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Impact of traditional home garden on socio-economy across altitudinal gradient of Mon District in Nagaland

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Abstract

Concept of home garden is very common in the hilly area of north eastern part of India and play a crucial role in livelihood, economy and biological diversity conservation. The present study aims to study of the home garden in three different altitudinal ranges in Mon district of Nagaland with the prime objective about the socioeconomic status of existing home garden, distribution and the variety of products and their local uses. The household was selected as a sampling unit of study. Data was gathered through a structured interview covering 60 households, 20 from each village. The home gardens across the altitudes were studied in detail in order to ascertain the roles played by these gardens in the socio-economic context. The survey comprises of 47 plant species from 29 different families. *Cucumis sativa* (28%) was recorded to contribute the highest to the total annual income in the high altitude followed by *Capsicum chinensis* (25%) whereas; *Abelmoschus esculentus* (5%) contributed the least. *Parkia timoriana* (33%) was recorded to contribute the highest to the total annual income in the high altitude followed by *Sechium edule* (21%) whereas; *Rhus semialata* (2%) contributed the least. *Camellia sinensis* (40%) was recorded to contribute the highest to the total annual income in the high altitude followed by *Areca catechu* (31%) whereas, *Zingiber officinale* (5%) contributed the least. The economic analysis of home gardens across varying altitudes shows that home gardens in low altitudes were valued more than the ones in the mid hills and highlands. The total yield in larger gardens was higher than in medium and small gardens, but the yield per unit area was higher in small gardens and dropped as garden size increased. In many cases, the family's financial situation was improved by the home gardens, which provided additional revenue while also contributing to social and cultural improvement.

Keywords distribution, home garden, Mon District, socio-economic, uses, variety

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Introduction

Home gardens are traditional agro ecosystems close to human habitations that are intensively tended for daily requirements. They support a distinct and occasionally extraordinary genetic variety of crop plants and their wild relatives [1-2]. They have captivated huge attention because of their important role in preservation of biodiversity, ecological and socioeconomic functions, native peoples' livelihoods, and protection of soil [3-4]. Several studies from the world, including India, have reported the diversity of home garden among crop and non-crop species. [5-6]. Home gardens are a potential strategy of conserving crops and their wild progenitors, as well as indirectly

contributing to the conservation of wild food plants in the wild [7]. To a greater extent, it also functions as a repository for genetic resources and biodiversity [8-9]. Traditional home gardens, which are mostly based on indigenous knowledge systems and contain a diverse range of local products with social and traditional importance, may be the most promising and ecologically viable choice for farming communities [10-12]. Small gardens can fulfill the requirement of crucial labor from within the house, however large gardens provide work opportunities in rural areas [13]. The production of a home garden provides different opportunities like small-scale businesses, marketing prospects and other employment. [14-15]. Home gardens provide the most basic social benefit by directly contributing to household food security by enhancing the availability, accessibility, and usage of food products. Home gardens provides easy access to fresh plant and animal food in rural and urban areas [16-19]. Home grown food provides daily energy and nutrient requirements in the families [20-23]. They're also good for resource-scarce situations since they provide economic benefits like cheaper capital and labor costs, more self-sufficiency, risk avoidance, and more fairly distributed labor [1, 24-25]. Understanding the value of home garden resources requires empirical information on the role of homestead forests in household economies [23, 26]. To properly comprehend the advantages of Mon District home gardens to their users, it is vital to examine the socio-economic dimensions of these systems, as well as their significance to those who manage and conserve them [13,15, 27-29].

Methodology

The present study entitled “Socio-economic status of traditional home gardens in Mon district of Nagaland” was conducted in the year 2021 in three villages namely Tizit, Longkei and Aboi of three different altitudinal ranges (viz. high altitude, mid altitude & low altitude) Mon district.

Study area

The study area is situated in the northernmost district of Nagaland; 1786 Sq.km. District altitude varies from 290 to 1800 m above mean sea level and the topography is of undulating nature with gentle to steep slope. Average rainfall ranges from 2000 to 3000 mm (mostly between May and October), while average relative humidity and temperature are 76% and 24.4°C, respectively. Soil is predominantly laterite in hilly areas and red in the plains bordering Assam.

Collection of primary data

The household served as the study's primary data collection unit. Data was gathered from 60 home gardens in the research villages, which were divided into three altitudinal ranges and three farm groups based on their size. Plant inventories yielded a wealth of information on plant diversity, as well as socioeconomic data from structured interviews in each of the families. Oral questions were asked on the respondents' education, family size, occupation, age and composition, home garden area and their other lands, land used in the past and garden’s age, income of family, sale made from the garden, and so on [13]. Home garden income was determined by asking respondents how much they had harvested, sold, and consumed from their gardens. Inputs were explains as any financial investment to the garden's yearly economic cycle, and included human labor, seeds, organic manure and fertilizers, paid labor, and other supporting charges [30]. Some sold their wares at a nearby market near their home, some at farm gates on the side of the road, while others to traders without paying for transportation and very little to big marketplaces. The opportunity costs of household labor and land are considered into the economic assessment of home gardens [15, 31-32].

Data analysis

For categorical variables, descriptive statistics such as frequencies and percentages were used, and for continuous variables, mean standard deviation. The net financial worth of the home gardens was calculated using basic economic approaches such as benefit and cost comparison.

Results

Socio-economic patterns of home garden

Table 1 shows the projected costs of inputs/outputs for various garden sizes at various elevations. Small gardens had a lower monetary input/output ratio per $100m^2$ across all altitudes, while large gardens had a higher monetary input/output ratio per $100m^2$ because large gardens could sell more excess products than small gardens with subsistence reasons. The intensity of cultivation as measured by the profits (from sales) per unit (mean profit/$100m^2$ home garden) was computed for all home garden categories at all elevations and the maximum profit area was highest in small home gardens in the mid hills and lowest in medium sized gardens in the low lands. In the mid hills, the monetary input/output ratio of a large home garden was highest, while in the lowlands, it was lowest.

Table 1: Economics output (Rs. /$100m^2$) of different sized home gardens at different altitudes

Altitude Category	Production Measure	Small	Medium	Large
High	**Input**	462	109	58
	Output	2246	625	869
	Input/output ratio	4.8	5.7	14.9
Mid	**Input**	248	88	37
	Output	1548	752	808
	Input/output ratio	6.2	8.5	21.8
Low	**Input**	587	323	179
	Output	2527	1435	1380
	Input/output ratio	4.3	4.4	7.7

People dependence on home garden

Regardless of the garden use as for money creation, household use, or therapeutic plants, all of the respondents rely on it. The large gardens in the high altitude supplied as much as 50% of their household income, while small gardens in the mid hills contributed the least. The percentage to total household income in small sized home garden was maximum (9.8%) in highlands and minimum (5.9%) in the mid hills. For medium sized home garden the maximum percentage (24.7%) was recorded in high lands and minimum (5.9%) in mid hills whereas, for large sized home garden the maximum percentage (43.5%) was recorded in high lands and minimum (23.6%) in midhills [13, 15]. Different crops contributed differentially throughout altitudes among the garden items whose surplus was sold for money. In most cases, a home garden provides roughly a third of total family income, and mean yearly revenues from the sale and contribute largely to family income in low altitude gardens than in mid and high altitude gardens. Regardless of the season families across all the altitudes depended on the home garden for spices such as ginger, garlic, chilli, coriander, and *Zanthoxylum solanaceae*. The majority of crops in the high and mid altitudes were tree crops, while various herbs, climbers, and shrubs contributed to the revenue in the low altitudes. Few plants and crops dominated contribution in high and low altitude gardens, although many fruit and nut trees contributed without significant dominance in the mid hills.

Plant use in the home garden

A total of 47 plant species from 29 different families were reported. Each plant species was said to have up to four different uses. The food or vegetable category had the highest percentage of representation (48.4%), followed by spices (19.1%), fodder (11.1%), medicinal (8.9%), fuelwood (6.2%), and other reasons. Across all altitudes, the composition patterns of plant uses followed a similar pattern. In the highlands, trees such as *Parkia timoriana, Mangifera indica, Termenalia chebula, Psidium guajava, Pyrus*

pyriflora, *Myrica esculenta*, and others were common as food or fruit plants, whereas vegetables such as *Colocasia esculenta*, *Cucurbita moschata*, *Zingiber officinale*, and climbers such as *Passiflora edulis*.

Table 2. Products Contribution to total household income from

Altitude Category	Garden Category	Mean annual income (Rs.)	% of the total household income (Rs.)
High	Small	14012	9.8
	Medium	35400	24.7
	Large	62200	43.5
Mid	Small	9480	5.9
	Medium	14313	8.9
	Large	37840	23.6
Low	Small	10600	5.11
	Medium	24000	11.6
	Large	55060	26.6

Medicinal plants found in home garden of study area

The responders employed a variety of plants in the garden to conduct traditional medicine. The present study shows that almost all plant parts are used as medicine. The most used plant parts for curing disease are leaves followed by rhizomes, fruits, seeds, whole plant, stems, flowers and twigs. Shrubs are the major sources of medicines followed by herbs, trees, weeds and climbers. Most of the plants are used to treat diseases such as diarrhea and dysentery, wounds and cuts, headache, tooth ache, skin diseases, gastric blood pressure, cholera, snake bites, cough, fever, stomach problem, throat problem, and malaria, while very less number of plants are used to treat rheumatism, jaundice, urinary disorder, and eye diseases, which are all lumped together under the others category.

Discussion

At comparison to the mid altitude and high altitude homes, the most of the respondents in the low altitude were elder and had a larger family. Their traditional homestead gardens, which were located at a lower elevation, were also older. This demonstrates that home gardens were an integral element of their way of life and farming methods. In comparison to the high and mid altitudes, lower altitude families had a higher average yearly family income, owing to the fact that more respondents and household heads worked for the government (70%) and had fewer daily wage earners (10%). As demonstrated by their educational level, more respondents in lower altitudes had higher education (pre-university and colleges). The bulk of responders were farmers in this hilly rural state. Piggery and poultry were run through among half of the respondents across all three altitudinal groups, however apiculture was only seen in the low altitudes. Tea gardens were common in the mid and high altitudes, and were favored because the Konyak tribe of Mon region traditionally drank black tea, ensuring demand, supply, and revenue consistency throughout the year. Across all categories, the average home garden size ranged from 63.14m^2 to 882m^2, with an average mean size of 209.3m^2 (median=213 m^2). The mean home garden sizes in the mid hills were found to be significantly smaller, which may be due to the study towns' proximity to roads, where population density is often higher. Depending on the family size and the vocations of the household leaders and other family members, labor inputs in the home garden will vary. One common finding was that labor input was higher in low-altitude home gardens (Table 2), and women predominated. During the field trips, the majority of the ladies were busy in their gardens, planting, seeding, weeding, gathering vegetables, preparing nursery beds, nursing chickens, or watering the plants. During field trips, several were not even available at home as they are also involved in selling.

Table 3 Important Species available in Home garden of Mon District and their uses

SN.	Species	Family	Vernacular Name (Area)	Period of Availability	Use Category	Remark
1.	*Canarium strictum*	Burseraceae	Kong	Oct.-Dec.	Fruit	Common in Tizit block; taste like aonla
2.	*Capsicum chinensis*	Solanaceae	Raja Marcha	May-July	Berry-Fruit	One of the hottest chilli in the world
3.	*Capsicum frutescens*	Solanaceae	Marcha	Throughout the year	Berry-Fruit	Used in chutney, salads, curry, pickle, etc.
4.	*Citrus limon*	Rutaceae	Nimbu	Throughout year	Fruit	Used to make juice or as a flavouring ingredient.
5.	*Colocasia esculenta*	Araceae	Kuchu	Throughout year	Tuber	Staple cooked vegetable
6.	*Eryngium foetidum*	Apiaceae	Dunia	Throughout the year	Leafy vegetable	Eaten raw or cooked, as flavouring agent in curry and chutney
7.	*Houttuynia cordata*	Combretacea	Kaiyukhing	Throughout the year	Leafy vegetable	Eaten directly as a vegetable; also roots cooked as vegetable; added in pickle
8.	*Livistona jenkinsiana*	Arecaceae	Toko, Yuoh	Oct.-Dec.	Fruit	Mesocarp eaten after soaking ripe fruit in salt for 4-5 days
9.	*Parkia timoriana*	Fabaceae	Yongchak	June-Nov.	Fruit (unripe)	Young pods form delicious vegetable, also used in chutney
10.	*Rhussemialata*	Anacardiaceae	Aomah	Nov.-Jan.	Fruit	Decoction/curry of powdered fruit therapeutically valued
11.	*Solanum violaceum*	Solanaceae	Khamkhah	Aug.-Jan.	Fruit (unripe)	Common in homestead garden; eaten as vegetable
12.	*Zanthoxylum acanthopodium*	Rutaceae	Makat	May-Nov.	Leafy vegetable	Spice/condiment; medicinal, Young leaves and shoot as condiment; fruit-husk used in chutney
13.	*Zanthoxylum rhetsum*	Rutaceae	Michangakoti	May-Jan.	Leafy vegetable	Young leaves and shoot as condiment
14.	*Allium chinensis*	Amaryllidaceae	Naga Lassan	Throughout the year	Whole plant	Used in chutney and as an essential condiment
15.	*Anana scomosus*	Bromeliaceae	Anaras	June- Nov	Fruit	Eaten as a fruit
16.	*Areca catechu*	Arecaceae	Tamul	Throughout the year	Seed	Traditionally chewed with betel leaf, slaked lime and kalasada
17.	*Artocarpus heterophyllus*	Moraceae	Panjong	March-June	Fruit, Seed	Eaten raw or cooked.
18.	*Azadirachta indica*	Meliaceae	Neem	Throughout the year	Leaves	Used to treat skin diseases
19.	*Brassica nigra*	Brassicaceae	Yanshoi	Sep-March	Leaves	Eaten raw or boiled as a veggie
20.	*Carica papaya*	Caricaceae	Jumlei	Throughout the year	Fruit	Eaten raw as a fruit or boiled as a side dish.
21.	*Citrus maxima*	Rutaceae	Namphup	Throughout the year	Fruit	Eaten as a fruit.
22.	*Citrus reticulata*	Rutaceae	Chanum	Dec-Feb	Fruit	Usually eaten plain or in fruit salads.
23.	*Cocos nucifera*	Arecaceae	Narikol	March-May	Fruit	Usually eaten as a fruit and also used for bladder stones, diabetes, high cholesterol and weight loss.
24.	*Coffee arabica*	Rubiaceae	Coffee	Sep-March	Seed	A source of caffeine and iss an important cash crop.
25.	*Cucumis sativa*	Cucurbitaceae	Maikuh	May-August	Fruit	Commonly eaten as a salad.
26.	*Sechium edule*	Cucurbitaceae	Showao/Squash/ Eskos	Oct-June	Fruit, Leaves	A staple of local cuisine, apart from the fruit, the leaves are used in preparation of various dishes

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SN.	Species	Family	Vernacular Name (Area)	Period of Availability	Use Category	Remark
27.	*Cucurbita moschata*	Cucurbitaceae	Waohtum	Throughout the year	Fruit, Leaves	The edible fruit is cooked as a vegetable and leaves are simply boiled as a side dish.
28.	*Elsholtzia blanda*	Lamiaceae	Mengan	June- October	Leaves	Fresh leaves are eaten for reducing high blood pressure.
29.	*Ipomoea batatas*	Convolvulaceae	Khun	June-August	Rhizome	Its large, starchy, sweet-tasting, tuberous roots are used as a root vegetable.
30.	*Litchi chinensis*	Saindaceae	Litchu	May-June	Fruit	Consumed as fruit.
31.	*Livistoni ajenkensiana*	Arecaceae	Luhyak	Dec-Feb	Whole plant	The seeds are eaten as a substitute for betel nut.
32.	*Mangifera indica*	Anacardiaceae	Makmo	April-July	Fruits	Taken as a fruit.
33.	*Musa acuminata*	Musaceae	Ngo	Throughout the year	Fruit, flower, inner stem	Leaves are usually used as healthy and hygienic eating plates.
34.	*Myrica esculenta*	Myricaceae	Yin	Feb-April	Fruit	Eaten directly as a fruit. To treat indigestion.
35.	*Ocimum tenuiflorum*	Lamiaceae	Tulsi	Throughout the year.	Leaves	Cough, stomach-ache, Dysentery.
36.	*Passiflora edulis*	Passifloraceae	Bail	Sept-Oct	Fruit, Leaves	Used to treat anxiety, migraine and insomnia.
37.	*Phaseolus vulgaris*	Fabaceae	Bhae	Dec-Feb	Fruit, Seed	French bean is usually boiled and eaten as a side dish. It is also used for diabetes, high cholesterol and obesity.
38.	*Phyllanthus emblica*	Phyllanthaceae	Phang	Feb-June	Fruit	Traditionally used for the treatment of diarrhea, jaundice and inflammation.
39.	*Psidium guajava*	Myrtaceae	Muduram	August-Sept	Fruit, Bark, Leaves	Bark decoction used for stomach-ache and leaves decoction used for high fever and headache.
40.	*Pyrus pyriflora*	Rosaceae	Naspatti	May-Sept	Fruit	Taken directly as fruit. It is good for mild digestion problems and diarrhea.
41.	*Saccharum officinarum*	Poaceae	Ngoilo	Dec-May	Stem	The stems and the by-products of sugarcane are used for feeding the livestock.
42.	*Solanum kurzii*	Solanaceae	Khamkhahkhahsa	Throughout the year	Fruit	Bitter fruits eaten directly or cooked. It is also used to treat malaria.
43.	*Solanumlycopersicum*	Solanaceae	Soishi	Throughout the year	Berry	Used as a vegetable in almost all the cuisines.
44.	*Tamarindus indica*	Fabaceae	Imli	February	Fruit	Used for making pickle. Traditionally used for abdominal pain.
45.	*Termenalia chebula*	Combretaceae	Haikahyak	Throughout the year	Fruits	Unripe fruits are more purgative and the ripe ones are astringent.
46.	*Zingiber officinale*	Zingiberaceae	Jhae	Throughout the year	Rhizome	It is an essential daily used spice for cooking; also used to treat various types of stomach problems.
47.	*Camellia sinensis*	Theaceae	Khalap	March-Nov	Leaves	Used as tea leaf. Mostly seen in the low altitudes.

The mean monthly working time of 22 hours is comparable to the 8 hour per week in Sri Lanka [29], but lower than the report from Rahman et al., [23], where both men and women contributed nearly equally to 32.6 hours per week per family. The investment of time also depends upon the owner's occupation as well as on the objective of garden and its size.

Current study revealed the significance of local seed supplies significant for community-level plant genetic resource management in home gardens. The dominant source of seed supply is self-saved seeds, followed by purchased from commercial store as well as from government organizations and the wild. In Kaski, Nepal, the first source of seed supply is self-saved seeds while purchased seeds in [31]. The primary source of planting material for wood and timber species was self-generated from adjacent natural vegetation and the wild. For several therapeutic plants, gathering from the wild was also a significant source [26, 32].

Table 4. List of Medicinal Plants

S. No.	Scientific Name	Family	Plant Parts	Ailment
1	*Allium bakeri*	Liliaceae	All parts of plants	Cholera and stomach pain
2	*Ananas comosus*	Bromeliaceae	Fruits	Abortive purpose
3	*Azadiractaindica*	Meliaceae	Leaves	Malarial fever, wounds, skin diseases
4	*Carica papaya*	Caricaceae	Fruits	Gastric & urinary disorder
5	*Houttuyniacordata*	Saururaceae	Whole parts	Cold and fever stomach-ache
6	*Myrica esculenta*	Myricaceae	Fruits	To treat indigestion
7	*Parkia timoriana*	Mimosaceae	Pods, bark, leaves	Used to treat piles, diarrhea, dysentery, etc.
8	*Passifloraedulis*	Passifloraceae	Seeds, leaves	Diabetes, blood pressure
9	*Phyllanthus emblica*	Phyllanthaceae	Fruits	Diarrhea, jaundice and inflammation.
10	*Psidium guajava*	Myrtaceae	Barks & leaves	Bark decoction used for stomach-ache and leaves decoction used for high fever and headache
11	*Rhus semialata*	Anacardiaceae	Seeds	Stomach-ache, indigestion and skin diseases
12	*Saccharum officinale*	Poaceae	Stem	Jaundice
13	*Solanum kurzii*	solanaceae	Fruits	Treat malaria
14	*Terminalia chebula*	Combretaceae	Fruit	Dysentery, mouth freshener, stomach ache, etc.
15	*Zingiber officinale*	Zingiberaceae	Rhizomes	Juice of rhizomes given to pregnant woman just before delivery to reduce labour pain

A major population in Mon district rely on forests for fuel wood, it is important for household cooking in other hills rural areas of north east India. Food plants, tubers, veggies, and rhizomes were all important home garden products that directly aided the gardeners' dietary and health demands [13]. For example, in large gardens, paid labor was occasionally used for home garden output, however in small and medium sized gardens, home garden input was negligible. The home garden production was also dependent on biodiversity management, division of labor, and integration of by-products from other agricultural systems, implying a noticeable energy exchange interaction between the different household agriculture subsystems more in large gardens than in small gardens. In mid-altitude home gardens, about 75% of households did not sell any garden goods and grew them only for their own consumption, compared to only 35% and 55% in high hills and low altitude, respectively. Small household gardens inclined towards subsistence oriented, whilst medium and large gardens are more commercial in nature, with the involvement of traders - to sell the produce. The sale of the nuts was done directly from the garden in larger gardens in lowlands where there were more areca nut trees. Young lads were brought in by the buyer or

middleman to climb the trees and gather the nuts in abundance [33-34]. The production from home gardens helps many rural poor people become self-sufficient, and the sale of surplus offers a source of money for the subsistence economy. The efficiency of the output to input ratio is determined by the garden's objective and goal, as well as the owner's and family members' objectives and other economic activities [15]. In terms of financial output input, large gardens were more structured than small and medium sized gardens. Because the number of plant species used in the large garden was usually higher which eventually results in large produce. The sustainability of the Mon district's home gardens is dependent not only on the species composition, diversity, species richness, and inherent structure of the gardens, but also on the disruptive forces that come from the surrounding biophysical and socioeconomic circumstances [15]. Although based on our limited research, it is premature to conclude that small gardens are more sustainable than medium and large gardens; there is sufficient evidence to support our claims due to higher species density, lower risk management, and higher home garden return per unit area in the former than the latter.

Conclusion

The results of this study revealed that home gardens at lower altitudes were comparably smaller and more numerous than those at medium and large altitudes. Though many farmers' first goal in managing a home garden is to provide for their families, the majority of them sold their surplus crops to generate revenue, while larger gardens gravitated toward commercialization for greater economic benefits and as a source of employment. The sale of excess goods by home gardens supplied about 10% to 50% of total household income in small gardens and up to 50% in large gardens. The majority of the domestic species were also used for food and vegetables, according to the study. Smaller home gardens with lower monetary rewards have been demonstrated to be more environmentally friendly.

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