis* Mill.	0.50	9.05	0.72	1.90	0.86	3.48
3.	*Alpinia nigra* (Gaertn) Burtt.	0.90	78.46	1.29	2.86	7.43	11.58
4.	*Alternanthera sessilis* D.C.	6.30	32.37	9.01	1.90	3.07	13.98
5.	*Amaranthus viridis* Linn	3.80	13.11	5.44	2.86	1.24	9.54
6.	*Centella asiatica*	3.70	2.42	5.29	4.76	0.23	10.28
7.	*Clitoria ternatea*	0.60	0.80	0.86	0.95	0.08	1.89
8.	*Curcuma caesia* Roxb.	0.50	25.07	0.72	0.95	2.38	4.04
9.	*Dendrobium chrysotoxum* Lindl.	0.10	0.05	0.14	0.95	0.00	1.10
10.	*Eryngium foetidum* Linn.	0.90	0.30	1.29	2.86	0.03	4.17
11.	*Euphorbia hirta* Linn.	1.00	1.02	1.43	2.86	0.10	4.38
12.	*Euryale ferox* Salisb	2.10	23.15	3.00	4.76	2.19	9.96
13.	*Gynura cusimbua* (D. Don) Moore.	4.40	55.22	6.29	4.76	5.23	16.29
14.	*Hedychium flavum* Robx.	1.10	89.23	1.57	2.86	8.45	12.88
15.	*Hedychium spicatum* Buch.- Ham.	0.60	13.05	0.86	1.90	1.24	4.00
16.	*Houttuynia cordata* Thunb.	0.70	0.08	1.00	2.86	0.01	3.87
17.	*Ipomoea aquatica* Forsk.	0.40	8.32	0.57	1.90	0.79	3.27
18.	*Jussiaea repens* Linn.	0.50	13.04	0.72	1.90	1.24	3.86
19.	*Kalanchoe pinnata* (Lam.) Pres	0.60	2.05	0.86	0.95	0.19	2.00
20.	*Lysinachia ovovata* Z.D.H.	2.50	3.02	3.58	6.67	0.29	10.53
21.	*Musa paradisiaca* Linn.	0.60	112.44	0.86	1.90	10.65	13.42
22.	*Nelumbo nucifera* Gaertn.	0.20	30.18	0.29	0.95	2.86	4.10
23.	*Neptunia oleracea* Lour.	0.50	0.08	0.72	1.90	0.01	2.63
24.	*Nicotiana tabacum* Linn.	0.50	7.62	0.72	0.95	0.72	2.39
25.	*Nymphaea nouchali* Burm.f.	0.80	26.73	1.14	1.90	2.53	5.58
26.	*Ocimum sanctum* Linn.	0.10	0.06	0.14	0.95	0.01	1.10
27.	*Oenanthe javanica* (Bleune) D.C.	3.40	44.11	4.86	1.90	4.18	10.95
28.	*Oxalis corniculata* Linn.	3.30	2.52	4.72	8.57	0.24	13.53
29.	*Persicaria lapathifolia* L.	1.50	1.06	2.15	3.81	0.10	6.06
30.	*Phragmites australis* (Cav.) Trin. ex Steud.	3.50	186.93	5.01	1.90	17.71	24.62
31.	*Polygonum barbatum* Linn.	10.90	43.18	15.59	2.86	4.09	22.54
32.	*Polygonum perfolistum* Linn.	0.20	1.01	0.29	1.90	0.10	2.29
33.	*Portulaca oleracea* Linn.	0.80	9.05	1.14	2.86	0.86	4.86
34.	*Tagetes erecta* L.	1.20	0.50	1.72	0.95	0.05	2.72
35.	*Trapa natans* Linn.	0.90	12.48	1.29	2.86	1.18	5.33
36.	*Vanda coerulea* Griff. ex Lindl.	0.10	0.03	0.14	0.95	0.00	1.10
37.	*Zingiber officinale*	0.60	43.75	0.86	1.90	4.15	6.91
38.	*Zizania latifolia* (Griseb.)	7.00	149.57	10.01	1.90	14.17	26.09
	Total	69.90	1055.46	100.00	100.00	100.00	300.00

Table 7: Floristic composition of shrubs in Thanga village

Sl. No.	Scientific name	Density (N ha^{-1})	Basal area (m^2 ha^{-1})	Relative density	Relative frequency	Relative dominance	IVI
1.	*Adhatoda vasica* Nees	120.00	0.26	9.09	7.69	3.90	20.69
2.	*Bougainvillea glabra*	39.00	0.52	3.03	3.85	7.76	14.64
3.	*Cestrum nocturnum* L.	40.00	0.34	3.03	3.85	5.06	11.94
4.	*Citrus limon* Linn.	120.00	1.12	9.09	11.54	16.81	37.44
5.	*Citrus maxima* (Burm.) Merr.	41.00	0.84	3.03	3.85	12.65	19.53
6.	*Gardenia jasminoides* Ellis.	40.00	0.25	3.03	3.85	3.80	10.68
7.	*Hibiscus rosa-sinensis* L.	80.00	0.69	6.06	7.69	10.33	24.08
8.	*Jasminum jambec* (Linn.) Ait.	40.00	0.12	3.03	3.85	1.81	8.69
9.	*Lantana camara* Linn.	280.00	0.22	21.21	7.69	3.37	32.28
10.	*Phlogacanthus thyrsiflorus* Nees.	120.00	0.20	9.09	7.69	3.01	19.80
11.	*Punica granatum* Linn.	40.00	0.40	3.03	3.85	6.03	12.90
12.	*Rosa chinensis* Jacq.	80.00	0.44	6.06	7.69	6.63	20.38
13.	*Sesbania sesban* Linn.	120.00	0.17	9.09	11.54	2.55	23.18
14.	*Solanum torvum* Swartz.	40.00	0.06	3.03	3.85	0.84	7.72
15.	*Solanum xanthocarpum* Linn.	40.00	0.04	3.03	3.85	0.60	7.48
16.	*Zanthoxylum acanthopodium* D.C.	80.00	0.98	6.06	7.69	14.83	28.58
	Total	1320.00	6.64	100.00	100.00	100.00	300.00

Table 8: Floristic composition of trees in Thanga village

Sl. No.	Scientific name	Density (N ha^{-1})	Basal area (m^2 ha^{-1})	Relative density	Relative frequency	Relative dominance	IVI
1.	*Albizia stipulata* (Roxb.) Boivin	2.00	0.08	3.64	3.92	0.48	8.04
2.	*Artocarpus heterophyllus* Lam.	2.00	0.07	3.64	3.92	0.43	7.99
3.	*Bambusa nutan* Wall. ex Munro	4.01	15.10	7.27	7.84	91.07	106.19
4.	*Cedrela toona* Roxb.	2.00	0.08	3.64	3.92	0.51	8.07
5.	*Emblica officinalis* Gaertn.	4.01	0.04	7.27	7.84	0.21	15.33
6.	*Eucalyptus* spp.	5.01	0.20	9.09	9.80	1.18	20.08
7.	*Grevillea robusta* A.Cunn. ex R.Br.	3.00	0.23	5.45	5.88	1.36	12.70
8.	*Leucaena leucocephala* (Lam.) de Wit	2.00	0.02	3.64	3.92	0.12	7.68
9.	*Mangifera indica* Linn.	9.01	0.22	16.36	15.69	1.36	33.41
10.	*Michelia champaca* Linn.	2.00	0.04	3.64	3.92	0.27	7.83
11.	*Parkia javanica* Merr.	11.02	0.20	20.00	15.69	1.20	36.89
12.	*Pinus roxburghii* Sarg.	2.00	0.17	3.64	3.92	1.03	8.59
13.	*Psidium guajava* Linn.	3.00	0.03	5.45	5.88	0.17	11.51
14.	*Spondias pinnata* (Linn.f.) Kurz	2.00	0.02	3.64	3.92	0.14	7.70
15.	*Syzygium cuminii* (Linn.) Skeel.	1.00	0.04	1.82	1.96	0.22	4.00
16.	*Tamarindus indica* Linn.	1.00	0.04	1.82	1.96	0.22	4.00
	Total	55.08	16.58	100.00	100.00	100.00	300.00

Spondias pinnata and *Leucaena leucocephala*.

The data presented in Table 9 shows the calculated diversity indices for the plant species observed in the village gardens. The Shannon-Wiener Diversity Index (H') for the plant species in Thanga village ranges from 2.25 to 3.34, indicating a moderate to high level of species diversity. The maximum Shannon-Weiner index was exhibited under herbs (23.34) followed by shrubs (2.67) and trees (2.25). This suggests that the species within the home gardens are fairly evenly distributed, with no single species dominating the community. The Simpson's Diversity Index ranges from 0.83 to 0.96, which indicate a diverse and well-balanced community, with a strong presence of various species in relatively even proportions. The maximum Simpson's Diversity Index was registered under herbs (0.96) followed by shrubs (0.92) and trees (0.83). A species richness range of 8.71 to 12.56 in Thanga village suggests moderate to high biodiversity within the home gardens. The maximum species richness was recorded in shrubs (12.56) followed by trees (8.80) and herbs (8.71).

Table 9: Vegetation indices of herbs, shrubs and trees in Thanga village

Plant categories	Vegetation indices		
	Shannon-Weiner index	Simpson's diversity Index	Species richness
Herbs	3.34	0.96	8.71
Shrubs	2.67	0.92	12.56
Trees	2.25	0.83	8.80

The species richness and diversity indices calculated for home gardens of Thanga village indicate a moderate to high level of biodiversity. Home gardens are significant microhabitats, supporting species richness and providing ecological stability (Patel et al., 2022; Santos et al., 2022). Earlier research has indeed suggested that not only are home gardens integral parts of household subsistence but they also contribute enormously to in situ biodiversity conservation (Pushpakumara et al., 2020; Shao et al., 2021). Despite this apparent biodiversity, a number of challenges face the sustainability of these home garden systems. Habitat fragmentation, changing land-use patterns and influence of external market forces were noted as potential risks to plant diversity. Similar concerns have been voiced in studies indicating vulnerability of traditional agroecosystems towards socio-economic changes and pressures from outside; Gupta et al., 2022; Santoro, 2023). Moreover, the introduction of non-native ornamental species may cause ecological imbalance and reduce the cultural relevance of native species. Traditional knowledge should be integrated with conservation strategies for long-term sustainability of plant bioresources in the Thanga village. Initiatives like seed banks, nurseries, and community-based conservation programs will help ensure that plant diversity and its associated knowledge is preserved not only for the time being but will also facilitate their intergenerational transfer. Promoting the local cultivation of locally significant species is another important step. This research is part of a growing body of literature highlighting the importance of home gardens to the ecosystem, culture, and economy. This study thus highlights the necessity of policies and initiatives in supporting these systems as key contributors to biodiversity conservation and sustainable livelihoods in rural communities.

4. CONCLUSION

Home gardens in Thanga village are biodiversity-rich systems with significant ecological and cultural value. The gardens play a vital role in local food security, cultural practices, and ecological stability, as indicated by the high species richness and diversity indices. Given the challenges posed by climate change and environmental pressures, home gardens offer a sustainable alternative for biodiversity conservation. Promoting sustainable practices and integrating traditional knowledge into conservation strategies can enhance their resilience.

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