"STUDY OF PLANT DIVERSITY, ABOVE GROUND CARBON SEQUESTRATION POTENTIAL AND FOOD VALUE OF TRADITIONAL HOMEGARDEN SYSTEM IN RATNAGIRI DISTRICT"

Thesis submitted to

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
DAPOLI, DIST. RATNAGIRI, MAHARASHTRA STATE.

In partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE (FORESTRY)

In

SILVICULTURE AND AGROFORESTRY

By

SANGARE SIDDHESH MANOHAR

Under the guidance of

Dr. S. S. Narkhede
Dean (Agriculture) and Director of Instruction
Dr. BSKKV, Dapoli

COLLEGE OF FORESTRY,
DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
DAPOLI, DIST. RATNAGIRI, MAHARASHTRA STATE.

MAY, 2018

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
COLLEGE OF FORESTRY,
Dapoli, Dist. Ratnagiri (MS) Pin 415 712
Phone – 02358 283655, Fax – 02358 283655

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This is to be certified that the thesis entitled **"Study Of Plant Diversity, Above Ground Carbon Sequestration Potential And Food Value Of Traditional Homegarden System In Ratnagiri District"** is a record of independent bonafied research work carried out by **Mr. Sangare Siddhesh Manohar** (Registration No. FDPM-16-62) at this college during the period of study from 2016 - 2018 under our guidance and supervision for the degree of Masters of Science (Forestry) in Silviculture And Agroforestry of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The said thesis has not previously formed the basis for the award of any degree, diploma, fellowship or any other similar title.

Chairman
Dr. S. S. Narkhede
Dean (Agriculture) and Director of Instruction
Dr. BSKKV, Dapoli

Members of the advisory committee

Dr. V. K. Patil
(Associate Professor)
College of forestry,
Dapoli..
Countersigned
Associate Dean
College of Forestry, Dapoli

Dr. R. T. Thokal
(Chief scientist)
AICRP on water
management CES, Wakavli

Dr. A. D. Rane
(Associate Professor)
College of Forestry,
Dapoli.
External Examiner

“STUDY OF PLANT DIVERSITY, ABOVE GROUND CARBON SEQUESTRATION POTENTIAL AND FOOD VALUE OF TRADITIONAL HOMEGARDEN SYSTEM IN RATNAGIRI DISTRICT”

SANGARE SIDDHESH MANOHAR

COLLEGEOF FORESTRY,

(DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH)

DAPOLI - 415 712, DIST. RATNAGIRI (M.S.)

MAY, 2018

DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"Study Of Plant Diversity, Above Ground Carbon Sequestration Potential And Food Value Of Traditional Homegarden System In Ratnagiri District"** reported in this thesis, except where otherwise indicated, is my original work and has not been submitted for any degree or examination at any other university.This thesis does not contain other persons' writing, unless acknowledged as being sourced from other researchers. Where other written sources have been quoted, then their words have been re-written and the information attributed to them has been referenced.

Place: Dapoli. (Sangare Siddhesh Manohar)
Date: Regd. No. FDPM-16-62

DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
COLLEGE OF FORESTRY,
Dapoli, Dist. Ratnagiri (MS), Pin 415 712
Phone – 02358 283655, Fax – 02358 283655

Dr. S. S. Narkhede
(Dean (Agriculture) and Director of Instruction
Dr. BSKKV, Dapoli

CERTIFICATE

This is to certify that, the thesis entitled **"Study Of Plant Diversity, Above Ground Carbon Sequestration Potential And Food Value Of Traditional Homegarden System In Ratnagiri District"** is a record of independent bonafide research work carried out by **Mr. Sangare Siddhesh Manohar** (FDPM-16-62) at this college during the academic period 2016- 2018, under my guidance and supervision for the degree of M.Sc. (Forestry) of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The said thesis has not previously formed the basis for the award of any degree, diploma, associate ship, fellowship or any other similar title.

The source of materials used and all assistance received if any, during the course of investigation have been duly acknowledged.

Place: Dapoli
Date:

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Date:
Place: Dapoli

Signature of student
Sangare Siddhesh Manohar
M.Sc. (Forestry)
College of Forestry, Dapoli.

Counter signature of major guide
Dr. S. S. Narkhede
Dean (Agriculture)
Director of Instruction,
Dr. B.S.K.K.V.,Dapoli.

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Place : Dapoli

Date : / /2018 (Sangare Siddhesh Manohar)

CHAPTER I

INTRODUCTION

Man has close relation with the nature. Humans love to live under surrounding nature. As it gives all necessary things and aesthetic view to the human being. Plants from nature have had tremendous role in human life. Plants provide almost all necessary things to the humans. That's why from the early civilization human being grows at least few plants surrounding their houses. The purpose is behind that to get some benefits from the plants which are planted around or near their houses. Benefits may be tangible or intangible. Tangible benefits are like getting food, fuel wood and intangible benefits are like scenic beauty, shade, pollution free air etc.

Thus, planting plants surrounding the houses is the one of the oldest form of cultivation. The system of cultivating is known as Homegardens in agroforestry. Homegardens are the traditional agroforestry system which has complexity in their structure and has multiple functions (Das and Das 2005). It is included in Silvi-pastuaral system in the classification of agroforestry system given by P. K. R. Nair (1985).

Homegardens can be also defined as traditional land use practice around a homestead, where several plant species are maintained by members of the household, and their products are primarily intended for household consumption (Shrestha *et al.* 2001).

Homegardens represent intimate, multi-storey combinations of various perennial and annual crops, sometimes in association with domestic animals, around the homestead which serves as a permanent or temporary (Rana *et al.* 2016). In the Homegardens various plant species are cultivated and maintained on the basis of choice, needs and importance of plants. Homegardens also include livestock within a compound of individual houses. Homegardens are rich in biodiversity as they have multi-storey structure on small unit of land. Average sizes of most of the Homegardens are less than one ha (Fernandes and Nair, 1986). The Homegardens are the sites of conservation of a large diversity of plants both wild and domesticated (Das and Das, 2005).

Homegardens are suitable systems for the high rainfall areas in tropical condition. The basic objective of maintaining this agroforestry system is to ensure availability of multiple products such as food, fuel, vegetables, fruits, fodder, medicines besides generating income and employment (Soemarwoto, 1987; Hoogerbrugge and Fersco, 1993; Kumar and Nair, 2004).

The warm humid tropics are assumed to be the seat of homegardens. Home gardens have probably scattered origins and has gradually spread to many humid regions in South Asia and South- East Asia. It includes Indonesia (Java), Philippines, Thailand, Sri Lanka, India and Bangladesh. In the Africa where homegarden practices are prevalent include Sudan, Ethiopia, Nigeria, Kenya, Tanzania etc. also Peruvian Amazon, Brazilian, Mexican, Honduras etc. are the potential homegarden region in the Latin America.

India has large tradition of Homegardening. Homegarden in India are mostly distributed across in humid tropical climate. They are abundantly found in Kerala, Tamilnadu, Northeast India, Maharashtra states. Homegardens of India have large diversity among plants as India has different climatic zones. Plant diversity of Homegardens changes as per the changes in climatic zone.

In Northeast India, traditional Homegardens have been maintained as a part of rural survival over generations, with the complex vegetational structures harbouring divers' type of local plant species with multiple functions (Tangjang and Arunachalam, 2009). Homegardens in Kerala have long been important multi-purpose agroforestry systems that combine ecological and socio-economical sustainability (Peyre *et al*. 2006). Saikia et al. (2012) reported that Homegardens of Upper Assam, northeastern India are diverse and species-rich.

In different localities homegardens referred by various names in their local languages. For instance the Javanese homegardens are known as 'Talun-Kebun' and 'Pakarangans' , in Mt. Kilimanjaro in East Africa offen described as 'Chagga'. In Kerla India it called as 'Purayida Krishi'

Despite the limitation in management area, Homegardens shows multi strata and complex structure. They have large plant diversity in small area. Homegardens include

almost all life forms of plants viz. herb, shrub, trees and climber in their various developmental stages. Homestead gardens also show diversity in their functions. Thus, homegardens has large plant diversity and are also important sites for *in situ* on-farm conservation maintained by farmers (Das and Das 2005).

Trees play an important role in reduction of CO_2 emissions as well as enhancing carbon sinks. Carbon sequestration by trees occurs both belowground, in the form of enhancement of soil carbon plus root biomass and aboveground as carbon stored in standing biomass. Plants remove carbon dioxide (CO_2) from atmosphere through photosynthesis and it store in biomass and soil as organic matter or secondary carbonates (Watson *et al*., 2000). Now day's deforestation has increases and denudation of forest land is happen. Thus, this situation is adversely affected to the earth. Results in global climate change, caused by rising levels of carbon dioxide (CO_2) and other greenhouse gases is recognized as a serious environmental issue of the twenty-first century. But Homegarden system helps to increase the tree cover outside the conventional forest area. Thus, they help to reduce the amount of carbon from the atmosphere.

Homegardens is the practice of agroforestry in which plants are cultivated within the compounds of individual houses. This plant biomass around the houses is the stored carbons. As almost half of the biomass of vegetation is considered as carbon storage of that vegetation (Pearson *et al*. 2005).

Tropical Homegardens have a special role in carbon (C) sequestration because of their ability for carbon storage in the standing biomass, soil, and the wood products (Kumar, 2006), thus Homegardens are very helpful to mitigate the problems of climate change.

Homegardens have an important role in rural livelihood. Most of the rural areas are away from the local market. Thus rural people cannot be able to go and buy the daily needs food material like vegetables, animal products from the market. Homegarden is one of the supplier of that daily needs to rural household. Properly managed homegardens can improve people's livelihoods and quality of life, reduce poverty, and foster economic growth into the future on a sustainable basis (Maroyi, 2009).

Homegardens are an integral part of local food systems and agricultural landscapes of developing countries all over the world (Galhena, 2012). Homestead vegetable gardening can play a significant role in improving food security for the resource poor rural households in developing country (Asaduzzaman *et al.* 2011). Plant cultivated in Homegardens has various uses viz. food, fodder, fuel, medicinal, ornamental etc. As plants has various uses they has specific role in the household consumption. Homegarden is a subsistence agroforestry system. Thus whatever produced by plants in Homegardens is mainly used for house hold consumption. Most of the things which are produced in Homegardens are daily used in the houses viz. spices, vegetables, fruits and fuel wood. It helps to enhancing food security (Galhena 2012). This is also reduces the cost of purchasing of these things from the market because they are available in their own Homegardens. Some medicinal plants were cultivated in the homestead gardens which are very useful for maintaining health of the people lives in those houses.

Tera (1954) and Stoler (1975) reported that Javanese Homegardens provide more than 40% of whole energy requirement of the local farming communities. Sommers (1978), in survey of 40 households with Homegardens in the Philippines, found that Homegardens supplied nearly all the households with the recommended daily requirement for vitamin A, vitamin C, iron and calcium.

As human population is increasing there are so many social and environmental problems like food insecurity, global warming etc. are raised due to this population exploitation. Homegarden is one of the agroforestry system which helps to overcome from these problems.

Present study was undertaken to understand how actually Homegardens are affective to mitigate these global problems and also underline the importance of Homegardens. The study was undertaken with the following three objectives

1. To document plant diversity in the homestead gardens of Ratnagiri district.
2. To estimate carbon sequestration potential of Homegardens.
3. To estimate food value of Homegardens.

CHAPTER II

REVIEW OF LITERATURE

2.1 Importance of Homegardens:

Traditional homegardens are one of the oldest agroforestry systems, mainly found in tropical countries. It is also practiced in Indian sub-continents in tropical region. The planting of trees around the homestead for getting benefits from them it is the oldest form of the agriculture. Also in religious view, cultivation of plants around home is the sign of prosperity of that family. The cult of tree worship has been a tradition and faith in India through the ages. Planting of Tulsi (*Ocimum sanctum*) in front of houses is a Hindu tradition. Tulsi have so many medicinal uses. Cultivation of *Haldi* which has so many uses is also traditional cultivation system. In India, the system of cultivation is generally practiced in south India from Konkan Maharashtra to end of Kerala as well as in the north eastern Indian states.

Traditional Home gardens are managed by the members of family. Species to be cultivated in the Homegardens are depends upon the choice of family members. Homegarden provides almost half of the daily needs to the family as it produce multiple products. And also provides most of the intangible benefits such as environmental and ecological benefits. Homegarden are directly linked with the livelihood security of farmers who are primarily at subsistence level (Nair 2001).

2.2 Plant diversity in Homegarden:

As Homegardens are multi strata – complex cultivation system, it has large plant diversity. Diversity also depends upon the choice and needs of the member of family. In some Homegardens some rare plants from the forest are cultivated as it has some benefits. Interest of gardening of family members are directly affects the diversity in the Homegardens.

Shirke (2016) studied the tree diversity, growth structure and carbon sequestration potential of homegardens in Konkan region. In the study, survey of 15 homegardens in

various agroclimatic zones in konkan region of Maharashtra was undertaken. She also compared the homegardens according to size viz. small, medium and large. Total 127 plant species were recorded by in the study. It was also noticed that homegarden was one of the best agroforestry system to mitigate the climate change.

Vegetation survey of 80 homegardens in 17 villages of Golaghat and Jorhat districts of Upper Assam, conducted by Saikia *et al.* (2012). They analyzed structure, diversity and uses of plants. Altogether, 294 plant species representing 217 genera and 92 families were encountered by them. Of these, 260 species were economically important and were categorized into seven use categories. The remaining 34 species were weeds and grasses. *Aquilaria malaccensis* Lam., an endangered and red listed species of India, was the most dominant tree (1,414 trees ha^{-1}). This species contributes significantly to the economy of the region. Principal Component Analysis (PCA) using frequency data showed two groups for each of the tree, shrub and herb layers. Thye also noticed the high floristic diversity and presence of many rare/endangered species in the homegardens reflect the ways how owners utilize and conserve plant diversity. However, genetic diversity of such rare species of forest origin could be affected in managed ecosystems due to limited gene flow, inbreeding and selection pressure.

Shukla *et al.* (2017) studied that plant diversity, structure and uses of plants in Homegardens of Jharkhand. A total of 116 species representing 50 families and 102 genera were documented in this study. Dominating family recorded in the gardens was Fabaceae with 20 species. They classified plant species in home garden as four strata in which the first strata consist of annuals and herbaceous plants (vegetables, medicinal and ornamental). Out of the total documented species, leaves of the 44 species were used followed by fruits (31 species), flowers (25 species) and at least one species each for bulb, culm, bark, pods and stem. Majority of the plant species were used as vegetables (51 species) followed by traditional medicines (30 species) and at least with two species each for house construction, furniture and agricultural implements. This study presented the baseline data about plant diversity in the home gardens, uses of plants and arrangement of the plants in the home gardens.

Das and Das (2005) examined the traditional homegardening systems of Dorgakona village, Barak Valley, North East India. They recorded average homegarden size falls within the range of 0.02–1.20 ha with an average of 0.30 ha. The total number of species encountered by them in the homegardens was 122, with fruits as the dominant use-component. In their study they recorded five major management zones in homegardens based on their function, location and composition: (i) bamboo groves (*Bansh tilla*) (ii) betel groves (*Gua baari*) (iii) banana groves (*Kola baari*) (iv) vegetable garden (*Sabje baari*), (v) dense or extended zones. The species relative importance values show that the most dominant components in homegardens were *A. catechu* (52.7%), *Musa sp*. (22.2%), *A. heterophyllus* (9.4%) and *M. indica* (9.3%). Other important species of homegardens include *T. ciliata*, *Psidium guajava*, *Carica papaya*, *Citrus maxima* and *Cocos nucifera*. The species that have multiple uses as well as commercial importance showed higher RIV due to higher prevalence in homegardens.

Kabir and Webb (2008) investigated the floristic and structural diversity of 402 homegardens from six regions across southwestern Bangladesh. Each region contained a mean of 293 species in a mean of 67 homegardens. A total of 49,478 individuals (107 per homegarden and 1003 per hectare) of trees and shrubs were counted from 45.2 ha total sampled area by them. They mentioned that tree and herb assemblages have predominance in the homegardens.

Sahoo (2009) studied crop diversity, agricultural sustainability and livelihood security of homegardens of North-East India. A total of 231 species (105 trees, 50 shrubs and 76 herbs) belonging to 88 families were observed composing the gardens and among these 27% species were common to all gardens. It indicating that Trees and Herb has dominant in the homegarden.

Pandey *et al.* (2006) conducted a survey in 19 home gardens and 10 home - forest-gardens in South Andaman to elucidate species structure and diversity in their floristic composition. Number of ligneous species was 18 in home garden and 10 in home-forest-garden. They recorded that plantation crops i.e., coconut, Arecanut; fruit plants – mango, banana, papaya and spices - clove, nutmeg and cinnamon were major species in the home garden. Density and relative frequency of Arecanut was maximum in

both home garden as well as in home - forest - garden. Home garden being similar in physiognomy to tropical evergreen forest, formed five tiered and home- forestgarden four tiered canopy structure. Coconut constituted top storey, Arecanut and jackfruit fourth storey, mango, cashewnut and tamarind third storey, spices second storey and annuals like *Zinziber officinalis*, *Curcuma longa* and *Manihot esculenta* and pineapple in first storey of the home garden. Home - forest - garden differed from the home garden as the former lacked spice trees and contained forest tree species only in the top storey. Similarity in species composition between home garden and home-forest-garden was 72%. It was also noted the diversity of plant species greater in home - forest - garden whereas, equitability, concentration of dominance and species richness in home garden.

Sahoo and Rocky (2015) studied species composition and plant diversity in homegardens of Mizoram homegardens. Shannon and Simpson's diversity indices were used in the study. About 351 plant species belonging 101 families were found in 92 home gardens. The homegardens were classified according to their elevation and recorded maximum plant species in lower elevation. Shannon index of diversity showed that higher diversity of shrubs found in the lower elevation while Simpson's index value found to be lowest.

Floristic structure, composition and functional characteristics of homegardens studied by Rana *et al.* (2016) in the Garhwal region. They had selected two districts on the basis of maximum (Uttarkashi) and minimum (Rudraprayag) geographical area of the state. The result showed that floristic tree diversity was maximum contributed by agroforestry crops (64% 53.84%, 62.5%, 66.7%) and followed by horticulture crops (36%, 46.16%, 37%, 33.3%) with respect to Malkhi, Khumera, Kurura and Panchan gaun village respectively. The contribution of forest and van panchayat for fuel-wood were estimated 13.5 and 5 kg, 11.5 and 6.5 kg, 2.6 and 6.2 kg/day for group of farmers during rainy, winter and summer seasons, respectively. We observed that 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 by them from the study area.

Krishnal & Weeraheva (2014) studied the composition, structure, diversity and different systems of homegardens in the Batticaloa district. Srilanka by comparing

various diversity indices. The study was conducted in three Divisional Secretariat divisions in the district where 206 samples were collected. Results of the study revealed that average number of trees per household was 6.56. Species richness, varied from 2- 56 with the mean of 12.93. Mean Shannon index was 0.66. Two different types of systems were identified viz., single layered and Multi layered systems. Single storied system composed only of banana or cashew or coconut trees. Only 23% homegardens were classified as single layered system while the rest were multi layered system.

Tangjang and Arunachalam (2009) studied the role of traditional home gardens in north east India they revealed that species grown in traditional home garden system were mystified by the livelihood requirement and traditional knowledge. Nonetheless, significant difference in species selection for homegardens may be due to climatic regime. They also noted that by combining ecological wisdom of villagers with scientific knowledge, higher the productivity of homegardens may achieved without causing substantial environmental degradation and homegardens are help in conserving the local plant diversity.

Neelamegam *et al.* (2015) in their study collected the information from the households (respondents) of 128 home gardens (of which 66 were rural HGs and 62 were urban HGs), categorized into –hutted, tiled, terraced, storied, fenced and non-fenced, in addition to enumerate the available plants. The overall HG area surveyed in both rural and urban HGs was 17209.88m^2 (1.72ha.) with an average HG area of 134.45m^2 (0.013ha) and it is higher in rural (183.03m^2) as compared to urban (82.74m^2) HG area. The number of species recorded by them in the HGs was 89 species belongs to 45 families comprises 80 genus. The range of species recorded overall in the HGs surveyed was 5-35 with an average of 13.86 species/HG. Five vertical strata – emergent (>10m), canopy (10-15m), understory (5-10m), shrubs (1-5m) and herbs (<1m), were identified in the HGs with maximum percentage (31.46%) of herbs among the life form groups. In case of plant utilization pattern –edible, medicinal, vegetable, ornamental and multipurpose uses were recorded from the HG respondents with an overall maximum (38.20%) use of ornamental plants. They also indicated the need for creating awareness

among the households about the importance of HG plants for their day-to-day life and its conservation.

Gebauer (2005) studied the plant Species Diversity of Home Gardens in El Obeid, Central Sudan. Objective of study was to analyses the cultivated plants of 81 surveyed home gardens. The plants studied in the home gardens included those for human consumption such as fruit trees, wild fruit trees and vegetables. In total, 32 plant species were found in the study gardens. The range of species was found, because irrigation is used under semiarid conditions. However, the lack of continuous sufficient irrigation water is the main factor which prevents an increase in species number and species diversity. In general, home garden products were mainly used as supplemental food in households and not sold on local markets.

On the basis of a cluster analysis of tree/shrub species density and subsequent further grouping using homegarden size as additional characteristic, six homegarden types were differentiated by Peyre *et al.* (2006). They surveyed 30 homegardens of Kerala. These were assessed on the basis of structural, functional, management and dynamics characteristics. They found four development stages of homegardens along a gradient from traditional to modern homegardens. Fifty percent of the homegardens still displayed traditional features, whereas 33% incorporated modern practices. The process of modernization includes a decrease of the tree/shrub diversity, a gradual concentration on a limited number of cash-crop species, an increase of ornamental plants, a gradual homogenization of homegarden structure and an increased use of external inputs. They also found that the rare changes in the homegarden size but gradual changes in composition of homegardens from last decade. Also noted as commercialization increased the diversity of components in homegardens is decreased.

Wiersum (2006) studied the diversity and change in homegarden cultivation in Indonesia. The structure and composition of homegardens depend both on their position in the overall farming system and on livelihood strategies of the managers. Rural transformations result in changes in livelihoods and farming systems, and have impacts on homegarden function and composition.

Sistla *et al.* (2016) studied the biodiversity among the agroforestry systems. They mentioned that agroforestry practices promote the biodiversity and natural resource diversity. Also noted that agroforestry systems have the potential to maintain higher levels of biodiversity and greater biomass than lower diversity crop or pasture systems. Greater plant diversity may also enhance soil quality, further supporting agricultural productivity in nutrient-limited tropical systems.

Molla and Kewessa (2015) studied the woody species diversity in traditional agroforestry Practices of Dellomenna district of Southeastern Ethiopia. Selection of three study sites based on presence of agroforestry practices were done by them. Total forty-eight (48) sample quadrants having an area of 20 m × 20 m, 16 sample quadrants in each study site, were systematically laid using four transect lines at different distance by them. For diversity they used different indices. They recorded total 55 woody species of 31 families. They also noted that traditional agroforestry plays major role in conservation of native woody species.

2.3 Carbon sequestration potential of Homegarden:

Plants has large amount of stored carbon. Out of total biomass plant body has 45-50% of the sequestrate carbon. Process of absorbing carbon from atmosphere and storing in the form of biomass is called as the carbon sequestration.

Removal of carbon dioxide (CO^2) from atmosphere through photosynthesis and its eventual storage in biomass and soil as organic matter or secondary carbonates have, of late, received considerable scientific attention (Watson *et al*., 2000). Three main mechanisms via which agroforestry system removes the CO^2 from the atmosphere viz. Carbon sequestration, Carbon conservation and Carbon substitutuion (Montagnini and Nair, 2004). The homegardens perhaps are unique in that all three mechanisms are relevant; i.e., they sequester Carbon in biomass and soil, reduce fossil-fuel burning by promoting woodfuel production, help in the conservation of Carbon stocks in existing forests by reducing the pressure on natural forests and ensure greater synergy with the Convention on Biological Diversity (Kumar 2006).

Carbon stock in Indonesian homegardens was studied by Roshetko *et al.* (2002). Species richness and biomass of plants were recorded. Field study indicated that homegardens with an average age 13 years stored about 35.5 Mg Carbon ha^{-1}. Study revealed clear opportunity exists to management that leads to higher carbon stock at system level. However, intensive mechanism needed that assure small holders would benefit from selecting management practices that favor high C stock.

Murthy *et al.* (2013) reported the role of agroforestry systems in carbon mitigation. Agroforestry provides a unique opportunity to combine the twin objectives of climate change adaptation and mitigation. It has the ability to enhance the resilience of the system for coping with the adverse impacts of climate change. Agroforestry systems offer important opportunities for creating synergiesn between both adaptation and mitigation actions. Agroforestry systems have the potential to provide significant mitigation options but they require proper management that influences the amount of carbon sequestered. They noted the role of agroforestry practices in climate change mitigation in India can be realized to its full potential by overcoming various technical, financial and institutional barriers.

Devkumar *et al.* (2012) studied the carbon stock assessment in Arecanut and shade tree of coffee and cardamom plantations. Tree density was 1083 t ha^{-1} in areca nut garden, while it was 223 and 260 t ha^{-1} in coffee and cardamom plantations, respectively. Total carbon stock contributed from above ground biomass, litter and SOC was highest in cardamom plants with 194.27 t ha^{-1} and it was least in Arecanut plants with 159.48 t ha^{-1}. While coffee recorded the 170.12 t ha^{-1}, whereas coffee plantation occupied the highest land area among the three crops and with higher tree diversity that contribute towards carbon stocking and biodiversity conservation among the plantation crop.

Aboveground measurements of Carbon stock (and, by implication, Carbon sequestration) are direct derivatives of aboveground biomass (AGB) measurements/estimates, assuming that 50% of the biomass was made up by Carbon (Nair 2011). It was reported that above ground biomass is estimated by the total summing up the amount of harvested and standing biomass. Estimation of tree biomass by whole-tree harvesting is an old approach: it consists of cutting down sample trees, separating

various parts (stem, leaves, inflorescence, etc.), digging out and washing the roots, determining their dry weights from samples of each part, and adding them up to get the total biomass. After dividing up the harvested representative trees into their various components (branches, dead branches, branchlets, leaves, roots and fine roots), and determining their dry weight, the Carbon content in each is measured. Using the data, allometric equations are developed as regression models with the measured variables such as diameter at breast height (DBH), total tree height or commercial bole height, and sometimes wood density, as the independent variables and total dry weight as the dependent variable. This is the destructive method of determining tree biomass, though comparatively accurate, is extremely time- and labor-intensive, especially for large trees. It is often used to validate other, less invasive and costly methods. Such as, the estimation of Carbon stock using nondestructive in-situ measurements and remote sensing. Such allometric equations developed based on biophysical properties of trees and validated by occasional measurements of destructive sampling are widely used in forestry for estimating standing volumes of forests. With increasing understanding about the role of forests in sequestering C carbon, various allometric equations have been developed for different forest types (Brown 1997; FAO 2004; Pearson *et al*. 2005; Chave *et al*. 2005; Basuki *et al*. 2009; Fernández-Núñez *et al*. 2010).

Efforts in developing allometric equations for agroforestry situations have generally been slow and researchers trying to use this approach are forced to use broad approximations. For example, for estimating the standing tree biomass in the parkland AFS in the Sahel where species-specific allometric equations were not available for the region, Takimoto *et al*. (2008) followed the UNFCCC (2006) recommendation to use the Brown (1997) general equations for parkland trees.

Another way of the estimating biomass is the estimating of volume of trees and product of volume and specific gravity of their wood gives the biomass of that tree.

Dixon *et al.* (1993) gives estimations to calculate the biomass by measuring the volume of stem wood and multiplying it with species-specific wood density; that number was then multiplied by 1.6 to get an estimation of whole-tree biomass; Carbon content was assumed as 50% of the estimated whole-tree biomass, and root biomass was

excluded. This rough estimation was then used for more extensive estimations of global forest biomass. More recently, World Agroforestry Centre www.cgiar-icraf.org developed information databases which includes tree parameters such as wood density for agroforestry species, accessed were used in such allometric calculations.

Kumar *et al*. (1998) in their study made efforts to develop allometric equations for some common agroforestry tree species in Kerala, India, such equations vary greatly with species, age, wood density, bole shape, and other factors, and could lead to excessive inaccuracies. Besides, such determinations can be difficult for smallholder agroforestry plots that comprise much of the agroforestry in developing countries. These systems involve a multitude of plants of varying growth habits yielding diverse economic products, and the species are planted and their products harvested, mostly for household consumption, throughout the year. Variations in tree management can be another issue: trees in AFS may be pruned depending on management practices or may have different growth forms due to differences in spacing compared to natural (forest) systems. Furthermore, no two agroforestry plots are similar: each may be unique in terms of plant composition, planting arrangements, and stand densities.

Shirke (2016) estimated the carbon sequestration potential of homegardens in various agro-climatic zones in Konkan region of Maharashtra. Carbon stock is calculated by multiplying the tree biomass by 0.5. Carbon stock of 15 homegardens of Konkan region was estimated during the study.

Carbon sequestration potential of selected tree species was calculated by Chavan and Rasal (2010). They studied the total carbon sequestered in trees in the campus Dr. B. A. M. University, Aurangabad. The biomass and total organic carbon of standing trees was estimated by non-destructive method. The tree height and girth was taken into consideration for the measurement of biomass and carbon content. The total biomass and total organic carbon has been determined and compared with Allometric model. They calculated biomass by using mechanical equation prepared by previous researcher i.e. $Y = \text{Exp.}\ \{-2.4090 + 0.9522\ \text{In}\ (D^2 \times H \times S)\}$. In case of literature of density of tree species are unavailable then 0.6 gm/cm^3 were taken by them. Below ground biomass was calculated considering 15% of the above ground biomass.

Suryawanshi *et al.* (2014) estimated the carbon sequestration potential of the some tree species in environment of North Maharashtra University, Jalgaon MS. They used non-destructive method to estimate total biomass and carbon sequestrated in the tree species. The aboveground and belowground organic carbon (tones/tree) and total organic carbon of each species were calculated. Aboveground biomass (AGB) has been calculated by multiplying volume of biomass and wood density and the volume was calculated based on diameter and height. As any plant species 50% of its biomass is considered as carbon thus they used formula [Carbon = Biomass* 50% or Biomass/2] to estimate sequestrate carbon stock. The calculated total organic carbon has been compared with allometric model. *Moringa olifera* species was found to be dominant sequestrated 15.775 tons of carbon and having 14 trees followed by *Azadirachta indica* 12.272tones. The species *Eucalyptus citriodora* has lowest carbon sequestration potential i.e. 1.814 tones.

2.4 Food and economic value of Homegardens:

In the earlier period main objective of cultivation of homegardens is the production of the food for subsistence level. It means products from the homegardens were utilized by only the family members. There was no commercial selling in market. But in now days in modern trends homegardens are cultivated as commercial purpose for getting maximum economic benefits from the products produced in it.

It has been established that even moderate and mild energy malnutrition contributes to child mortality, and micronutrient deficiencies are associated with increased risk of child and maternal mortality (Bloem *et al.* 2001). It is estimated that, worldwide, 53 percent of the approximately 10 million child deaths every year can be attributed to malnutrition (Black *et al.* 2003).

Homegardens are one strategy for addressing malnutrition and micronutrient deficiencies. Even though animal products are the best sources of micronutrients, vegetables and fruits may be the only source of micronutrients that are reliably available to poor households (Talukder *et al.* 2000, Bloem et al 1998, Reddy 1995). Sri Lankan

homegardens have been reported to produce 60 percent of leafy vegetables and 20 percent of all vegetables consumed by the household (Hoogerbrugge and Fresco 1993, citing Ensing and others 1985).

Marsh (1998) reported that homegardens typically produce more than 50 percent of vegetables, fruits, medicinal plants and herbs consumed by the household. The bulkiness of fresh fruits and vegetables favors their consumption near the production site, especially where the infrastructure is least adequate to allow transport of rural crops to cities (Vasey 1990). Homegardens on Java have been reported to provide 14 percent of household protein requirements (Hoogerbrugge and Fresco 1993).

Galhena *et al.* (2013) mentioned that the homegardens was promising approach to enhance household food security and wellbeing. They also reported that homegardens are an integral part of local food systems and the agricultural landscape of developing countries all over the world and have endured the test of time and looking towards home gardens as a strategy to enhance household food security and nutrition.

Gopalan *et al.* (1980) in their book ‘Nutritive value of Indian food’ gave the list of edible fruits and vegetables with their nutritive profile. It includes nutritive value of plants cultivated in homegardens.

CHAPTER III

MATERIALS AND METHODS

3.1 Study area:

The present study has been conducted in Homegardens of Ratnagiri district of Maharashtra, India. Ratnagiri district is located in the south-western part of Maharashtra State. This district is located between $16^0$29' N to $18^0$04' N latitude and $73^0$11' E to $73^0$42' E longitude. Ratnagiri district has Arabian sea on its west boundary and range of Western ghats i.e. Sahyadri mountains on eastern boundary. North and south boundary of Ratnagri has Raigad and Sindhudurga district respectively. This district has nine tehsils namely: Mandangad, Dapoli, Khed, Chiplun, Guhagar, Sangameshwar, Ratnagiri, Lanja and Rajapur.

According to the 2011 census Ratnagiri district has a population of 1,612,672. So far as density of population is concerned out of 640 districts Ratnagiri stands 311th rank. The density of population is 197 habitants per sq. Km. (510 p.sq.mi.). During the decade 2001-2011 the growth rate of population was 5.96%. It has a sex ratio of 1122 female for every 1000 males. It's literacy percent is 82.18%.

3.1.1 Geography

Geographical area of Ratnagiri is about 8,208 km^2. Over 85% of the land surface in Ratnagiri district is hilly. All rivers in the district originate in the Sahyadri ranges and flow from east to west and merge in Arabian Sea. Shastri, Jagbudi, Bav, Vashisthi, Muchkundi and Savitri are the main rivers of this district. It has 167 km long sea coast which contains many beaches, pats, and forts. 180 km long Sahyadri hill range contains hills, hill forts, wild life and many places of scenic beauty. Hills, sea shores, creeks, rivers, hot water springs, forests, water falls thus it has large faunal and floral diversity.

Geographically, the district can be classified into three zones. 1) The Sahyadri Region: The area lying in the east bordering the Sahyadri Ranges which is a hilly track covering an area of 15 Kms. from eastern boundry. Its average altitude is above 400m. Locally referred as '*Ghat matha*'. 2) The low level lateritic Plateau: The middle track of the district having a plateau surface between the Foothills and 15 kms away from

coastline. It has height above 150m to 400m from the mean sea level. This part of the region is locally known as '*Valati*'. 3) The river line and esturing level surfaces: The western part of the district, the coastal zone. The average elevation of the area is below 150m. It is locally called '*Khalati*'.

3.1.2 Climate

Ratnagiri district fall under two agro-climatic zones viz., South Konkan Coastal zone and Western ghats. Ratanagiri district has humid tropical climate. Three main season found in this district viz., Summer, Monsoon and Winter.

Rainfall is main environmental factor that decide the vegetation structure. Rainfall of this district is not uniform over whole area. Average rainfall is 3500mm from coast to Sahyadri the proportion of rainfall increases. June to September is the rainy season. During the month of July the district receives maximum rain. Ratnagiri district has humid tropical climate.

3.1.3 Soil

Soil mainly found is Lateritic, it is predominant soils in the district and extensive spreads of laterites are noticed throughout the District. They vary in colour from red to brownish red, owing to the preponderance of hydrated iron oxides. Due to the inundation of the sea a part of the coastal soils has become salty known as Salty soil. They are locally known as 'Khar-Khajan'. The another type of soil found in coastal strips of the district having deep sandy loams and in these soils coconut and arecanut gardens thrive well.

3.1.4 Agriculture

Agriculture in the Ratnagiri is at subsistence level, mainly depends on the rain water. According to 2011 Census, 63.02 percent of the total workers of the District are in the agriculture field, out of which 41.58 percent workers were engaged as cultivators and 21.44 percent were engaged as agricultural labors in the District.

3.1.5 Forestry

Total forest area of district is 64 km^2, out of that 60 km^2 is under forest department. About 2 km^2 of each out of remaining forest area is under revenue department and under privet ownership. Some part of Chandoli national park is covered by this district.

Table 3.1: Land utilization pattern in district

Sr. No.	**Land use category**	**Area in hector**
1	Forest	60
2	Land put to non-agricultural use	210
3	Barren and uncultivable land	1980
4	Cultivable waste land	1382
5	Land under miscellaneous tree crops and groves	492
6	Permanent pasture and other grazing land	280
7	Current fallow	510
8	Other fallow	680
9	Net area sown	2580
10	Area sown more than ones	335
11	Gross cropped area	2915
Total geographical area		**8174**

(Source: Socio-economic review and district statistical abstract of Ratnagiri District 2016-17)

3.1.6 Animal husbandry

Table 3.2: Livestock population of Ratnagiri.

Sr. No.	Livestock	Numbers
1	Total Cross bred / Indigenous Cattle	5,80,552
2	Total Buffaloes	43,862
3	Total Sheep	47
4	Total Goats	60,381
5	Total Equine	48
7	Other Livestock	49,930
8	Total Bovine	6,75,072

(Source: Socio-economic review and district statistical abstract of Ratnagiri District 2016-17)

3.2 Methodology

For sampling Ratnagiri district has been divided into three regions running from west to east according to distance from the sea. The average E-W distance of Ratnagiri is 51 km the first region R_1 is from west boundary to 17 km from west. Second region R_2 is located between 17 km to 34 km from west boundary. Third zone R_3 starts 34 km from west and ends at east boundary of the district. Divided three regions are similar to the geographical zones as explained above viz., *Khalati*, *Valati* and *Ghatmatha*. Ratnagiri district is divided into three regions with the help of google earth.

3.2.1 Selection of villages

Ratnagiri has nine Talukas. Selection of villages in the district has been done in such a manner that five villages has been selected in each Talukas. Total number of villages selected for study is 45. Another care was taken while section of villages is that

numbers of all selected villages should have equal in the three divided regions of Ratnagiri i.e. 15 villages in region. (Figure 3.1)

Table 3.3: List of villages selected and their GPS location for homegarden survey

Sr. No.	Taluka	Villages	Region	Latitude	Longitude
1	Chiplun	Malghar	2	17°29'1.66"N	73°27'21.49"E
		Pachal	2	17°29'11.42"N	73°28'6.67"E
		Kamathe	3	17°28'3.16"N	73°31'2.90"E
		Kalambaste	3	17°31'53.66"N	73°32'33.97"E
		Parshuram	3	17°33'25.34"N	73°30'13.06"E
2	Dapoli	Devke	1	17°41'19.64"N	73° 9'7.58"E
		Mordi Anjarle	1	17°50'59.44"N	73° 6'4.88"E
		Asud	1	17°46'55.15"N	73° 8'55.60"E
		Palgad	2	17°49'38.20"N	73°19'32.45"E
		Vanaoushi T Natu	2	17°48'28.32"N	73°18'35.39"E
3	Guhagar	Asgoli	1	17°27'47.01"N	73°11'48.44"E
		Guhagar	1	17°27'47.01"N	73°11'48.44"E
		Narvan	1	17°20'1.00"N	73°14'16.74"E
		Devghar	2	17°29'9.00"N	73°20'47.51"E
		Gimavi	2	17°29'35.30"N	73°19'29.95"E

4	Khed	Sakhroli	2	17°45'18.93"N	73°20'44.88"E
		Suseri	2	17°43'38.27"N	73°22'46.32"E
		Kudoshi	3	17°43'1.98"N	73°27'27.32"E
		Tale	3	17°44'25.74"N	73°27'39.64"E
		Mandave	3	17°47'19.26"N	73°28'28.11"E
5	Lanja	Majal	2	16°50'3.71"N	73°30'22.65"E
		Ajnari	2	16°56'55.25"N	73°31'46.99"E
		Korli	3	16°51'30.81"N	73°38'58.35"E
		Govil	3	16°52'26.89"N	73°39'9.67"E
		Shiposhi	3	16°55'24.04"N	73°38'4.46"E
6	Mandangad	Tamhane	1	17°57'16.11"N	73°11'9.26"E
		Pachral	1	17°58'59.90"N	73°12'28.36"E
		Ghosale	1	18° 0'9.29"N	73°12'21.86"E
		Konhavle	1	17°57'43.43"N	73°11'17.62"E
		Palghar	2	17°57'25.39"N	73°17'22.02"E
7	Rajapur	Bhoo	1	16°43'26.56"N	73°34'12.92"E
		Oni	2	16°43'26.56"N	73°34'12.92"E
		Kolvan	3	16°42'11.16"N	73°38'57.27"E
		Yelvan	3	16°42'45.81"N	73°40'16.41"E
		Bagavewadi	3	16°42'16.80"N	73°40'12.77"E

8	Ratnagiri	Shirgaon	1	17° 1'1.07"N	73°17'58.65"E
		Kasar veli	1	17° 2'48.57"N	73°17'48.79"E
		Nevare	1	17° 6'42.75"N	73°17'23.75"E
		Basani	1	17° 3'35.34"N	73°18'2.73"E
		Pali	2	16°58'55.91"N	73°29'11.25"E
9	Sangmeshwar	Kond Ammbed	2	17°11'0.19"N	73°32'36.24"E
		Mhabale	2	17°10'0.91"N	73°32'0.89"E
		Vighravli	3	17° 7'11.56"N	73°37'10.79"E
		Sonavade	3	17° 7'39.38"N	73°36'30.12"E
		Vada Vesrad	3	17°11'7.30"N	73°35'8.24"E

3.2.2 Selection farmers (Homegardens)

Six Homegardens has been randomly selected from each selected villages. Thus numbers of surveyed Homegardens units are 270. List of Homegardens and their geographical location given in Appendices.

3.2.3 Data collection:

Data has been collected by direct field visit of farmers by asking direct questions to the farmers and direct measurement of vegetation in field. Area of Homegardens has been calculated by using GPS. To find out diversity of plants every plant in the respective Homegardens has been recorded. Measurement of height and girth of the trees will be done with the help of Ravi altimeter and measuring tape respectively. Identification of plant species has been done on the basis of common name and with the help of local people and experts.

To estimate pant diversity name of plant species and their number in respective homegarden is recorded. Age, height and girth have been recorded to estimate carbon

stock. Food value or nutritive value was estimated with the help of production potential of the plants.

3.3 Data analysis

3.3.1 Plant diversity

Plant diversity indices and quantitative parameters of community structure is estimated according to Village, Taluka, Region and whole district. It's again separated on the basis of their life forms viz., tree, shrub, herb, climbers. Using standard procedure (Patil and Mhaiske, 2014)

Frequency is the proportion of sampling units in which a particular species occurs were calculate by

$$\text{Frequency} = \frac{\text{Total no of sampling units in which species occurred}}{\text{Total no of sampling units studied}}$$

Density is the number of individuals of species per unit area is calculated by

$$\text{Density} = \frac{\text{Total no of individuals of the species}}{\text{Total no of sampling units studied}}$$

Dominance is the number of individuals of a species with respect to its occurrence is calculated by using following formula.

$$\text{Dominance} = \frac{\text{Total no of individuals of the species}}{\text{Total no of sampling units in which the species has occurred}}$$

Importance value index for each species is the sum of total relative measures of frequency, density and dominance.

IVI = Relative frequency + Relative density + Relative dominance

Relative measures can be calculated for species 'A'

$$\text{Relative frequency} = \frac{\text{Frequency of species 'A'}}{} \times 100$$

$$\text{Relative density} = \frac{\text{Density of species 'A'}}{\text{Total density of all species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Dominance of species 'A'}}{\text{Total dominance of all species}} \times 100$$

Simpson's and Shannon diversity indices are used to calculate the plant diversity. To calculate these indices PAST (Paleontological Statistics) software has been used.

Simpson's diversity index (D) = $\sum P_i^2$

Shannon diversity index (H) = $\sum P_i \times \log (P_i)$

Where, P_i is the proportion of individuals of the i^{th} species to the number of individuals of all species.

3.3.2 Carbon stock in the trees

To estimate the biomass and organic carbon stock of standing trees, non-destructive method i.e. using volume and specific gravity were used (Chavan and Rasal 2010). For that measurement of tree height and girth has been taken with the help of Ravi Altimeter and Meter tape respectively. Volume of trees has been calculated by using tree height and GBH with standard quarter girth formula.

Volume = $[\text{Girth}/4]^2 \times \text{Height}$

Biomass calculated using simply multiplying the volume of trees with wood density (Suryawanshi *et al*. 2014).

Biomass = Volume × Wood Density

The data for wood density is obtained from literature of previous workers and from web (www.fao.org). Species whose basic density was not known the standard value of 0.6 was employed (Chavan and Rasal 2010).

Amount of sequestrated carbon in the tree was simply estimated by multiplying biomass with 0.5 which gives amount of carbon in tree (Suryawanshi *et al*. 2014). As any plant species 50% of its biomass is considered as carbon (Pearson *et al*. 2005).

3.3.3 Nutritive value

Nutritive value of the components of the homegardens has been explained with the help of nutritive profile given in previous literature.

Data has been presented in the form of graphs and tables with the help of excel worksheet. Maps prepared with the help of google earth.

CHAPTER IV

RESULTS AND DISCUSSION

Present study was conducted to estimate plant diversity, above ground carbon sequestration potential and food value of homegardens agroforestry system of Ratnagiri district of Konkan region of Maharashtra. For the study, district was classified into three regions namely Coastal, Middle and Eastern. Data were collected by surveying total 270 homegardens in Ratnagiri district and analyzed on the basis of various means. This chapter presents the result and discussions of the present study.

In this study minimum recorded area is 0.01 acre where maximum is 1.1 acre. Average size of homegardens in coastal region is maximum i.e. 0.093452 acre, followed by middle (0.089933 acre) and eastern (0.087522 acre) region respectively. Looking towards Taluka's Ratnagiri taluka has maximum average size of homegardens i.e. 0.1396 acre, followed by Rajapur (0.1321 acre) Guhagar (0.0931 acre), Khed (0.0908 acre), Dapoli (0.0896 acre), Chiplun (0.0782 acre), Lanja (0.0701 acre), Mandangad (0.0676 acre) and Sangameshwar (0.0514 acre) respectively.

4.1 Plants species distribution

4.1.1 Floristic assemblage in the homegarden and their distribution.

Survey was conducted to record the flora in 270 homegardens of the Ratnagiri district result revealed that there were almost 209 species representing 178 genera and 81 families. These plants were classified according to their life forms. Classified list of all species is given in Annexure II. Out of total recorded plant species, maximum tree species was 88 followed by herbs (70), climbers (28) and shrubs (23) (Figure 4.1). Among the families, Fabaceae is most dominant family comprising 18 species followed by Cucurbitaceae family includes 10 species (Figure 4.1 and 4.2)

Total species was grouped into their various life forms viz., Tree, Shrub, Herb and climber. Distribution of these all species in the taluka's is shown in table 4.1. This table shows that maximum number of trees species was recorded in the Dapoli taluka (56), followed equally by Chiplun and Guhagar (54), Ratnagiri (53), Rajapur (52), Lanja (45), Khed (42), Mandangad (37) and Sangameshwar (31). Distribution of shrub species shows highest numbers in Dapoli (18) followed by 16 species in Ratnagiri and Guhagar, 14 species in Lanja and 12 species in five taluka's viz., Mandangad, Khed, Rajapur, Chiplun and Sangameshwar. Data of herb species shows highest numbers of species in Dapoli i.e. 42. followed by 41 in Lanja, Rajapur and Chiplun, below that 35 species were found in Khed and Guhagar, followed by 31 and 30 in Sangameshwar and Mandangad respectively. Climber species distribution shows maximum 15 numbers in Chiplun followed by 14 in Rajapur, below that 13 and 12 species were found in Dapoli and Guhagar respectively, 11 species in both Khed and Ratnagiri, 9 species in Lanja and lowest 8 species found in Sangameshwar taluka. (Figure 4.3)

Region wise distribution of species is given in the table 4.2. Total numbers of species of all plants forms found in the Middle (R2) region (168) as it is intermediate zone of Coastal and Eastern i.e. Western Ghats region, followed by Coastal region (160) and Eastern region (154). Distribution of trees shows that highest numbers of 68 species in the Middle region (R2) followed by 67 and 65 in the Eastern (R3) and Coastal (R1) regions. Coastal region (R1) shows highest numbers of (22) shrub species followed by 18 in both remaining Middle (R2) and Eastern (R1) region. While herb species distribution shows maximum i.e. 62 species in Middle region (R2) followed by 55 and 46 numbers in Coastal (R1) and Eastern (R3) respectively. Distribution of climbers in Eastern region (R3) is high i.e. 23, followed by 20 and 18 species in the Coastal (R1) and Middle (R2) region. (Figure 4.4).

Table 4.1 Distribution of plant species in taluka's found in homegardens of Ratnagiri district

Taluka	Tree	Shrub	Herb	Climbers	Total
Dapoli	56	18	42	13	129
Mandangad	37	12	30	10	89
Khed	42	12	35	11	100
Lanja	45	14	41	9	109
Ratnagiri	53	16	33	11	113
Sangameshwar	31	12	31	8	82
Rajapur	51	12	41	14	118
Chiplun	54	12	41	15	122
Guhagar	54	16	35	12	117

Table 4.2 Distribution of plant species in regions found in homegardens of Ratnagiri district

Region	Tree	Shrub	Herb	Climbers	Total
R1 (Coastal)	65	22	55	18	160
R2 (Middle)	68	18	62	20	168
R3 (Eastern)	67	18	46	23	154

4.2 Diversity indices

The Shannon index (H') and Simpson's index (D) which are best indicators of diversity and dominance, were used to estimate the diversity among the homegardens. Diversity is calculated and compared between life forms, taluka's and regions in Ratnagiri district.

4.2.1 Diversity into plant forms

As plants found in the homegardens are cultivated hence the diversity among the various life forms was estimated based on observed numbers of species composition. This shows the interest of farmers for the cultivation of the life forms. Table 4.3 shows the diversity into life forms of plants. Herbs have more diversity illustrated by both values of H' and D in the homegardens of Ratnagiri, followed by trees, climbers and

shrubs. Simpson's index was maximum in shrubs assemblages i.e. (0.171233), whereas Shannon index was shown maximum values for herbs i.e. (3.444642). (Figure 4.5)

Table 4.3 Diversity into plant forms in homestead gardens Ratnagiri district

	Simpson	**Shannon**
Tree	0.118	2.833
Shrub	0.171	2.166
Herb	0.045	3.444
Climber	0.087	2.773

4.2.2 Plant diversity comparison between of taluka's of Ratnagiri

Table 4.4 shows Shannon diversity index of homegardens of the taluka's in Ratnagiri. Lanja has maximum diversity of tree assemblage shown by highest H' values, followed by the Chiplun. Dapoli has maximum diverse shrub assemblages shown by values of H'. Values of H' for herbs and climbers shows that the Chiplun possessed more diverse herbs and climbers assemblages than others (Figure 4.6).

Table 4.5 shows dominance among plants found in homegardens, indicated by Simpson's index. Guhagar has highest dominance of tree assemblage. Shrub dominance is highest in Sangameshwar taluka. Values of Simpson's index for herb and climber shows that Guhagar has highest herb and climber dominance. Climber dominance is higher in Guhagar because of cultivation of Lima beans (*Phaseolus lunatus*) in one homegarden in large quantity (Figure 4.7).

Table 4.4 Shannon diversity index of homegardens in taluka's of Ratnagiri

Taluka/Forms>	Tree	Shrub	Herb	Climbers
Dapoli	2.552	2.298	3.149	2.321
Mandangad	2.686	1.979	2.822	2.162
Khed	3.062	1.855	3.029	1.974
Lanja	3.117	1.847	2.929	1.894
Ratnagiri	2.719	1.986	3.055	2.119
Sangameshwar	2.733	1.736	2.781	1.724
Rajapur	2.918	1.787	3.02	2.313
Chiplun	3.094	1.763	3.256	2.4
Guhagar	1.941	2.278	2.812	1.363

Table 4.5 Simpson's diversity index of homegardens in taluka's of Ratnagiri

Taluka/Forms>	Tree	Shrub	Herb	Climbers
Dapoli	0.193	0.138	0.06	0.11
Mandangad	0.124	0.185	0.086	0.127
Khed	0.065	0.203	0.067	0.195
Lanja	0.071	0.228	0.082	0.185
Ratnagiri	0.128	0.211	0.06	0.145
Sangameshwar	0.09	0.259	0.086	0.234
Rajapur	0.094	0.238	0.074	0.123
Chiplun	0.077	0.223	0.049	0.116
Guhagar	0.276	0.14	0.111	0.462

4.2.3 Plant diversity comparison between regions of Ratnagiri district

Shannon diversity index of 3 regions for all life forms is given in table 4.6. Data of trees shows Eastern region (R3) has maximum diverse tree assemblage. Shrub diversity is highest in the coastal region (R1). Middle region (R2) has slightly more diversity of herbs than other regions. Eastern region (R3) also has more diversity of the climber assemblage. (Figure 4.8)

Simpson's index of trees shows maximum dominance in Coastal region (R1). Shrub and herb dominance is more in the Eastern region (R3) than other regions. Value of climbers has been showed that the Middle region (R2) has highest dominance. See table 4.7 and figure 4.9.

Table 4.6 Shannon diversity index of homegardens in regions of Ratnagiri

Region	Tree	Shrub	Herb	Climbers
R1 (Coastal)	2.385	2.254	3.355	2.65
R2 (Middle)	3.019	2.11	3.39	2.088
R3 (Eastern)	3.125	1.939	3.192	2.735

Table 4.7 Simpson's diversity index of homegardens in regions of Ratnagiri

Region/Forms	Tree	Shrub	Herb	Climbers
R1 (Coastal)	0.19	0.154	0.047	0.089
R2 (Middle)	0.089	0.18	0.046	0.226
R3 (Eastern)	0.0747	0.199	0.057	0.085

4.3 Diversity area relationship

4.3.1 Area of the homegardens

Average area of homegardens recorded during this study is 0.0928 acre. Highest recorded area of homegarden is 1.1 acre and lowest is 0.01 acre found in Ratnagiri district. The average area of homegardens in Coastal region (R1) is 0.934522 which is highest than Eastern region (R3) and Middle region (R2) i.e. 0.0913888 and 0.089933.

4.3.2 Diversity area relationship

To check the dynamics in the diversity according to the area, the diversity of each village of various plant forms was correlated with the total area of surveyed homegardens of each village. Diversity of village is estimated with the help of PAST software. Plotting graph indicated the various relations among the area and diversity for different plant life forms (Table 4.8).

Relation between Shannon index of trees and the area shows slightly increasing value of H' with the increasing area of the homegardens. But looking towards the values of H' upto 1 acre area shows the no any dynamics in the diversity On other hand Simpson's values (1-D) of trees shows slightly decreasing trends as area increases. Graph upto 1 acre shows decreasing trends in the 1-D values. It indicates that diversity of trees is decreases with increase in the area of homegardens. This is because of the as increases the area farmers interest goes towards mono-cropping and plantation of single tree crop.

Graph of shrub diversity relation with area shows decreasing trends as increase in area. Shows in both H' and 1-D values. But shows increasing trends upto 1 acre increase in area in both indices. It means increase in area upto 1 acre, diversity of shrubs increases rapidly but after that decreases.

Herb diversity slowly increases with the increase in the area indicated by H' values. H' values upto 1 acre shows similar increasing trends as shown in whole graph. Simpson's values for the herbs show very lesser increasing trends as increase in area. Climber diversity graph shows increasing trends as the area increases in both diversity indices. And also shows similar result upto 1 acre area of homegardens. (Figure 4.10 and 4.11)

After looking towards correlation of area to the diversity of all forms of plants cultivated in homegardens shows that there is slightly changes occurs in the tree and shrubs diversities. However show significant increase in diversity of the herbs and shrub assemblages.

Table 4.8 Diversity-Area relationship, with respect to surveyed villages in Ratnagiri district.

Sr. No.	Habit >>		Tree		Shrub		Herb		Climbers	
	Vilage	Area (Acer)	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**	**Simpson**	**Shannon**
1	Asud	0.32	0.9051	2.662	0.7978	1.752	0.8903	2.569	0.7347	1.352
2	Devake	0.655	0.704	1.88	0.575	1.22	0.9176	2.776	0.814	1.736
3	Anjarle	0.435	0.957	3.362	0.8006	1.917	0.9038	2.622	0.7222	1.504
4	Palgad	0.588	0.9463	3.192	0.825	2.149	0.9131	2.828	0.8067	1.719
5	Vanaushi	0.69	0.5715	1.527	0.8099	1.832	0.834	2.166	0.805	1.692
6	Pacharal	0.329	0.8857	2.577	0.768	1.526	0.8604	2.272	0.625	1.04
7	Ghosale	0.7	0.6966	1.902	0.8237	1.943	0.7501	2.06	0.6255	1.112
8	Konhavle	0.359	0.8657	2.428	0.8114	1.793	0.8795	2.286	0.6391	1.058
9	Tamhane	0.205	0.8817	2.531	0.6076	1.106	0.7605	1.659	0.4898	0.6829
10	Palghar	0.435	0.9319	2.87	0.77	1.599	0.8934	2.409	0.5313	0.9003
11	Sakharoli	0.299	0.8887	2.559	0.7469	1.654	0.8767	2.318	0.375	0.5623
12	Suseri	0.372	0.9172	2.749	0.8138	1.86	0.9079	2.565	0.4082	0.5983
13	Tale	0.4	0.8825	2.458	0.7891	1.706	0.8885	2.428	0.83	1.859
14	Mandave	1.144	0.9075	2.63	0.5432	1.091	0.8014	1.762	0.5444	0.9251
15	Kudoshi	0.511	0.9276	2.814	0.7222	1.388	0.9231	2.827	0.8333	1.864
16	Majal	0.712	0.9191	2.966	0.8256	1.976	0.8671	2.666	0.5616	0.9314
17	Ajnari	0.237	0.9	2.461	0.5873	0.9551	0.8066	1.772	0.6914	1.273
18	Korli	0.506	0.9389	3.044	0.6556	1.423	0.8684	2.262	0.568	1.072
19	Govil	0.271	0.8891	2.57	0.7507	1.515	0.786	2.08	0	0
20	Shiposhi	0.379	0.8966	2.448	0.7061	1.279	0.9093	2.561	0.7222	1.33
21	Shirgaon	0.446	0.787	2.029	0.8256	1.986	0.9262	2.738	0.642	1.061
22	Kasar veli	0.532	0.8381	2.302	0.8089	1.894	0.8967	2.479	0.716	1.427
23	Basani	0.164	0.8394	2.245	0.6514	1.371	0.7682	1.63	0	0
24	Nevare	2.52	0.8634	2.406	0.4551	0.9681	0.8933	2.475	0.631	1.041
25	Pali	0.528	0.9008	2.745	0.7312	1.562	0.9168	2.681	0.7562	1.504
26	Ambed	0.337	0.8984	2.482	0.4978	0.9043	0.864	2.259	0	0
27	Mhabale	0.386	0.9146	2.588	0.7984	1.839	0.8087	2.167	0.4444	0.6365
28	Yesradi	0.384	0.8813	2.352	0.6041	1.17	0.8227	1.955	0.6875	1.255
29	Vigravali	0.253	0.8657	2.292	0.5554	1.075	0.8302	1.962	0.6901	1.258
30	Sonavade	0.182	0.8681	2.391	0.7557	1.552	0.9035	2.537	0	0
31	Bhu	0.457	0.904	2.712	0.6348	1.224	0.9015	2.578	0.7273	1.342
32	Oni	1.241	0.9124	2.769	0.6373	1.32	0.908	2.78	0.4938	0.8487
33	Kolvan	1.241	0.9217	3.168	0.7795	1.653	0.8708	2.555	0.787	1.832
34	Bagave wadi	0.539	0.8412	2.392	0.7612	1.508	0.8921	2.507	0	0
35	Yelvan	0.833	0.8987	2.658	0.6956	1.512	0.8736	2.322	0.6074	1.293
36	Pachal	0.48	0.9017	2.772	0.7264	1.476	0.9017	2.561	0	0
37	Malghar	0.284	0.858	2.406	0.7258	1.414	0.9255	2.781	0.8119	1.913
38	Parshuram	0.76	0.8878	2.812	0.77	1.685	0.9059	2.811	0.7653	1.512
39	Kamthe	0.322	0.9255	2.944	0.5944	1.195	0.9349	2.854	0.8383	1.876

40	Kalambaste	0.5	0.9186	2.84	0.8199	1.873	0.9145	2.745	0.7766	1.805
41	Asgoli	0.354	0.8927	2.655	0.8313	1.903	0.9054	2.611	0.48	0.673
42	Narvan	0.376	0.854	2.268	0.6551	1.179	0.917	2.675	0.5536	0.9238
43	Guhagar	0.559	0.4736	0.7806	0.8786	2.203	0.8899	2.374	0.4444	0.6365
44	Gimavi	0.785	0.8944	2.757	0.6921	1.482	0.6873	1.838	0.2907	0.6997
45	Deoghar	0.72	0.9158	2.912	0.8642	2.095	0.9294	2.782	0.7755	1.55

4.4 Uses of plants in homegardens

Table 4.9 shows uses of the plants forms found in the homegardens. Total 79 species were recorded having food value, followed by ornamental (64) species. Plants species having food value are present in lager quantity of all life forms excepting the shrub species in the homegardens. Most of the shrub species having ornamental uses are found in large quantity (Figure 4.12).

Table 4.9 Uses of plants in homegardens

Forms	Food	Fodder	Fuel	Medicinal	MPT	Ornamental	Timber	Total
Tree	33	2	10	10	11	16	6	88
Shrub	2	0	0	5	0	16	0	23
Herb	25	1	0	16	0	27	1	70
Climbers	19	0	0	4	0	5	0	28
Total	79	3	10	35	11	64	7	209

4.5 Importance Value Index (IVI)

Importance value index shows the most important species cultivated in the homegardens of the Ratnagiri district. Importance value index for each life form of plant was calculated. Table 4.10 shows the top ten tree species having maximum IVI in that Arecanut (*Areca catechu*) has maximum IVI value (40.0023), followed by Coconut (*Cocos nucifera*) (31.812). These two species were cultivated commercially in some homegardens. Top ten tree species having maximum IVI index are mainly used for food purpose. Jaswand (*Hibiscus rosasinensis*) an ornamental species has highest IVI index among the shrubs (61.1972) followed by Brinjal (*Solanum melongena*) (44.3523). Looking towards herb shows Alu (*Colocasia esculenta*) an food crop has highest

maximum IVI value (17.3716) followed by Banana (*Musa acuminata*) (16.5041). Lima beans (*Phaseolus lunatus*) has maximum IVI value (40.7928), followed by Black pepper (35.0106). Observing all species of all life form shows that species having food value has maximum IVI followed by species having ornamental uses. Importance value index clearly indicates facts that farmer's interest goes towards the cultivation of plants species which has food value, followed by ornamental species.

Table 4.10 Top ten specie of each life form having maximum IVI index

Tree	**IVI**	**Shrub**	**IVI**	**Herb**	**IVI**	**Herb**	**IVI**
Arecanut	40.00	Jaswand	61.19	Alu vadi	17.37	Lima beans	40.79
Coconut	31.81	Brinjle	44.35	Banana	16.50	Kalimiri	35.01
Mango	22.02	Gulab	37.29	Mula	14.95	Ghevada	26.47
Jackfruit	13.11	Anant	19.97	Tulsi	14.79	Karnful	19.30
Cashew	11.36	Goldern duranta	17.84	Grass F	13.88	Chavali	18.95
Guava	10.47	Mogara	16.05	Chili	13.66	Watana	15.62
Sapota	8.62	Ixora	10.12	Aboli	13.32	Karle	13.50
Teak	7.61	Jasminum	9.93	Hirva math	11.40	Tondali	12.77
Curryleaves	6.84	Gulbakshi	8.28	Mataki	11.31	Mug	12.59
Lemon	6.78	Nirgudi	8.25	Marygold	11.26	Sweet potato	11.30

(* Botanical names of species are given in annexure II)

4.6 Carbon sequestration potential of homegardens

Above ground carbon sequestration potential or carbon stock in homegardens is calculated by using non-destructive method as discussed by Chavan *et al.* (2010). Total 289.3675 tonne carbon stock was recorded in the surveyed homegardens of Ratnagiri district. Distribution of carbon stock in homegardens of each taluka in Ratnagiri district is shown in Table 4.11. Data shows that homegardens of Ratnagiri taluka shows highest carbon stock (75.0876 tonne) sequestrated by the tree species followed by Guhagar taluka (71.561 tonne) (Figure 4.13).

Table 4.12 shows distribution of carbon stock in the Coastal, Middle and Eastern regions of the Ratnagiri. It is observed that sequestration of carbon was maximum in the Coastal region (R1) (152.3149 tonne), followed by the Middle region (R2) (86.4704 tonne) and lowest in Eastern region (R3) (50.5821). The Coastal region shows higher

carbon stock than others. This is because of high number of Arecanut and Coconut plantations with high density of trees in homegardens of coastal region (Figure 4.14).

Table 4.11 Sequestration of carbon in the homegardens in different taluka's of Ratnagiri

Taluka	Biomass (Tonne)	Carbon (Tonne)
Dapoli	91.583	45.791
Mandangad	24.679	12.339
Khed	26.146	13.073
Lanja	11.94	5.97
Ratnagiri	151.615	75.808
Sangameshwar	21.627	10.813
Rajapur	39.239	19.62
Chiplun	68.784	34.392
Guhagar	143.122	71.561

Table 4.12 Sequestration of carbon in the homegardens in the regions of Ratnagiri

Region	Biomass (Tonne)	Carbon stock (Tonne)
R1 (Costal)	304.63	152.315
R2 (Middle)	172.941	86.47
R3 (Eastern)	101.164	50.582

4.6.1 Area-Carbon stock relation

Total carbon stock of surveyed homegardens of each village is calculated and plotted against the area (figure 4.15). It shows as area of homegardens increases carbon stock in the homegarden is also increased. As explained earlier in area plant diversity relation analysis as area increases tree diversity slightly decreases or remain unchanged because of diverting towards the monoculture plantation of trees in the homegardens. It helps to increasing the carbon stock in the homegardens. Carbon stock of Guhagar village

shows highest carbon in lesser area because of the high density plantation of Arecanut and Coconut plants in the homegardens.

4.7 Livestock population in homegardens

Livestock is the one of the important component of the homegarden under agroforestry system. Some homegardens of Ratnagiri district also contain livestock as major component. Total numbers of livestock recorded in homegardens of Ratnagiri is 117 numbers of cattle, 235 of poultry birds (hen/cock), 4 of goat and 22 of buffalo.

4.7.1 Distribution of livestock in the homegardens on the basis of Taluka

Distribution of livestock in the taluka's and regions is shown in the tabular format. Table 4.13 shows the distribution of livestock in taluka's of Ratnagiri district. Dapoli taluka has maximum number of cattle population (27) with highest frequency value (2.33), followed by Mandangad (16) but it has lesser frequency (0.66). Chiplun and Sangameshwar show equal number of cattle (15) population but in varying frequencies of 0.02 and 0.133, respectively.

Data of recorded poultry birds include only hen population. Distribution of hen population shows that maximum 32 hen recorded in Rajapur and Ratnagiri taluka's, followed by three taluka's viz., Dapoli, Chiplun and Guhagar. All these taluka's contain 30 hen's each. Frequency of hen's occurrence is highest in the Ratnagiri, Sangameshwar and Rajapur taluka's (0.266), followed by Chiplun taluka (2.33). Goat population is very lesser in surveyed homegardens. Only one homegarden in Rajapur taluka has 4 individuals of goats. Looking towards buffalo population, Ratnagiri taluka has maximum population of buffalo (10) with the highest frequency (0.066). Below that Guhagar taluka has 5 individuals of buffalo in surveyed homegardens (Figure 4.16).

Table 4.13 Distribution of livestock population in homegardens in various taluka's of Ratnagiri and their frequency.

Taluka	Cattle	Frequency	Hen	Frequency	Goat	Frequency	Buffalo	Frequency
Dapoli	27	0.233	30	0.2	0	0	2	0.033
Mandangad	16	0.067	24	0.2	0	0	0	0
Khed	6	0.1	16	0.133	0	0	0	0
Lanja	8	0.1	15	0.133	0	0	1	0.033
Ratnagiri	14	0.133	32	0.267	0	0	10	0.067
Sangameshwar	15	0.133	26	0.267	0	0	0	0
Rajapur	7	0.067	32	0.267	4	0.033	2	0.033
Chiplun	15	0.2	30	0.233	0	0	2	0.033
Guhagar	9	0.1	30	0.167	0	0	5	0.033
Total	**117**	**0.126**	**235**	**0.207**	**4**	**0.004**	**22**	**0.0259**

4.7.2 Distribution of livestock in homegardens of on the basis of region

Table 4.14 shows the largest population of cattle in Coastal region (R1) followed by Middle region (R2). Frequency of occurrence of cattle shows highest values in the Middle region (R2). Distribution of hen also has highest numbers in Coastal region (R1) and has highest frequency of occurrence. Goat is found in only one homegarden of Eastern region. Buffalo population also is highest in the Coastal region (R1) and also has maximum frequency (Figure 4.17).

Table 4.14 Distribution of livestock population in homegardens in regions of Ratnagiri and their frequency.

Regions	Cattle	Frequency	Hen	Frequency	Goat	Frequency	Buffalo	Frequency
R1 (Costal)	51	0.144	101	0.244	0	0	17	0.044
R2 (Middle)	37	0.156	68	0.2	0	0	3	0.022
R3 (Eastern)	29	0.078	52	0.178	4	0.011	2	0.011
Total	**117**	**0.126**	**221**	**0.21**	**4**	**0.004**	**22**	**0.026**

4.8 Nutritive value of homegardens

As explained earlier, the data of table 4.14 and IVI shows the species having food value is preferred by farmers for cultivation in the homegardens. Thus it proves that the homegardens plays major role in providing nourishment to the family. Table 4.15 shows the nutrient profile of food products produced in the homegardens.

Table 4.15 Nutritive profile of food species found in homegardens of Ratnagiri

Common name of plants	Protein	Fats	Minerals	Crude fibers	CHO's	Energy	Calcium	Phosphorous	Iron
Alu	3.9	1.5	2.2	2.9	6.8	56	227	82	10
Amla	0.5	0.1	0.5	3.4	13.7	58	50	20	1.2
Arecanut	4.9	4.4	1	11.2	47.2	249	50	130	1.5
Badam	20.8	58.9	2.9	1.7	10.5	655	230	490	5.09
Bael	1.8	0.3	1.7	2.9	31.8	137	85	50	0.6
Banana	1.2	0.3	0.8	0.4	27.2	116	17	36	0.36
Bhendi	1.9	0.2	0.7	1.2	6.4	35	66	56	0.35
Bhopala	1.4	0.1	0.6	0.7	4.6	25	10	30	0.44
Bor	0.8	0.3	0.3	-	17	74	4	9	0.5
Brinjle	1.4	0.3	0.3	1.3	4	24	18	47	0.38
Bullock's heart	1.4	0.2	0.7	5.2	15.7	70	10	10	0.6
Cashew fruit	0.2	0.1	0.2	0.9	12.3	51	10	10	0.2
Cashew nut	21.2	46.9	2.4	1.3	22.3	596	50	450	5.81
Caw pea	24.1	1	3.2	3.8	54.5	323	77	414	8.6
Chili	2.9	0.6	1	6.8	3	29	30	80	4.4
Chinch	3.1	.	2.9	5.6	67.4	283	170	110	17
Coconut	6.8	62.3	1.6	6.6	18.4	662	400	210	7.8
Coconut water	1.4	0.1	0.3	0	4.4	24	24	10	0.1
Curryleaves	6.1	1	4	6.4	18.7	108	830	57	0.93
Pomegranate	1.6	0.1	0.7	5.1	14.5	65	10	70	1.79
Dodaka	0.5	0.1	0.3	0.5	3.4	17	18	26	0.39
Drumstick	2.5	0.1	2	4.8	3.7	26	30	110	0.18
Drumstic leaves	6.7	1.7	2.3	0.9	12.5	92	440	70	0.85
Dudhi Bhopala	0.2	0.1	0.5	0.6	2.5	12	20	10	0.46
Gawar	3.2	0.4	1.4	32	10.8	16	130	57	1.08
Ginger	2.3	0.9	1.2	2.4	12.3	67	20	60	3.5

Green gram	24	1.3	3.5	4.1	56.7	334	124	326	4.4
Green pea	7.2	1	0.8	4	15.9	93	20	139	1.5
Guava	0.9	0.3	0.7	5.2	11.2	51	10	28	0.27
Hirva math	2.8	0.5	1.2	2.2	5.3	37	292	51	2.5
Jackfruit	1.9	0.1	0.9	1.1	19.8	88	20	41	0.56
jackfruit seed	6.6	0.4	1.2	1.5	25.8	133	50	97	1.5
Jayphal	7.5	36.4	1.7	11.6	28.5	472	120	240	2.03
kakadi	0.4	0.1	0.3	0.4	2.5	13	10	25	0.6
Kalimiri	11.5	6.8	4.4	14.9	49.2	304	460	198	12.4
Karle	1.6	0.2	0.8	0.8	4.2	25	20	70	0.61
Karonda	1.1	2.9	0.6	1.5	2.9	42	21	28	-
Kovla	0.4	0.1	0.3	0.8	1.9	10	30	20	0.8
Lal Math	4.5	0.6	4.2	1.6	85	57	321	71	18
Lemon	1	0.9	0.3	1.7	11.1	57	70	10	0.26
Mango	0.6	0.4	0.4	0.7	16.9	74	14	16	1.3
Mataki	23.6	1.1	3.5	4.5	56.5	330	2	230	9.5
Methi	4.4	0.9	1.5	1.1	6	49	395	51	1.93
Mohari	20	39.7	4.2	1.8	23.8	541	490	700	7.9
Mula	0.7	0.1	0.6	0.8	3.4	17	35	22	0.4
Onion	1.8	0.1	0.6	0.6	12.6	59	40	60	1.2
Padaval	0.5	0.3	0.5	0.8	3.3	18	26	20	1.51
Papaya	0.6	0.1	0.5	0.8	7.2	32	17	13	0.5
Pinapple	0.4	0.1	0.4	0.5	10.8	46	20	9	2.42
Red gram	22.3	1.7	3.5	1	57.6	335	73	304	2.7
Santri	0.7	0.2	0.3	0.3	10.9	48	26	20	0.32
Sapota	0.7	1.1	0.5	2.6	21.4	98	28	27	1.25
Sitaphal	1.6	0.4	0.9	3.1	23.5	104	17	47	4.31
Suran	1.2	0.1	0.8	0.8	18.4	79	50	34	0.6
Sweet potato	1.2	0.3	1	0.8	28.2	120	46	50	0.21
Termeric	6.3	5.1	3.5	2.6	69.4	349	150	282	67.8
Tomato	1.9	0.1	0.6	0.7	3.6	23	20	3	1.8
Val	4.5	0.1	0.8	0.2	7.2	48	50	64	1.4
Velchi	10.2	2.2	5.4	20.1	42.1	229	130	160	4.6
Water melon	0.2	0.2	0.3	0.2	3.3	16	11	12	7.9

(Source: Nutritive Value of Indian Foods, By Gopalan C., Shashtri V., Balsubhramanian S.)

(* Botanical names of species are given in annexure II)
(* Nutritive value per 100 gram of edible portion)

4.8.1 Commercial status of species having food value.

Table 4.16 shows that homegarden is mainly subsistence level agroforestry system. It means that products produced in homegardens are used for household consumption. Food products from some plants are sold in the market after fulfilling the household consumption showing the intermediate system (Figure 4.18).

Table 4.16 Commercial status of the plants having food value

Food	Commercial	Food	Commercial	Food	Commercial
Alu	Subsistence	Hirva math	Subsistence	Arecanut	Intermediate
Amla	Subsistence	Karle	Subsistence	Banana	Intermediate
Badam	Subsistence	Karonda	Subsistence	Bullock's heart	Intermediate
Bael	Subsistence	Kovla	Subsistence	Cashew nut	Intermediate
Bhendi	Subsistence	Lal Math	Subsistence	Coconut	Intermediate
Bhopala	Subsistence	Lemon	Subsistence	Coconut water	Intermediate
Bor	Subsistence	Mataki	Subsistence	Dudhi Bhopala	Intermediate
Brinjle	Subsistence	Methi	Subsistence	Guava	Intermediate
Cashew fruit	Subsistence	Mohari	Subsistence	Jackfruit	Intermediate
Caw pea	Subsistence	Mula	Subsistence	jackfruit seed	Intermediate
Chili	Subsistence	Onion	Subsistence	Jayphal	Intermediate
Chinch	Subsistence	Padaval	Subsistence	kakadi	Intermediate
Curry leaves	Subsistence	Pineapple	Subsistence	Kalimiri	Intermediate
Pomegranate	Subsistence	Orange fruit	Subsistence	Mango	Intermediate
Dodaka	Subsistence	Suran	Subsistence	Papaya	Intermediate
Drumstick	Subsistence	Sweet potato	Subsistence	Red gram	Intermediate
Gawar	Subsistence	Termeric	Subsistence	Sapota	Intermediate
Ginger	Subsistence	Tomato	Subsistence	Sitaphal	Intermediate
Green gram	Subsistence	Val	Subsistence	Water melon	Intermediate
Green pea	Subsistence	Velchi	Subsistence	Kokam	Intermediate

(* Botanical names of species are given in Annexure II)

Discussion

In present study conducted in homegardens of Ratnagiri district, total 209 plant species found in different regions. Shirke (2016) recorded 127 plant species from the survey of homegardens of the Konkan region. She also noticed that Coastal region has more numbers of species than Eastern region (Sahyadri region). While Saikia et al. (2012) conducted Vegetation survey of 80 homegardens in 17 villages of Golaghat and Jorhat districts of Upper Assam. They recorded 294 plant species representing 217 genera and 92 families. Of these 142 were tree species followed by 96 of herbs and 56 of shrubs were recorded.

Trees and shrub has highest number of plant species as than other two life forms observed in present study. The findings are similar to other studies by Saikia *et al*. (2012) and Kabir and Webb (2008) also reported predominance of tree and herb assemblage in homegardens of Upper Assam and southwestern Bangladesh, respectively. Sahoo (2009) also found the trees and herbs have higher diversity in the homegardens.

Tree diversity in the homegardens of Ratnagiri is about 2.8331 as shown by Shannon index (H') in present study. Whereas plant diversity of homegardens of Golaghat and Jorhat district of Assam was calculated by Saikia *et al.* (2012 reported 3.29 and 3.25 values, respectively.

Sahoo and Rocky (2015) studied the diversity area relationship in the homegardens of Mizoram. It was observed weak increase in diversity as increase in the area, but shows significant dynamics in higher altitudinal homegardens. Sahoo (2009) reported the diversity showed an increasing trends with the area of homegardens.

Diversity area relationships show that as area increases the diversity of the plats shows dynamics showing different result for various life forms. The findings of this are similar to Kabir and Webb (2009) who reported strong relationship between homegarden size with species richness in Bangladesh homegardens. Das and Das (2005) in Barak valley of Assam recorded variations in species combination with fluctuating area of homegardens. However in other hand homegardens studies conducted by Rico Gray *et al*.

(1991) in Mexico indicated that there was no relation in homegardens size and diversity-dominance of plants.

Apart from area diversity relationship, the factors like water availability, climatic condition, Slope (Mainly in eastern region) and anthropogenic pressure are responsible for diversity dynamics, which were noticed while surveying and during interaction with the farmers. Ecological and socioeconomic factors like geographic location, climate, water availability, garden size and history, agricultural policy, market needs, dietary habits and household preferences influence the species diversity and utilization of the products of traditional homegardens (Gajaseni and Gajaseni 1999; Trinh et al. 2003).

Data of plant utilization presented by graphically shows that species having food and nutritious value has been preferred by farmers for cultivation in the homegardens. Sahoo (2009) also noticed that the species having food value are dominant in homegardens. Saikia *et al*. (2012) reported the plants having miscellaneous uses has more frequency but if we consider the combine number of fruit and vegetables as the food species they shows maximum numbers of species having food value.

Important value index for crops in the homegardens of Ratnagiri district shows Arecanut and Coconut has highest IVI value Pandey *et al.* (2006) also reported similar findings like present study where, Arecanut and Coconut has highest frequencies in South Andaman homegardens. Saikia *et al.* (2012) also reported similar findings that the Arecanut, Mango and Jackfruit as important and more frequent species of the homegardens of Upper Assam. Sahoo and Rocky (2015) reported Arecanut (16.61) is more important species of lower altitudes and Jackfruit has second important species shown by IVI values in middle (4.97) and lower (7.19) altitudinal homegardens of Mizoram.

Carbon stock distribution in Ratnagiri district shows higher carbon stock in the Coastal region (R1), followed by Middle region (R2) and Eastern region (R3). Similarly Carbon stock was higher in Coastal region than the Eastern region (Western Ghat) of the Konkan was reported by Shirke (2016). This is because of the increase in plantation of trees in homegardens in the coastal region mainly of Arecanut and Coconut species. Area

carbon stock relationship has same reason the area increases with an increase in the plantation of the number of trees. Because of an increase in numbers of trees, carbon stock in the form of biomass is also increased. Thus area - carbon stock relationship shows increasing trends as the area increases.

Population of livestock in the homegardens was found in very less number of homegardens out of the all surveyed homegardens. Presence of livestock is totally depends upon the need and interest of the owner. But another thing notices during interaction with the farmers that the numbers of livestock is decreases in the homegarden in recent days found in the Ratnagiri district due to lesser availability of the man power to manage them. It has many socio economic reasons of the district.

Looking towards commercial status of homegardens present study shows that homegardens is mainly subsistence level agroforestry system. Similarly Sahoo (2009) also recorded homegardens are mainly food producing subsistence level homegarden system which is similar to present study. Homegardens has limited area and major species were recorded having food value it indicates that food products produce from the homegardens are in lesser quantity and has ability to fulfill the requirement of only the members of family. Thus homegardens called as the subsistence level agroforestry system.

CHAPTER V

SUMMARY AND CONCLUSION

Homegarden is the multi-storey agroforestry system cultivated and maintained around the homestead by the members of family specialized by its complex structure. It provides basic things for the day to day life of the family. Homegardens are mainly found in humid tropical climate. Ratnagiri district has humid tropical climate but shows slightly diverse climatic condition in the overall geographical area because of Arabian Sea on western side and Sahyadri Mountain (Western Ghat) on eastern side. Traditionally cultivated homegardens are commonly found in the Ratnagiri district and shows great variation in their composition and function in throughout the district. To document plant diversity, carbon sequestration and food value of the Ratnagiri district the present study was undertaken. For the study purpose the area of Ratnagiri district was divided into 3 regions namely Costal (R1), Middle (R2) and Eastern (R3). Sampling units (Each homegarden) were selected in such a manner that one taluka contain five villages and each village contains six homegardens. Similarly for regions, each region contains 15 villages. Finally total 270 homegardens from 45 villages of 9 taluka's of Ratnagiri district were surveyed.

Range of homegarden area of surveyed home gardens is 0.01 acre to 1.1 acre. Coastal region shows larger size homegardens than other to region.

Total 209 plant species representing 178 genera and 81 families were recorded in survey of 270 homegardens of Ratnagiri district. Out of which 88 species of trees were recorded followed by 70 herbs, 28 climbers and 23 shrubs. Fabaceae plant family contains highest number of species i.e. 18, followed by Cucurbitaceae i.e. 10.

Distribution of various life forms in various taluka's shows that Dapoli taluka contain highest number (56) of tree species followed by Chiplun and Guhagar i.e. 54. Looking towards shrub assemblage also shows that Dapoli has maximum 18 species of shrubs, followed by 16 species in Ratnagiri. Maximum species of herb were found in

Dapoli i.e. 42 followed by 41 species in Lanja, Rajapur and Chiplun. Climber species distribution shows maximum of 15 numbers in Chiplun followed by 14 in Rajapur.

Region wise distribution of species shows maximum 168 species were recorded in Middle region (R2) followed by 160 species in coastal region. Tree species distribution shows that highest (68) species in the Middle region (R2) followed by 67 species in Eastern (R3). Coastal region (R1) has highest (22) shrub species followed by 18 in both remaining Middle (R2) and Eastern (R1) region. Highest 62 herb species were recorded in Middle region (R2), followed by 55 in Coastal region (R1). Climber species in Eastern region (R3) shows maximum 23 species, followed by 20 species in Coastal (R2) region.

Shannon diversity and Simpson's dominance indices were used to determine the diversity in the homegardens. Diversity comparison between plant life forms shows highest diversity in herb assemblage followed by trees.

Lanja taluka was observed to have maximum diversity of tree assemblage, followed by the Chiplun. Dapoli taluka shows maximum diversity of shrubs. Chiplun shows more diversity of herbs and climber assemblages. Looking towards data of Simpson's index shows that Guhagar has highest dominance of tree assemblage. Shrub dominance was highest in Sangameshwar taluka. Maximum dominance of herb and climber were found in Guhagar taluka.

Region wise diversity into plants in homegardens shows that Eastern region (R3) has maximum diverse tree assemblage. Coastal region (R1) has maximum shrub diversity. Herb diversity in three regions does not show any significant difference between them but Middle region (R2) shows slightly more diversity of herbs than other regions. Climber diversity is more in Eastern region. Dominance of trees is highest in Coastal region (R1). Shrub and herb dominance is more in the Eastern region (R3). Middle region (R2) has highest climber dominance.

To study the relation between homegarden size and diversity graphs of diversity of various plant forms is plotted against the homegarden size (area in acre) and shows result that Tree diversity exhibits stability even the area increases. This is because of increase in plantation one or two species in homegardens. Shrubs diversity shows

increasing trends upto one acre after that decreases as area increases. Diversity of herbs and shrubs shows increasing trends as area increases.

Farmers are interested to cultivate the plants having food and ornamental value presented by graph of uses of plants (figure 4.12). Importance value index of trees shows Arecanut has highest value in tree assemblages. Jaswand has maximum IVI value in shrubs. Highest IVI value of herbs shown in Alu. Lima beans show highest IVI value in climber assemblage. Species having food value show maximum IVI values except shrub assemblage.

Above ground carbon stock was calculated by using non-destructive method by using standing biomass of the trees. Carbon stock of taluka's shows homegardens of Ratnagiri (75.8 tonne) taluka has maximum carbon stock followed by Guhagar (71.56 tonne). Region wise carbon stock distribution shows Coastal region (R1) shows maximum carbon stock (152.31tonne), followed by Middle region (R2) (86.47 tonne).

Area-Carbon relationship shows that as the area of homegardens increases then carbon stock of the homegardens is also increased. As plantation of trees increases with the area increases, thus carbon stock of homegardens also increased.

In the homegardens of Ratnagiri district total livestock population of 117 cattle's, 235 hen and 22 buffalos were recorded. Only 4 individuals of goats were recorded in Rajapur taluka of Eastern region (R3).

Food production is the one of the primary aim of the homegardens as homegardens helps to nourish family of the owner. Nutritive profile of food products produced in the homegardens is described in in the result. Commercial status of food products of homegardens shows that homegarden system is subsistence level agroforestry system.

Conclusion

From the result of plant diversity, carbon sequestration potential and food value of homegardens it is concluded that

1) Homegardens has great diversity in their components. They shows large diversity of plants species which they contain. Diversity and dominance of plants were changes according to the regions and taluka's as changes in some factors of that locality and the anthropogenic pressure.
2) Diversity of tree assemblage is remains stable as increase in size of homegardens. Plantation of limited tree species (one or two) as increase in the area of is the main reason of the stability in the diversity.
3) Homegardens has main objective of food production and shrubs species having food and nutritive values are present in very lesser numbers thus graph of area-shrub diversity shows deceasing trends. Herbs and climbers shows increasing trends as increase in the area.
4) Homegardens helps in the sequestration of the carbon in the form of biomass. Coastal homegardens has large carbon stock as compared to others. As home gardens helps to increase tree cover outside the conventional forest area, also help to reduce the anthropogenic pressure on forest they act as the major carbon sink which helps to decrease effect of global warming.
5) Species having food and nutritive value are dominant in homegardens followed by ornamental plants shows that the primary aim of the homegardens is the food production and recreational is secondary. Enough food material is produced in the homegarden to fulfill the wants of the one family. Most of the homegardens are subsistence in economic nature. Nutrient status of the food material produced in the homegardens shows that they also help to overcome the problems of the malnutrition.
6) Livestock is the one of the component of the homegardens they helps not only to increase the economic status of the farmers but also provides organic fertilizers to their farms.

7) Agro-tourism in homegardens is new trend noticed in one homegarden of Asgoli village of Guhagar taluka helping farmers to increase the income. The farmer told me that “Tourists are the one of the cash crop of my home garden”.

Overlooking the all of the study indicates that homegardens are the back bone of economic, nutritious and healthy status of farmers of the Ratnagiri district which may help to keep away them from the suicides in the adverse condition. Homegardens also help for maintaining environmental stability by conserving natural resources and their diversity.

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Annexure I

List of owners and geographical location of the surveyed homegardens in Ratnagiri district.

Taluka	Dapoli			
Village	Asud			
Sr. No.	Name of Farmer	Area	Latitude	Longitude
1	S V Gandhi	0.065	17°47'4.67"N	73° 7'57.61"E
2	V Gurav	0.05	17°47'11.26"N	73° 8'2.67"E
3	S S Gurav	0.08	17°47'7.68"N	73° 7'58.12"E
4	V S Botre	0.08	17°46'57.07"N	73° 9'4.78"E
5	R R Kule	0.025	17°46'57.94"N	73° 9'6.48"E
6	M G Revale	0.02	17°46'57.86"N	73° 9'7.61"E
Village	Devke			
1	D R Baikar	0.2	17°41'19.90"N	73° 9'8.94"E
2	H G Baikar	0.15	17°41'19.64"N	73° 9'8.48"E
3	S G Baikar	0.11	17°41'20.50"N	73° 9'7.93"E
4	G G Jadhav	0.13	17°41'20.30"N	73° 9'6.60"E
5	B G Jadhav	0.04	17°41'18.92"N	73° 9'7.99"E
6	P N Jadhav	0.025	17°41'18.60"N	73° 9'8.27"E
Village	Anjarle			
1	A S Benere	0.09	17°50'59.41"N	73° 6'3.69"E
2	N S Dhadave	0.17	17°50'56.25"N	73° 6'5.19"E
3	R B Sawant	0.07	17°50'56.37"N	73° 6'4.11"E
4	S S Bardule	0.02	17°50'54.74"N	73° 6'3.85"E
5	G G Benere	0.035	17°50'54.01"N	73° 6'4.06"E
6	S S Bhekare	0.05	17°50'59.41"N	73° 6'3.69"E
Village	Palgad			
1	B D Patil	0.078	17°49'35.02"N	73°19'35.54"E
2	P G Bagade	0.08	17°49'36.35"N	73°19'35.25"E
3	P J Joshi	0.08	17°49'38.07"N	73°19'34.73"E
4	M M Joshi	0.05	17°49'39.30"N	73°19'34.69"E
5	A T Joshi	0.25	17°49'40.27"N	73°19'34.33"E
6	N R Gurav	0.05	17°49'40.61"N	73°19'36.07"E
Village	Vanaushi T Natu			
1	A S Chavan	0.2	17°48'30.32"N	73°18'30.73"E
2	A Pawar	0.09	17°48'29.30"N	73°18'31.70"E
3	R M Pawar	0.07	17°48'30.96"N	73°18'32.26"E
4	S Pawar	0.08	17°48'28.97"N	73°18'35.99"E

5	D B Chavan	0.15	17°48'33.40"N	73°18'30.70"E
6	S G Patane	0.1	17°48'32.50"N	73°18'31.90"E
Taluka	Mandangad			
Village	Pacharal			
1	N S Janngam	0.08	17°58'55.10"N	73°12'23.00"E
2	S M Vhadabe	0.03	17°58'55.57"N	73°12'22.95"E
3	D S Misal	0.05	17°58'58.62"N	73°12'27.71"E
4	J R Pardule	0.13	17°58'59.30"N	73°12'27.90"E
5	S B Pardule	0.02	17°59'0.01"N	73°12'27.91"E
6	T A Sawant	0.019	17°59'2.00"N	73°12'28.50"E
Village	Ghosale			
1	S J Ghosalkar	0.029	18° 0'10.11"N	73°12'23.07"E
2	S S Ghosalkar	0.21	18° 0'9.03"N	73°12'23.45"E
3	M A Vichare	0.01	18° 0'10.42"N	73°12'24.51"E
4	S D Ghosalkar	0.056	18° 0'11.07"N	73°12'23.07"E
5	A P Ghosalkar	0.199	18° 0'11.66"N	73°12'25.13"E
6	R G Yrunksr	0.196	18° 0'4.30"N	73°12'26.00"E
Village	Konhavle			
1	V T Tambe	0.1	17°57'45.01"N	73°11'17.59"E
2	S Y Tambe	0.01	17°57'44.20"N	73°11'17.70"E
3	M S Tambe	0.06	17°57'42.74"N	73°11'17.36"E
4	S S Tambe	0.07	17°57'44.19"N	73°11'16.43"E
5	N B Tambe	0.09	17°57'43.02"N	73°11'16.54"E
6	A N Tambe	0.029	17°57'43.06"N	73°11'16.17"E
Village	Tamhane			
1	C B Gammare	0.035	17°57'16.60"N	73°11'10.80"E
2	M B Gamare	0.05	17°57'16.01"N	73°11'11.19"E
3	M J Gamare	0.02	17°57'15.65"N	73°11'9.63"E
4	A S Gamare	0.01	17°57'16.91"N	73°11'9.36"E
5	G D Gamare	0.01	17°57'15.97"N	73°11'8.47"E
6	S V Gamare	0.08	17°57'15.08"N	73°11'8.26"E
Village	Palghar			
1	S S Salavi	0.09	17°57'24.71"N	73°17'20.62"E
2	S L Mhamankar	0.07	17°57'24.83"N	73°17'21.17"E
3	B B Mhamankar	0.075	17°57'25.21"N	73°17'20.34"E
4	K A Mhamankar	0.08	17°57'25.80"N	73°17'20.80"E
5	Y A Mhamankar	0.07	17°57'25.71"N	73°17'21.43"E
6	D D Bhopane	0.05	17°57'26.27"N	73°17'22.12"E
Taluka	Khed			

Village	Sakharoli			
1	J. G. Patil	0.029	17°45'17.10"N	73°20'48.60"E
2	V. G. Patil	0.02	17°45'19.28"N	73°20'45.68"E
3	G. Mukhnak	0.09	17°45'19.64"N	73°20'45.39"E
4	A. G. Chavan	0.089	17°45'19.39"N	73°20'45.10"E
5	S. S. Patil	0.045	17°45'20.46"N	73°20'44.03"E
6	S. T. Ghadve	0.026	17°45'19.59"N	73°20'44.33"E
Village	Suseri			
1	A. R. Gavade	0.077	17°43'38.50"N	73°22'46.99"E
2	S. Ghanekar	0.065	17°43'38.83"N	73°22'46.31"E
3	A. A. Mogre	0.07	17°43'39.22"N	73°22'45.95"E
4	P. S. Divale	0.03	17°43'39.29"N	73°22'45.14"E
5	S. A. Diwale	0.04	17°43'39.78"N	73°22'45.07"E
6	G. S. Diwale	0.09	17°43'36.61"N	73°22'47.56"E
Village	Tale			
1	R. Kadam	0.06	17°44'25.60"N	73°27'40.60"E
2	J. Kadam	0.055	17°44'26.77"N	73°27'41.89"E
3	S. Y. Kadam	0.07	17°44'24.85"N	73°27'40.99"E
4	S. Y. Kadam	0.09	17°44'23.25"N	73°27'37.97"E
5	S. R. Lolam	0.1	17°44'23.78"N	73°27'38.94"E
6	P. H. Lolam	0.025	17°44'26.15"N	73°27'40.43"E
Village	Mandave			
1	S. S. Ghag	0.92	17°47'19.60"N	73°28'24.60"E
2	S. Tambe	0.046	17°47'20.33"N	73°28'26.99"E
3	B. Nalawade	0.02	17°47'18.45"N	73°28'29.54"E
4	P. D. Pawar	0.05	17°47'17.70"N	73°28'27.30"E
5	A. B. Tambe	0.068	17°47'19.57"N	73°28'29.72"E
6	N. S. Tambe	0.04	17°47'21.10"N	73°28'28.80"E
Village	Kudoshi			
1	R. D Ambre	0.081	17°44'25.60"N	73°27'40.60"E
2	H. R. Ambre	0.02	17°44'26.77"N	73°27'41.89"E
3	K. B. Ambre	0.31	17°44'24.85"N	73°27'40.99"E
4	P. G. Ambre	0.01	17°44'23.25"N	73°27'37.97"E
5	G. T. Tambe	0.02	17°44'23.78"N	73°27'38.94"E
6	S. S. Ambre	0.07	17°44'26.15"N	73°27'40.43"E
Taluka	Lanja			
Village	Majal			
1	A R Majalkar	0.23	16°50'1.46"N	73°30'20.76"E
2	V. R. Majalkar	0.057	16°50'0.95"N	73°30'20.50"E

3	S. B. Kajarekar	0.049	16°50'3.03"N	73°30'23.68"E
4	S. N. Majalkar	0.04	16°50'3.58"N	73°30'25.28"E
5	M. P. Panchal	0.31	16°50'5.76"N	73°30'24.78"E
6	M. S. Bane	0.026	16°50'2.15"N	73°30'20.90"E
Village	Ajnari			
1	D. R. Pendhari	0.01	16°56'56.16"N	73°31'46.29"E
2	P. P. Pendhari	0.02	16°56'56.15"N	73°31'46.92"E
3	S. D. Gurav	0.07	16°56'55.81"N	73°31'45.54"E
4	U. S. Gurav	0.05	16°56'55.36"N	73°31'45.89"E
5	R. Gurav	0.039	16°56'53.17"N	73°31'48.00"E
6	V. N. Gurav	0.048	16°56'53.80"N	73°31'47.45"E
Village	Korli			
1	P. J. Zore	0.039	16°51'30.81"N	73°38'58.35"E
2	S. T. Zore	0.18	16°51'27.97"N	73°39'2.50"E
3	G. B. Kokare	0.02	16°51'21.63"N	73°39'1.77"E
4	J. V. Salukhe	0.09	16°51'19.56"N	73°39'3.76"E
5	C. B. Zore	0.081	16°51'34.54"N	73°39'0.53"E
6	R. Zore	0.096	16°51'35.03"N	73°39'0.55"E
Village	Govil			
1	S. R. Avasare	0.074	16°52'29.87"N	73°39'0.72"E
2	M. R. Avsare	0.031	16°52'29.62"N	73°39'4.83"E
3	M. R. Patiyami	0.039	16°52'30.87"N	73°39'9.08"E
4	T. R. Dhumal	0.04	16°52'28.99"N	73°39'11.33"E
5	V. Kadam	0.057	16°52'27.70"N	73°39'8.97"E
6	G. L. Jadhav	0.03	16°52'27.09"N	73°39'3.46"E
Village	Shiposhi			
1	K. M. Jadhav	0.091	16°55'23.57"N	73°38'1.96"E
2	T.v. sutar	0.032	16°55'23.00"N	73°38'2.72"E
3	D. S. Ghag	0.04	16°55'22.12"N	73°38'2.28"E
4	A. T. Shinde	0.12	16°55'20.72"N	73°38'3.73"E
5	B. D. Lambure	0.046	16°55'19.60"N	73°38'2.02"E
6	M. R. Ghag	0.05	16°55'19.33"N	73°38'3.72"E
Taluka	Ratanagiri			
Village	Shirgaon			
1	P. S. Pawar	0.0917	17° 1'5.05"N	73°17'38.26"E
2	P. R. Todankar	0.032	17° 1'9.66"N	73°17'43.16"E
3	S. V. Pawar	0.12	17° 1'12.39"N	73°17'46.76"E
4	S. S. Athavale	0.08	17° 1'13.78"N	73°17'49.56"E
5	V. G. Shinde	0.012	17° 1'11.47"N	73°17'54.57"E

6	A. G. Pawar	0.11	17° 1'9.92"N	73°17'57.10"E
Village	Kasar veli			
1	G. S shinde	0.1	17° 2'56.02"N	73°17'52.43"E
2	S. D. Gavade	0.12	17° 2'51.19"N	73°17'51.05"E
3	B.d. patvardhan	0.096	17° 2'50.26"N	73°18'0.23"E
4	A. Apate	0.136	17° 2'54.32"N	73°17'47.93"E
5	R. P. Avasare	0.03	17° 2'47.14"N	73°17'54.86"E
6	S. C. Mohite	0.05	17° 2'52.90"N	73°17'57.00"E
Village	Basani			
1	S. S. Gawade	0.013	17° 3'37.15"N	73°18'4.20"E
2	P. D. Gawade	0.02	17° 3'36.90"N	73°18'0.88"E
3	M. M. Gawade	0.015	17° 3'41.76"N	73°18'1.86"E
4	S. L. Nevarekar	0.04	17° 3'35.94"N	73°17'58.61"E
5	Y. S. Sawant	0.039	17° 3'32.94"N	73°17'57.79"E
6	D. M. Shirkar	0.037	17° 3'43.15"N	73°17'59.66"E

Village	Nevare			
1	C. D. Arekar	1.1	17° 6'42.70"N	73°17'26.29"E
2	S. D. Arekar	0.3	17° 6'41.76"N	73°17'25.30"E
3	L. L. Parkar	0.15	17° 6'41.59"N	73°17'24.45"E
4	P. B. Kadekar	0.2	17° 6'43.70"N	73°17'25.04"E
5	V. G. Khadekar	0.26	17° 6'42.00"N	73°17'23.78"E
6	S. P. Parkar	0.51	17° 6'41.87"N	73°17'26.53"E
Village	Pali			
1	S. G. Ghadashi	0.091	16°58'57.30"N	73°29'13.00"E
2	P. M. Ghadashi	0.064	16°58'56.74"N	73°29'11.68"E
3	P. P. Ghadashi	0.093	16°58'55.52"N	73°29'13.74"E
4	R. V. Panchal	0.13	16°58'54.03"N	73°29'13.11"E
5	S. V. Panchal	0.12	16°58'55.07"N	73°29'11.97"E
6	R. D. Pavaskar	0.03	16°58'53.30"N	73°29'9.00"E
Taluka	Sangameshwar			
Village	Ambed			
1	P. M. Shivalkar	0.059	17°10'58.02"N	73°32'34.52"E
2	A. C. Surve	0.06	17°10'59.49"N	73°32'34.44"E
3	S. S. Pulekar	0.055	17°11'0.89"N	73°32'34.50"E
4	N B Surve	0.048	17°11'0.66"N	73°32'35.23"E
5	R S Nagavekar	0.07	17°11'0.26"N	73°32'35.31"E
6	V A Ambakar	0.045	17°11'0.73"N	73°32'35.78"E

Village	Mhabale			
1	P Bhide	0.095	17°10'2.90"N	73°31'59.95"E
2	K R Kadam	0.012	17°10'2.38"N	73°32'0.55"E
3	K P Padhye	0.067	17°10'2.07"N	73°32'0.77"E
4	S Joshi	0.04	17°10'0.83"N	73°32'1.96"E
5	S P Shette	0.082	17° 9'57.37"N	73°32'5.48"E
6	A Bhide	0.09	17° 9'55.06"N	73°32'7.49"E
Village	Yesradi			
1	S P Solkar	0.75	17°11'6.43"N	73°35'8.79"E
2	S S Chaukekar	0.05	17°11'9.26"N	73°35'6.79"E
3	U B Parkar	0.08	17°11'9.48"N	73°35'5.49"E
4	N S Nagavekar	0.096	17°11'9.08"N	73°35'6.63"E
5	V V Nagavekar	0.043	17°11'7.94"N	73°35'7.51"E
6	S N Surve	0.04	17°11'8.19"N	73°35'8.70"E
Village	Vigravali			
1	S S Bhuravane	0.06	17° 7'9.66"N	73°37'11.12"E
2	V Surve	0.05	17° 7'10.12"N	73°37'10.68"E
3	P S Gamare	0.065	17° 7'10.70"N	73°37'10.47"E
4	S T Pachkudave	0.023	17° 7'11.11"N	73°37'10.22"E
5	S S Pachkudave	0.03	17° 7'11.58"N	73°37'11.27"E
6	A Pachkudave	0.025	17° 7'10.69"N	73°36'44.39"E
Village	Sonavade			
1	A S Sangare	0.02	17° 7'36.53"N	73°36'43.11"E
2	S V Sangare	0.041	17° 7'36.85"N	73°36'42.49"E
3	S T Sangare	0.015	17° 7'37.01"N	73°36'41.22"E
4	V B Joshi	0.023	17° 7'36.60"N	73°36'39.19"E
5	C G Chavan	0.018	17° 7'35.92"N	73°36'35.62"E
6	G T Chavan	0.065	17° 7'37.14"N	73°36'32.66"E
Taluka	Rajapur			
Village	Bhu			
1	V H Kambale	0.086	16°43'3.90"N	73°28'37.56"E
2	D G Ninave	0.131	16°43'1.78"N	73°28'37.74"E
3	L Y Bhuvad	0.023	16°43'2.50"N	73°28'38.65"E
4	R C Mandavkar	0.046	16°43'3.05"N	73°28'35.95"E
5	N V Kambale	0.031	16°43'1.86"N	73°28'35.57"E
6	S P Mestri	0.14	16°43'4.50"N	73°28'38.60"E

Village	Oni			
1	L D Bavkar	0.021	16°43'25.11"N	73°34'16.40"E
2	M D Nagam	0.12	16°43'35.60"N	73°34'2.22"E
3	D G Matkar	0.29	16°43'32.07"N	73°34'18.53"E
4	S D Bavkar	0.18	16°43'23.40"N	73°34'18.21"E
5	B J Bavkar	0.25	16°43'30.80"N	73°34'14.95"E
6	P A Surve	0.38	16°43'18.95"N	73°34'23.95"E
Village	Kolvan			
1	P M Rahate	0.059	16°43'25.11"N	73°34'16.40"E
2	G A More	0.076	16°43'35.60"N	73°34'2.22"E
3	K Rahate	0.088	16°43'32.07"N	73°34'18.53"E
4	S K More	0.11	16°43'23.40"N	73°34'18.21"E
5	S Gurav	0.1	16°43'30.80"N	73°34'14.95"E
6	G. b. Gurav	0.46	16°43'18.95"N	73°34'23.95"E
Village	Bagave wadi			
1	S K Panchal	0.124	16°42'20.55"N	73°40'11.57"E
2	P K Panchal	0.11	16°42'16.81"N	73°40'10.81"E
3	V A Kamtekar	0.08	16°42'17.38"N	73°40'7.53"E
4	S V Kamtekar	0.087	16°42'19.09"N	73°40'13.39"E
5	S V Kamtekar	0.06	16°42'14.93"N	73°40'9.41"E
6	M G Kamtekar	0.078	16°42'12.62"N	73°40'14.53"E
Village	Yelvan			
1	S M Malap	0.052	16°42'42.29"N	73°40'15.00"E
2	P M Malap	0.15	16°42'41.60"N	73°40'14.13"E
3	T S Sakapal	0.21	16°42'40.34"N	73°40'13.49"E
4	A T Salavi	0.19	16°42'42.86"N	73°40'13.12"E
5	A Y Malap	0.16	16°42'44.01"N	73°40'13.75"E
6	D P Panchal	0.071	16°42'44.63"N	73°40'14.99"E
Taluka	Chiplun			
Village	Pachal			
1	C. S. Gurav	0.02	17°29'9.10"N	73°28'4.70"E
2	S. B. Bhingare	0.06	17°29'10.24"N	73°28'5.07"E
3	R. N. Surve	0.06	17°29'10.94"N	73°28'4.40"E
4	M. A. Gurav	0.13	17°29'12.41"N	73°28'5.50"E
5	P. S. Guav	0.1	17°29'12.65"N	73°28'4.24"E
6	Y. S. Gurav	0.11	17°29'11.19"N	73°28'3.21"E

Village	Malghar			
1	S. L. Khatate	0.09	17°29'0.49"N	73°27'24.63"E
2	S. K. Vaje	0.05	17°28'59.75"N	73°27'23.95"E
3	A. G. Tatkare	0.04	17°29'0.30"N	73°27'23.88"E
4	T. J. Vaje	0.056	17°29'1.11"N	73°27'23.78"E
5	A. B. Vaje	0.01	17°29'1.77"N	73°27'24.01"E
6	P. S. Khedekar	0.038	17°29'0.63"N	73°27'23.06"E
Village	Parshuram			
1	S. D. Kinjale	0.07	17°33'28.95"N	73°30'9.57"E
2	V. P. Bait	0.02	17°33'28.57"N	73°30'9.81"E
3	D. S. Gajamat	0.09	17°33'27.52"N	73°30'10.35"E
4	P. S. Yesare	0.13	17°33'21.34"N	73°30'12.39"E
5	V. A. More	0.08	17°33'20.64"N	73°30'12.82"E
6	R. L. Dhadave	0.37	17°33'18.77"N	73°30'11.63"E
Village	Kamthe			
1	D. S. Bechavade	0.06	17°28'20.30"N	73°30'57.30"E
2	P. B. Zujam	0.14	17°28'19.67"N	73°30'57.03"E
3	P. B. Gurav	0.02	17°28'20.03"N	73°31'2.50"E
4	R. K. Gurav	0.04	17°28'18.74"N	73°31'2.92"E
5	P. N. Kanase	0.032	17°27'49.80"N	73°31'3.97"E
6	A. S. Harekar	0.03	17°27'50.57"N	73°31'4.70"E
Village	Kalambaste			
1	S. G. Sawant	0.12	17°31'51.39"N	73°32'35.19"E
2	L. D. Bhuwad	0.1	17°31'52.88"N	73°32'34.90"E
3	P. B. Kerade	0.1	17°31'52.41"N	73°32'34.32"E
4	V. S. Rashe	0.07	17°31'52.63"N	73°32'33.43"E
5	M. V. Pawar	0.08	17°31'55.10"N	73°32'29.49"E
6	S. T. Pawar	0.03	17°31'54.76"N	73°32'29.41"E
Taluka	Guhagar			
Village	Asgoli			
1	V P Khandekar	0.09	17°27'44.94"N	73°11'54.54"E
2	S S Kavankar	0.05	17°27'44.70"N	73°11'49.35"E
3	S S Kavankar	0.055	17°27'45.87"N	73°11'49.18"E
4	S Y Kavankar	0.08	17°27'47.15"N	73°11'44.68"E
5	A C Karnag	0.03	17°27'48.92"N	73°11'44.83"E
6	N Zagade	0.049	17°27'44.81"N	73°11'57.00"E

Village	Narvan			
1	V B Joshi	0.13	17°20'0.21"N	73°14'17.03"E
2	S R Joshi	0.12	17°19'59.80"N	73°14'16.37"E
3	P P Joshi	0.05	17°19'59.51"N	73°14'16.56"E
4	B S Sangare	0.02	17°19'59.66"N	73°14'16.08"E
5	G V Sangare	0.04	17°20'0.33"N	73°14'15.64"E
6	H S Bachim	0.016	17°19'59.37"N	73°14'15.40"E
Village	Guhagar			
1	V V Khare	0.12	17°28'36.40"N	73°11'31.95"E
2	P P damale	0.1	17°28'37.76"N	73°11'31.72"E
3	A Parhure	0.12	17°29'2.71"N	73°11'22.29"E
4	M Sathe	0.09	17°28'40.59"N	73°11'30.90"E
5	V Jadhav	0.095	17°28'41.87"N	73°11'30.64"E
6	A Jangali	0.034	17°28'43.28"N	73°11'30.34"E
Village	Gimavi			
1	V. T. Jadhav	0.07	17°29'28.94"N	73°19'28.26"E
2	P. S. Jadhav	0.02	17°29'31.10"N	73°19'27.41"E
3	S. J. Jadhav	0.15	17°29'47.05"N	73°19'31.45"E
4	Sau. Varsha S. Jadhav	0.18	17°29'34.78"N	73°19'32.98"E
5	G. Jadhav	0.17	17°29'32.73"N	73°19'24.49"E
6	U. S. Mohite	0.195	17°29'25.90"N	73°19'26.11"E
Village	Deoghar			
1	V N More	0.12	17°29'28.94"N	73°19'28.26"E
2	D. M. Mhamunkar	0.09	17°29'31.10"N	73°19'27.41"E
3	Manika H Lad	0.08	17°29'47.05"N	73°19'31.45"E
4	Indira K Sakpal	0.11	17°29'34.78"N	73°19'32.98"E
5	S R Gujar	0.18	17°29'32.73"N	73°19'24.49"E
6	S V Zagade	0.14	17°29'25.90"N	73°19'26.11"E

Annexure II

Scientific name and family of plants species found in homegardens.

Sr No	Common Name	Scientific name	Family
Trees			
1	Ain	*Terminalia alata*	Combretaceae
2	Anjir	*Ficus carica*	Moraceae
3	Aonla	*Phyllanthus emblica*	Phyllanthaceae
4	Apta	*Bauhinia racemosa*	Caesalpiniaceae
5	Arecanut	*Areca catechu*	Arecaceae
6	Asana	*Bridelia retusa*	Phyllanthaceae
7	Asopalav	*Polyalthia longifolia*	Annonaceae
8	Atak	*Flacourtia montana*	Salicaceae
9	Babhul	*Acacia nilotica*	Mimosaceae
10	Badam	*Prunus ducis*	Rosaceae
11	Bael	*Aegle marmelos*	Rutaceae
12	Behada	*Terminalia bellericca*	Combretaceae
13	Bhend	*Thespsia populnea*	Malvaceae
14	Bibba	*Semecarpus anacardium*	Anacardiaceae
15	Bivala	*Pterocarpus marsupium*	Fabaceae
16	Bor	*Ziziphus mauritiana*	Rhamnaceae
17	Bullock heart	*Annona reticulata*	Annonaceae
18	Cashew	*Anacardium occidentale*	Anacardiaceae
19	Chafa	*Plumeria rubra*	Apocynaceae
20	Chandavad	*Macaranga peltata*	Euphorbiaceae
21	Chinch	*Tamarindus indica*	Ceasalpineaceae
22	Coconut	*Cocos nucifera*	Arecaceae
23	Curryleaves	*Murraya koenigii*	Rutaceae
24	Dalchini	*Cinnamomum verum*	Lauraceae
25	Pomegranate	*Punica granatum*	Punicaceae
26	Dhaman	*Grewia tiliifolia*	Tiliaceae
27	Drumstick	*Moringa oleifera*	Moringaceae
28	Erand	*Jatropha curcas*	Euphorbiaceae
29	Glericedia	*Gliricidia sepium*	Fabaceae
30	Gokhar	*Cordia dichotoma*	Boraginaceae
31	Guava	*Psidium guajava*	Myrtaceae
32	Harada	*Terminalia chebula*	Combretaceae

33	Jackfruit	*Artocarpus hetrophyllus*	Moraceae
34	Jam	*Syzygium samarangense*	Myrtaceae
35	Jamun	*Syzygium cumini*	Myrtaceae
36	Jayphal	*Myristica fragrans*	Myristicaceae
37	Kadamb	*Neolamarckia cadamba*	Rubiaceae
38	Kanchan	*Phanera variegata*	Fabaceae
39	Kanher	*Thevetia peruviana*	Apocynaceae
40	Karaj	*Pongamia pinnata*	Fabaceae
41	Katesavar	*Bombax ceiba*	Bombacaceae
42	Kavati Chafa	*Plumeria pudica*	Lythraceae
43	Khair	*Acacia catechu*	Mimosaceae
44	Khajur	*Phoenix dactylifera*	Arecaceae
45	Kharavati	*Ficus hispida*	Moraceae
46	Kinjal	*Terminalia paniculata*	Combretaceae
47	Kokam	*Garcinia indica*	Clusiaceae
48	Lemon	*Citrus limon*	Rutaceae
49	Mangium	*Acacia mangium*	Mimosaceae
50	Mango	*Mangifera indica*	Anacardiaceae
51	Moin	*Lannea coromandelica*	Anacardiaceae
52	Mosambi	*Citrus limetta*	Rutaceae
53	Neem	*Azadirachta indica*	Meliaceae
54	Nimbara	*Melia azedarach*	Meliaceae
55	Noni	*Morinda citrifolia*	Rubiaceae
56	Palm	*Elaeis guineensis*	Arecaceae
57	Pangara	*Erythrina variegata*	Fabaceae
58	Papanas	*Citrus maxima*	Rutaceae
59	Papaya	*Carica papaya*	Caricaceae
60	Pimpal	*Ficus religiosa*	Moraceae
61	Pivala Gulmohor	*Peltophorum pterocarpum*	Ceasalpineaceae
62	Prajakta	*Nyctanthes arbortristis*	Oleaceae
63	Putanjeeva	*Putranjiva roxburghii*	Putranjivaceae
64	Raintree	*Samanea saman*	Mimosaceae
65	Rayavla	*Emblica officinalis*	Euphorbiaceae
66	Sandle	*Santalum album*	Santalaceae
67	Santri	*Citrus sinensis*	Rutaceae
68	Sapota	*Manilkara Zapota*	Sapotaceae
69	Shivan	*Gmelina arborea*	Verbinaceae
70	Silver oak	*Grevillea robusta*	Proteaceae
71	Sita ashok	*Saraca asoca*	Caesalpiniaceae

72	Sitaphal	*Annona squamosa*	Annonaceae
73	Soapnut	*Sapindus indica*	Sapindaceae
74	Sonchafa	*Michelia champaka*	Mangnoliaceae
75	Sterculia	*Sterculia urens*	Sterculiaceae
76	Subabul	*Leucaena leucocephala*	Mimosaceae
77	Surangi	*Mammea suriga*	Clusiaceae
78	Surmad	*Caryota urens*	Arecaceae
79	Suru	*Casuarina equisetifolia*	Casuarinaceae
80	Tagar	*Tabernaemontana divaricata*	Apocynaceae
81	Teak	*Tectona grandis*	Verbinaceae
82	Tejpatta	*Cinnamomum tamala*	Lauraceae
83	Tetu	*Oroxylum indicum*	Bignoniaceae
84	Tisal	*Zanthozylum rhesta*	Rutaceae
85	Umbar	*Ficus racemosa*	Moraceae
86	Undi	*Calophyllum inophyllum*	Clusiaceae.
87	Vad	*Ficus bengalensis*	Moraceae
88	X-Mus tree	*Araucaria columnaris*	Araucariaceae
Shrubs			
89	Agnimanth	*Clerodendrum phlomidis*	*Verbenaceae*
90	Anant	*Gardenia jasminoides*	Rubiaceae
91	Boganvelia	*Bougainvillea glabra*	Nyctaginaceae
92	Brinjle	*Solanum melongena*	Solanaceae
93	Cosmus	*Cosmos caudatus*	Asteraceae
94	Croton	*Codiaeum variegatum*	Crotonoideae
95	Dorali	*Solanum anguivi*	Solanaceae
96	Ghaneri	*Lantana camara*	Verbenaceae
97	Goldern duranta	*Duranta erecta*	Verbenaceae
98	Gulab	*Rosa chinenesis*	Rosaceae
99	Gulbakshi	*Mirabilis jalapa*	Nyctaginaceae
100	Ixora	*Ixora coccinea*	Rubiaceae
101	Jasminum	*Jasminum auriculatum*	Oleaceae
102	Jaswand	*Hibiscus rosasinensis*	Malvaceae
103	Karvand	*Carissa carandas*	Apocynaceae
104	Kuda	*Holarrhena pubescens*	*Apocynaceae*
105	Kunda	*Jasminum multiflorum*	Oleaceae
106	Mayurpankhi	*Platycladus orientalis*	Cupressaceae
107	Mehendi	*Lawsonia inermis*	Lythraceae
108	Mogara	*Jasminum sambac*	Oleaceae
109	Nirgudi	*Vitex nigundo*	Lamiaceae

110	Ratrani	*Cestrum ncturnum*	Solanaceae
111	Shankasur	*Caesalpinia pulcherrima*	*Caesalpiniaceae*
Herbs			
112	10 O clock	*Portulaca grandiflora*	Portulacaceae
113	Aboli	*Crossandra infundibuliformis*	Acanthaceae
114	Adulsa	*Justica adhatoda*	Acanthaceae
115	Aghada	*Achyranthes aspera*	Amaranthaceae
116	Alu vadi	*Colocasia esculenta*	Aracaae
117	Aster	*Aster amellus*	Asteraceae
118	Banana	*Musa acuminata*	Musaceae
119	Basmati	*Pandanus amaryllifolius*	Pandanaceae
120	Bhendi	*Abelmoschus esculentus*	Malvaceae
121	Boat lili	*Tradescantia spathacea*	Commelinaceae
122	Bramhakamal	*Saussurea obvallata*	Asteraceae
123	Bryophylum	*Bryophyllum pinnatum*	Crassulaceae
124	Chahapat	*Cymbopogon citratus*	Poaceae
125	Chavali	*Vigna unguiculata*	Fabaceae
126	Chili	*Capsicum annuum*	Solanaceae
127	Clitoria	*Clitoria ternatea*	Fabaceae
128	Cotton	*Gossypium hirsutum*	Malvaceae
129	Creaping daisy	*Sphagneticola trilobata*	Asteraceae
130	Dhotra	*Datura innoxia*	Solanaceae
131	Durva	*Cynodon dactylon*	Poaceae
132	Gawar	*Cyamopsis tetragonoloba*	Fabaceae
133	Ginger	*Zingiber officinale*	Zingiberaceae
134	Grass F	*Panicum maximum*	*Poaceae*
135	Gulchadi	*Polianthes tuberosa*	Asparagaceae
136	Hirva math	*Amaranthus paniculatus*	Amaranthaceae
137	Kakavi	*Portulaca oleracea*	Portulacaceae
138	Kalmegh	*Andrographis paniculata*	Acanthaceae
139	Kamal	*Nelumbo nucifera*	Nelumbonaceae
140	Kardal	*Canna indica*	Cannaceae
141	Karvi red	*Impatiens walleriana*	Balsaminaceae
142	Khus	*Vetiveria zizanioides*	Poaceae
143	Korafad	*Aloe vera*	Asphodelaceae
144	Kothimbir	*Coriandrum sativum*	Apiaceae
145	Krishnatulsi	*Ocimum tenuiflorum*	Lamiaceae
146	Lal Math	*Amaranthus cruentus*	Amaranthaceae
147	Lili	*Lilium longifloram*	Liliaceae

148	Lucky bamboo	*Dracaena sanderiana*	Asparagaceae
149	Maka	*Eclipta prostrata*	Asteraceae
150	Marygold	*Tagets patula*	Asteraceae
151	Mataki	*Vigna aconitifolia*	Fabaceae
152	Mes Bamboo	*Pseudooxytenanthera stocksii*	Poaceae
153	Methi	*Trigonella foenum-graecum*	Fabaceae
154	Mohari	*Brassica juncea*	Brassicaceae
155	Mula	*Raphanus sativus*	Brassicaceae
156	Onion	*Allium cepa*	Alliaceae
157	Oos	*Saccharum officinarum*	Poaceae
158	Ova	*Trachyspermum ammi*	Apiaceae
159	Pev	*Cheilocostus speciosus*	Costaceae
160	Pinapple	*Ananas comosus*	Bromeliaceae
161	Pudina	*Mentha arvensis*	Lamiaceae
162	Rui	*Calotropis gigantea*	Apocynaceae
163	Sabja	*Ocimum basilicum*	Lamiaceae
164	Sadafuli	*Catheranthus roseus*	Apocynaceae
165	Shevanti	*Chrysanthemum morifolium*	Asteraceae
166	Snake plant	*Sansevieria trifasciata*	Ruscaceae
167	Sontakka	*Hedychium coronarium*	Zingiberaceae
168	Suran	*Amorphophallus paeoniifolius*	Araceae
169	Swargiiya nartak	*Strelitzia reginae*	Strelitziaceae
170	Terada	*Impatiens balsamina*	Balsaminaceae
171	Termeric	*Curcuma longa*	Zingiberaceae
172	Til	*Sesamum indicum*	Pedaliaceae
173	Tomato	*Solanum lycopersicum*	Solanaceae
174	Tulsi	*Ocimum sanctum*	Lamiaceae
175	Tur	*Cajanus cajan*	Fabaceae
176	Val	*Phaseolus vulgaris*	Fabaceae
177	Vekhand	*Acorus calamus*	Acoraceae
178	Velchi	*Elettaria cardamomum*	Zingiberaceae
179	White Chitrak	*Plumbago zeylanica*	Plumbaginaceae
180	Zenia	*Zinnia elegans*	Asteraceae
181	Zipari	*Arelia reen*	Araliaceae
Climbers			
182	Bhopala	*Cucurbita maxima*	cucurbitaceae
183	Bittle vine	*Piper betel*	Piperaceae
184	Chavali	*Vigna unguiculata*	Fabaceae
185	Chibud	*Cucumis melo*	Cucurbitaceae

186	Dodaka	*Luffa acutangula*	Cucurbitaceae
187	Dudhi Bhopala	*Lagenaria siceraria*	Cucurbitaceae
188	Ghevada	*Lablab purpureus*	Fabaceae
189	Gudmar	*Gymnema sylvestre*	Apocynaceae
190	Gulvel	*Tinospora cordifolia*	Menispermaceae
191	Kakadi	*Cucumis sativus*	Cucurbitaceae
192	Kalimiri	*Piper nigrum*	Piperaceae
193	Kalingad	*Citrullus lanatus*	Cucurbitaceae
194	Karinda	*Dioscorea bulbifera*	Dioscoreaceae
195	Karle	*Momordica charantia*	Cucurbitaceae
196	Karnful	*Allamanda cathartica*	Apocynaceae
197	Khajakhujali	*Mucuna pruriens*	Fabaceae
198	Kovla	*Benincasa hispida*	Cucurbitaceae
199	Krushnakamal	*Passiflora foetida*	Passifloraceae
200	Madhumalati	*Combretum indicum*	Combretaceae
201	Mayalu	*Basella alba*	Basellaceae
202	Money plant1	*Epipermnum aureum*	Arecaceae
203	Mug	*Vigna radiata*	Fabaceae
204	Padaval	*Trichosanthes cucumerina*	Cucurbitaceae
205	Pavta	*Phaseolus lunatus*	Fabaceae
206	Shatavari	*Asparagus racemosus*	Asparagaceae
207	Sweet potato	*Ipomoea batatas*	Convolvulacaae
208	Tondali	*Caccinia grandis*	Cucurbitaceae
209	Watana	*Pisum sativum*	Fabaceae

Annexure III

Details about IVI index of the plants found in Homegardens.

Sr No	Scientific name	Abundance	Occurrence	Frequency	Density	Dominance	IVI
			Trees				
1	Ain	35	21	0.077777778	0.12962963	1.666666667	2.626097576
2	Anjir	28	20	0.074074074	0.103703704	1.4	2.299321982
3	Aonla	4	3	0.011111111	0.014814815	1.333333333	1.044962332
4	Apta	1586	99	0.366666667	5.874074074	16.02020202	39.99597374
5	Arecanut	13	9	0.033333333	0.048148148	1.444444444	1.550890319
6	Asana	30	14	0.051851852	0.111111111	2.142857143	2.502213104
7	Asopalav	11	7	0.025925926	0.040740741	1.571428571	1.500766367
8	Atak	24	21	0.077777778	0.088888889	1.142857143	2.12396516
9	Babhul	16	14	0.051851852	0.059259259	1.142857143	1.654461419
10	Badam	4	3	0.011111111	0.014814815	1.333333333	1.044962332
11	Bael	6	5	0.018518519	0.022222222	1.2	1.091111541
12	Behada	103	64	0.237037037	0.381481481	1.609375	5.772982178
13	Bhend	320	71	0.262962963	1.185185185	4.507042254	11.36659446
14	Bibba	62	38	0.140740741	0.22962963	1.631578947	3.864270184
15	Bivala	9	6	0.022222222	0.033333333	1.5	1.375403258
16	Bor	10	8	0.02962963	0.037037037	1.25	1.332678723
17	Bullock heart	1147	208	0.77037037	4.248148148	5.514423077	31.80422367
18	Cashew	112	87	0.322222222	0.414814815	1.287356322	6.840278444
19	Chafa	43	31	0.114814815	0.159259259	1.387096774	3.067499149
20	Chandavad	7	5	0.018518519	0.025925926	1.4	1.2321538
21	Chinch	6	6	0.022222222	0.022222222	1	1.014878698
22	Coconut	74	55	0.203703704	0.274074074	1.345454545	4.707720947
23	Curryleaves	12	8	0.02962963	0.044444444	1.5	1.520859913
24	Dalchini	128	32	0.118518519	0.474074074	4	6.098420918
25	Pomegranate	30	5	0.018518519	0.111111111	6	4.476125773
26	Dhaman	241	107	0.396296296	0.892592593	2.252336449	10.46688822
27	Drumstick	3	1	0.003703704	0.011111111	3	1.974551643
28	Erand	294	147	0.544444444	1.088888889	2	13.10718836
29	Glericedia	16	11	0.040740741	0.059259259	1.454545455	1.702670431
30	Gokhar Bhokhar	26	21	0.077777778	0.096296296	1.238095238	2.215261963
31	Guava	5	4	0.014814815	0.018518519	1.25	1.057603233
32	Harada	2	1	0.003703704	0.007407407	2	1.332691628
33	Jackfruit	15	7	0.025925926	0.055555556	2.142857143	1.921844618
34	Jam	28	19	0.07037037	0.103703704	1.473684211	2.296478337
35	Jamun	11	8	0.02962963	0.040740741	1.375	1.426769318

36	Jayphal	8	5	0.018518519	0.02962963	1.6	1.37319606
37	Kadamb	7	5	0.018518519	0.025925926	1.4	1.2321538
38	Kanchan	3	1	0.003703704	0.011111111	3	1.974551643
39	Kanher	5	3	0.011111111	0.018518519	1.666666667	1.269474218
40	Karaj	5	4	0.014814815	0.018518519	1.25	1.057603233
41	Katesavar	67	36	0.133333333	0.248148148	1.861111111	3.989208324
42	Kavati Chafa	113	85	0.314814815	0.418518519	1.329411765	6.784500712
43	Khair	9	6	0.022222222	0.033333333	1.5	1.375403258
44	Khajur	700	171	0.633333333	2.592592593	4.093567251	22.02328145
45	Kharavati	4	4	0.014814815	0.014814815	1	0.885259864
46	Kinjal	7	5	0.018518519	0.025925926	1.4	1.2321538
47	Kokam	10	9	0.033333333	0.037037037	1.111111111	1.294702792
48	Lemon	2	2	0.007407407	0.007407407	1	0.755641029
49	Mangium	2	1	0.003703704	0.007407407	2	1.332691628
50	Mango	29	10	0.037037037	0.107407407	2.9	2.764477131
51	Moin	6	4	0.014814815	0.022222222	1.5	1.229946602
52	Mosambi	14	9	0.033333333	0.051851852	1.555555556	1.636286161
53	Neem	61	35	0.12962963	0.225925926	1.742857143	3.771180194
54	Nimbara	5	5	0.018518519	0.018518519	1	0.950069281
55	Noni	1	1	0.003703704	0.003703704	1	0.690831612
56	Palm	32	25	0.092592593	0.118518519	1.28	2.532408584
57	Pangara	1	1	0.003703704	0.003703704	1	0.690831612
58	Papanas	5	4	0.014814815	0.018518519	1.25	1.057603233
59	Papaya	1	1	0.003703704	0.003703704	1	0.690831612
60	Pimpal	4	2	0.007407407	0.014814815	2	1.413338866
61	Pivala Gulmohor	188	88	0.325925926	0.696296296	2.136363636	8.624421837
62	Prajakta	66	48	0.177777778	0.244444444	1.375	4.256713316
63	Putanjeeva	1	1	0.003703704	0.003703704	1	0.690831612
64	Raintree	48	20	0.074074074	0.177777778	2.4	3.242100592
65	Rayavla	15	13	0.048148148	0.055555556	1.153846154	1.596531367
66	Sandle	76	53	0.196296296	0.281481481	1.433962264	4.696861191
67	Santri	2	2	0.007407407	0.007407407	1	0.755641029
68	Sapota	1	1	0.003703704	0.003703704	1	0.690831612
69	Shivan	4	4	0.014814815	0.014814815	1	0.885259864
70	Silver oak	94	66	0.244444444	0.348148148	1.424242424	5.612487883
71	Sita ashok	169	70	0.259259259	0.625925926	2.414285714	7.615999896
72	Sitaphal	7	4	0.014814815	0.025925926	1.75	1.402289972
73	Soapnut	8	7	0.025925926	0.02962963	1.142857143	1.184957678
74	Sonchafa	35	33	0.122222222	0.12962963	1.060606061	2.834349343
75	Sterculia	6	5	0.018518519	0.022222222	1.2	1.091111541
76	Subabul	4	4	0.014814815	0.014814815	1	0.885259864

77	Surangi	1	1	0.003703704	0.003703704	1	0.690831612
78	Surmad	2	2	0.007407407	0.007407407	1	0.755641029
79	Suru	3	2	0.007407407	0.011111111	1.5	1.084489947
80	Tagar	1	1	0.003703704	0.003703704	1	0.690831612
81	Teak	1	1	0.003703704	0.003703704	1	0.690831612
82	Tejpatta	2	2	0.007407407	0.007407407	1	0.755641029
83	Tetu	3	2	0.007407407	0.011111111	1.5	1.084489947
84	Tisal	1	1	0.003703704	0.003703704	1	0.690831612
85	Umbar	1	1	0.003703704	0.003703704	1	0.690831612
86	Undi	1	1	0.003703704	0.003703704	1	0.690831612
87	Vad	10	8	0.02962963	0.037037037	1.25	1.332678723
88	X-Mus tree	2	1	0.003703704	0.007407407	2	1.332691628
	Total	**6314**		**7.562962963**	**23.3851852**	**159.69826**	**299.974661**
Shrubs							
89	Agnimanth	135	76	0.281481481	0.5	1.776315789	19.97561485
90	Anant	33	9	0.033333333	0.122222222	3.666666667	7.828409771
91	Boganvelia	532	87	0.322222222	1.97037037	6.114942529	44.35237298
92	Brinjle	4	1	0.003703704	0.014814815	4	5.818157246
93	Cosmus	36	11	0.040740741	0.133333333	3.272727273	7.725568641
94	Croton	2	1	0.003703704	0.007407407	2	2.987081743
95	Dorali	116	15	0.055555556	0.42962963	7.733333333	17.84167978
96	Ghaneri	385	102	0.377777778	1.425925926	3.774509804	37.29369145
97	Goldern duranta	41	12	0.044444444	0.151851852	3.416666667	8.2896202
98	Gulab	64	22	0.081481481	0.237037037	2.909090909	10.12014981
99	Gulbakshi	61	19	0.07037037	0.225925926	3.210526316	9.939933443
100	Ixora	689	171	0.633333333	2.551851852	4.029239766	61.19721558
101	Jasminum	16	9	0.033333333	0.059259259	1.777777778	4.518894276
102	Jaswand	18	8	0.02962963	0.066666667	2.25	5.095609778
103	Karvand	17	6	0.022222222	0.062962963	2.833333333	5.542717079
104	Kuda	37	12	0.044444444	0.137037037	3.083333333	7.663518218
105	Kunda	116	52	0.192592593	0.42962963	2.230769231	16.05631543
106	Mayurpankhi	8	3	0.011111111	0.02962963	2.666666667	4.467158516
107	Mehendi	45	16	0.059259259	0.166666667	2.8125	8.252120973
108	Mogara	6	2	0.007407407	0.022222222	3	4.684835242
109	Nirgudi	1	1	0.003703704	0.003703704	1	1.571543992
110	Ratrani	6	2	0.007407407	0.022222222	3	4.684835242
111	Shankasur	9	4	0.014814815	0.033333333	2.25	4.092956294
	Total	**2377**		**2.374074074**	**8.80370370**	**72.8083994**	
Herbs							
112	10 O clock	488	96	0.355555556	1.807407407	5.083333333	13.327703
113	Aboli	128	34	0.125925926	0.474074074	3.764705882	4.497098024

114	Adulsa	691	118	0.437037037	2.559259259	5.855932203	17.37161138
115	Aghada	623	118	0.437037037	2.307407407	5.279661017	16.5041749
116	Alu vadi	11	5	0.018518519	0.040740741	2.2	0.81634654
117	Aster	210	26	0.096296296	0.777777778	8.076923077	5.50117193
118	Banana	62	3	0.011111111	0.22962963	20.66666667	4.005038547
119	Basmati	48	26	0.096296296	0.177777778	1.846153846	2.711880956
120	Bhendi	53	21	0.077777778	0.196296296	2.523809524	2.507598105
121	Boat lili	60	29	0.107407407	0.222222222	2.068965517	3.100526563
122	Bramhakamal	548	89	0.32962963	2.02962963	6.157303371	13.66960765
123	Bryophylum	26	4	0.014814815	0.096296296	6.5	1.556013125
124	Chahapat	20	4	0.014814815	0.074074074	5	1.263871316
125	Chavali	6	3	0.011111111	0.022222222	2	0.584080216
126	Chili	7	4	0.014814815	0.025925926	1.75	0.630897398
127	Clitoria	90	9	0.033333333	0.333333333	10	3.175037995
128	Cotton	19	4	0.014814815	0.07037037	4.75	1.215181015
129	Creaping daisy	55	4	0.014814815	0.203703704	13.75	2.968031866
130	Dhotra	550	25	0.092592593	2.037037037	22	11.40861291
131	Durva	35	1	0.003703704	0.12962963	35	5.682122536
132	Gawar	10	3	0.011111111	0.037037037	3.333333333	0.828434382
133	Ginger	103	32	0.118518519	0.381481481	3.21875	3.983449154
134	Grass F	4	2	0.007407407	0.014814815	2	0.488572732
135	Gulchadi	59	25	0.092592593	0.218518519	2.36	2.842265479
136	Hirva math	94	3	0.011111111	0.348148148	31.33333333	5.959871879
137	Kakavi	4	2	0.007407407	0.014814815	2	0.488572732
138	Kalmegh	158	41	0.151851852	0.585185185	3.853658537	5.362813979
139	Kamal	23	4	0.014814815	0.085185185	5.75	1.409942221
140	Kardal	459	69	0.255555556	1.7	6.652173913	11.26980081
141	Karvi red	179	11	0.040740741	0.662962963	16.27272727	5.276426685
142	Khus	553	34	0.125925926	2.048148148	16.26470588	11.2424559
143	Korafad	123	5	0.018518519	0.455555556	24.6	5.436498558
144	Kothimbir	4	1	0.003703704	0.014814815	4	0.713614175
145	Krishnatulsi	747	24	0.088888889	2.766666667	31.125	14.95833331
146	Lal Math	25	1	0.003703704	0.092592593	25	4.079377903
147	Lili	43	5	0.018518519	0.159259259	8.6	2.136389974
148	Lucky bamboo	33	9	0.033333333	0.122222222	3.666666667	1.577523633
149	Maka	317	52	0.192592593	1.174074074	6.096153846	8.321926815
150	Marygold	20	11	0.040740741	0.074074074	1.818181818	1.298098217
151	Mataki	13	2	0.007407407	0.048148148	6.5	1.26153793
152	Mes Bamboo	139	32	0.118518519	0.514814815	4.34375	4.564666306
153	Methi	223	48	0.177777778	0.825925926	4.645833333	6.735499866
154	Mohari	32	8	0.02962963	0.118518519	4	1.543104691

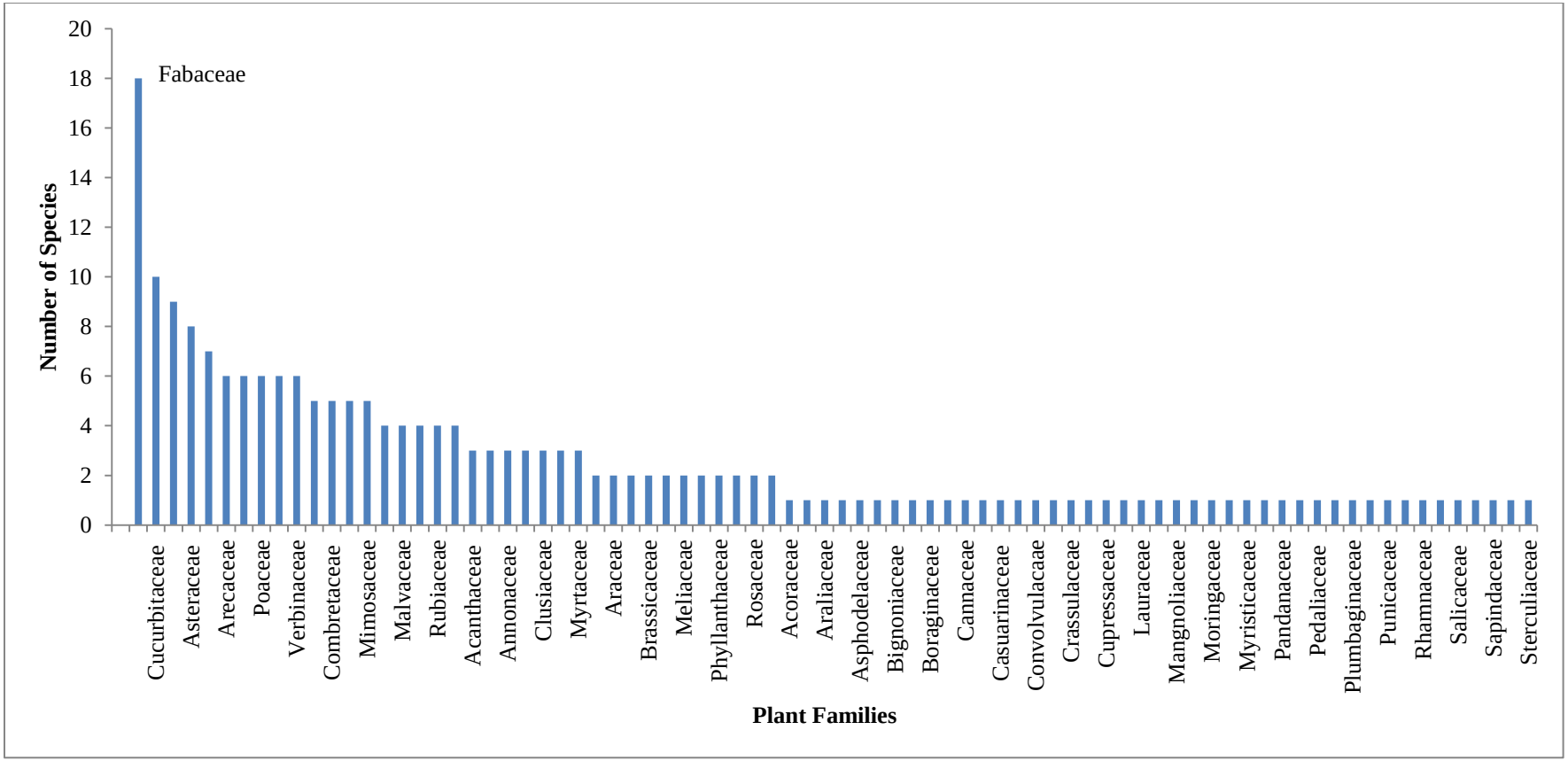
155	Mula	37	13	0.048148148	0.137037037	2.846153846	1.791496264
156	Onion	9	3	0.011111111	0.033333333	3	0.767345841
157	Oos	31	5	0.018518519	0.114814815	6.2	1.641373686
158	Ova	270	26	0.096296296	1	10.38461538	6.534242661
159	Pev	141	25	0.092592593	0.522222222	5.64	4.27289784
160	Pinapple	331	147	0.544444444	1.225925926	2.25170068	14.79994209
161	Pudina	103	17	0.062962963	0.381481481	6.058823529	3.31824729
162	Rui	6	2	0.007407407	0.022222222	3	0.660342776
163	Sabja	6	2	0.007407407	0.022222222	3	0.660342776
164	Sadafuli	4	1	0.003703704	0.014814815	4	0.713614175
165	Shevanti	36	8	0.02962963	0.133333333	4.5	1.663476456
166	Snake plant	67	33	0.122222222	0.248148148	2.03030303	3.465308755
167	Sontakka	93	14	0.051851852	0.344444444	6.642857143	3.072634385
168	Suran	15	7	0.025925926	0.055555556	2.142857143	0.998859857
169	Swargiiya nartak	2	1	0.003703704	0.007407407	2	0.393065248
170	Terada	17	6	0.022222222	0.062962963	2.833333333	1.052062972
171	Termeric	6	2	0.007407407	0.022222222	3	0.660342776
172	Til	57	5	0.018518519	0.211111111	11.4	2.713908976
173	Tomato	160	2	0.007407407	0.592592593	80	13.88663617
174	Tulsi	5	1	0.003703704	0.018518519	5	0.873888638
175	Tur	15	1	0.003703704	0.055555556	15	2.476633271
176	Val	4	1	0.003703704	0.014814815	4	0.713614175
177	Vekhand	130	2	0.007407407	0.481481481	65	11.31008551
178	Velchi	8	2	0.007407407	0.02962963	4	0.83211282
179	White Chitrak	9	2	0.007407407	0.033333333	4.5	0.917997842
180	Zenia	15	3	0.011111111	0.055555556	5	1.13387709
181	Zipari	27	1	0.003703704	0.1	27	4.39992683
	Total	**8699**		**5.107407407**	**32.2185185**	**672.138367**	
Climbers							
182	Bhopala	9	3	0.011111111	0.033333333	3	3.69595259
183	Bittle vine	8	2	0.007407407	0.02962963	4	3.679361214
184	Chavali	12	2	0.007407407	0.044444444	6	5.086141613
185	Chibud	4	2	0.007407407	0.014814815	2	2.272580815
186	Dodaka	3	1	0.003703704	0.011111111	3	2.25598944
187	Dudhi Bhopala	129	27	0.1	0.477777778	4.777777778	26.47903915
188	Ghevada	25	9	0.033333333	0.092592593	2.777777778	7.710676103
189	Gudmar	130	49	0.181481481	0.481481481	2.653061224	35.01067707
190	Gulvel	22	8	0.02962963	0.081481481	2.75	6.976472232
191	Kakadi	54	15	0.055555556	0.2	3.6	13.50417717
192	Kalimiri	63	28	0.103703704	0.233333333	2.25	19.30192043
193	Kalingad	1	1	0.003703704	0.003703704	1	1.040596619

194	Karinda	7	4	0.014814815	0.025925926	1.75	3.297461943
195	Karle	33	12	0.044444444	0.122222222	2.75	9.760704744
196	Karnful	15	6	0.022222222	0.055555556	2.5	5.312814638
197	Khajakhujali	27	8	0.02962963	0.1	3.375	7.774942816
198	Kovla	10	3	0.011111111	0.037037037	3.333333333	3.96231392
199	Krushnakamal	195	5	0.018518519	0.722222222	39	40.79289214
200	Madhumalati	46	11	0.040740741	0.17037037	4.181818182	11.30491846
201	Mayalu	43	17	0.062962963	0.159259259	2.529411765	12.76920192
202	Money plant1	35	6	0.022222222	0.12962963	5.833333333	8.933365824
203	Mug	1	1	0.003703704	0.003703704	1	1.040596619
204	Padaval	20	1	0.003703704	0.074074074	20	12.58682842
205	Pavta	36	3	0.011111111	0.133333333	12	10.88770849
206	Shatavari	77	4	0.014814815	0.285185185	19.25	18.95607305
207	Sweet potato	10	1	0.003703704	0.037037037	10	6.509864313
208	Tondali	5	1	0.003703704	0.018518519	5	3.471382261
209	Watana	25	1	0.003703704	0.092592593	25	15.62531047
	Total	**1045**		**0.855555556**	**3.87037037**	**195.311513**	

Annexure IV

List of abbreviations and symbols

Sr. No.	Abbreviation	Meaning
1	AGB	Above Ground Biomass
2	CHO’s	Carbohydrates
3	*et al*	and others
4	FAO	Food and Agriculture Organization
5	Fig	Figure
6	GPS	Global Positioning System
7	Ha	Hectare
8	*i. e.*	That is
9	M	Meter
10	No.	Number
11	Sr. No.	Serial Number
12	UNFCCC	United Nations Framework Convention on Climate Change
13	*Viz.*,	Videlicet (Namely)
14	WWW	World Wide Web
15	%	Per cent


Number of Species
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16
14
12
10
8
6
4
2
0
Fabaceae
Cucurbitaceae
Asteraceae
Arecaceae
Poaceae
Verbinaceae
Combretaceae
Mimosaceae
Malvaceae
Rubiaceae
Acanthaceae
Annonaceae
Clusiaceae
Myrtaceae
Araceae
Brassicaceae
Meliaceae
Phyllanthaceae
Rosaceae
Acoraceae
Araliaceae
Asphodelaceae
Bignoniaceae
Boraginaceae
Cannaceae
Casuarinaceae
Convolvulacaae
Crassulaceae
Cupressaceae
Lauraceae
Mangnoliaceae
Moringaceae
Myristicaceae
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Pedaliaceae
Plumbaginaceae
Punicaceae
Rhamnaceae
Salicaceae
Sapindaceae
Sterculiaceae
Plant Families

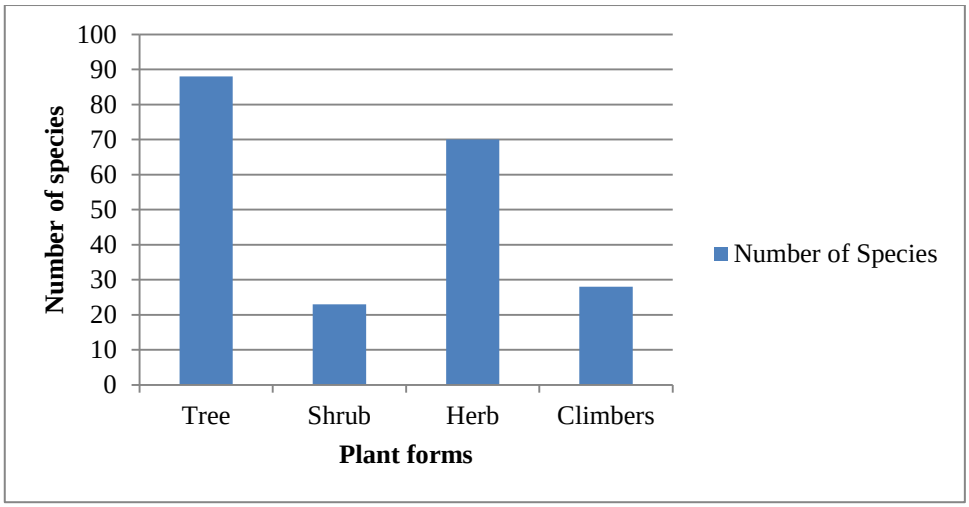


Figure 4.2 Distribution of species in various life forms found in homegardens

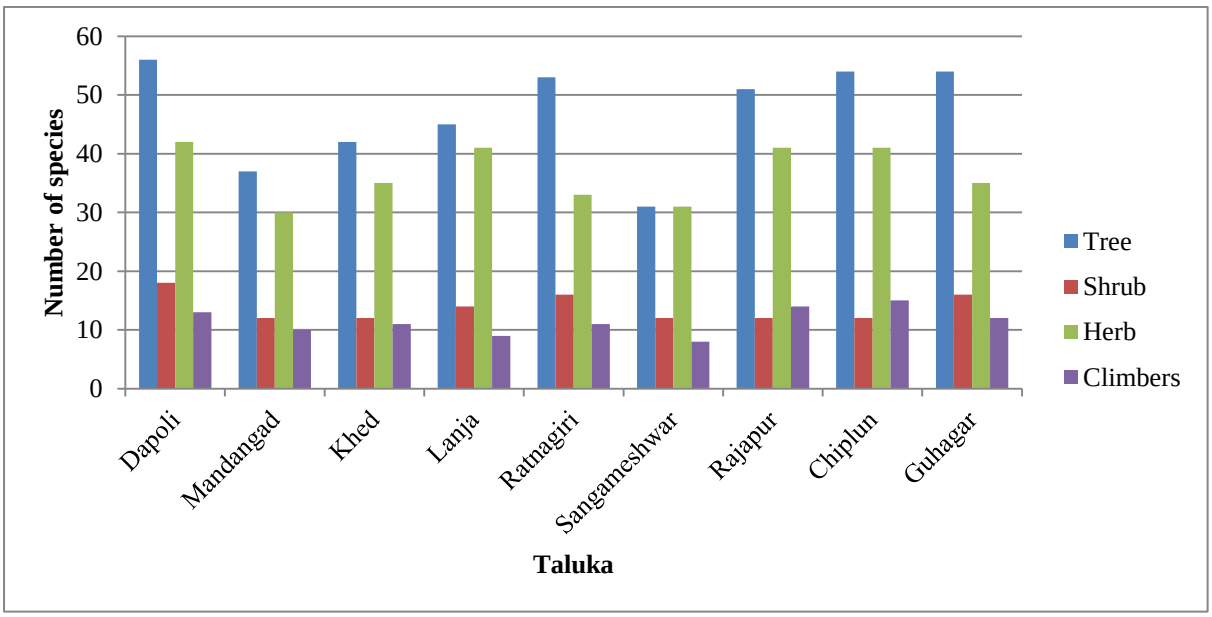


Figure 4.3 Distribution of species found in homegardens in taluka's of Ratnagiri

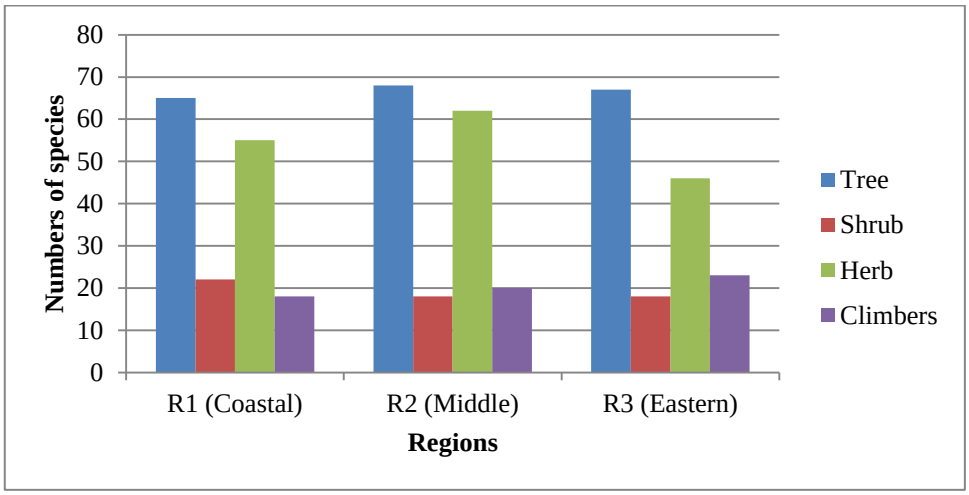


Figure 4.4 Distribution of species found in homegardens in regions of Ratnagiri

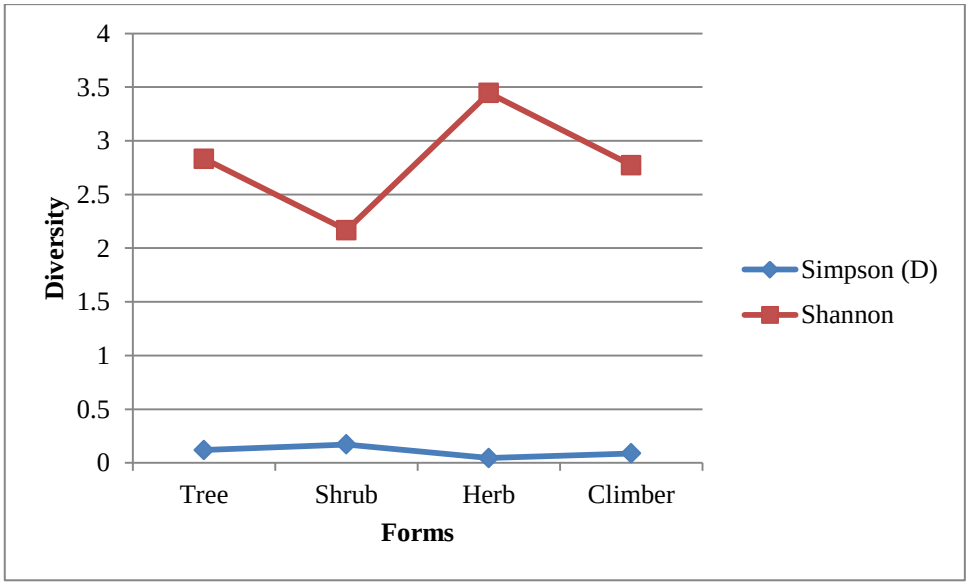


Figure 4.5 Diversity of various life forms found in homegardens

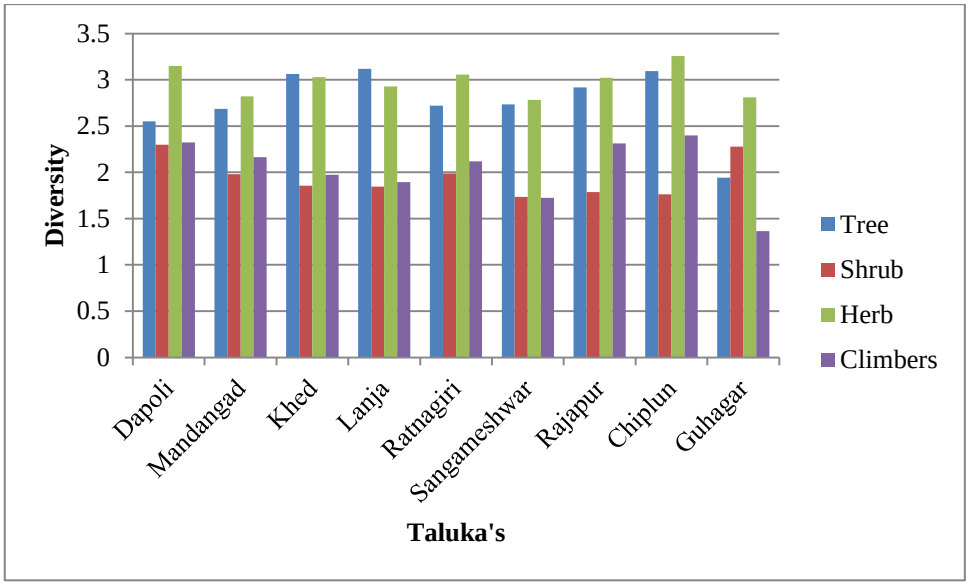


Figure 4.6 Distribution of Shannon diversity (H') index of plant forms found in homegardens in taluka's of Ratnagiri

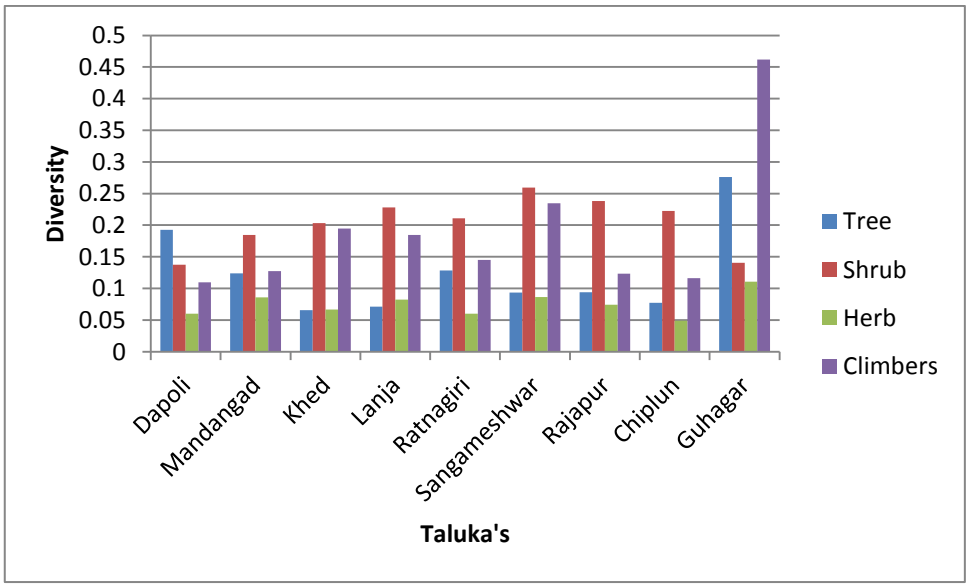


Figure 4.7 Distribution of Simpson's diversity index (D) of plant forms found in homegardens in taluka's of Ratnagiri

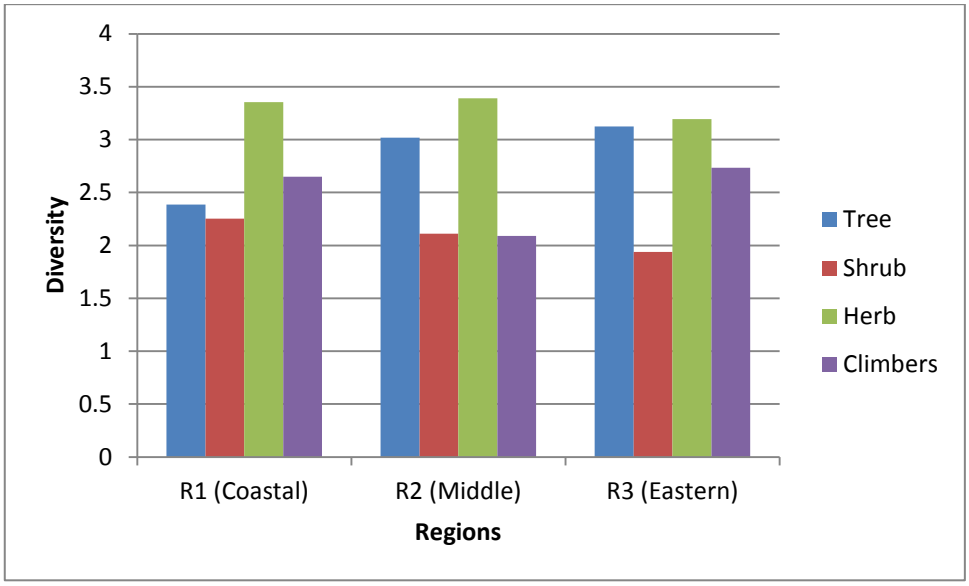


Figure 4.8 Distribution of Shannon diversity index (H')of plant forms found in homegardens in regions of Ratnagiri

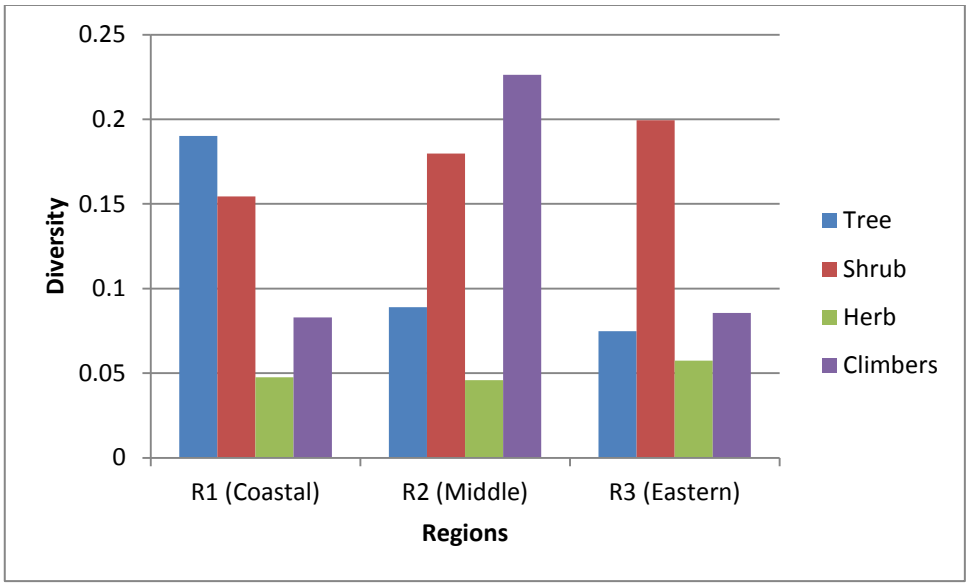
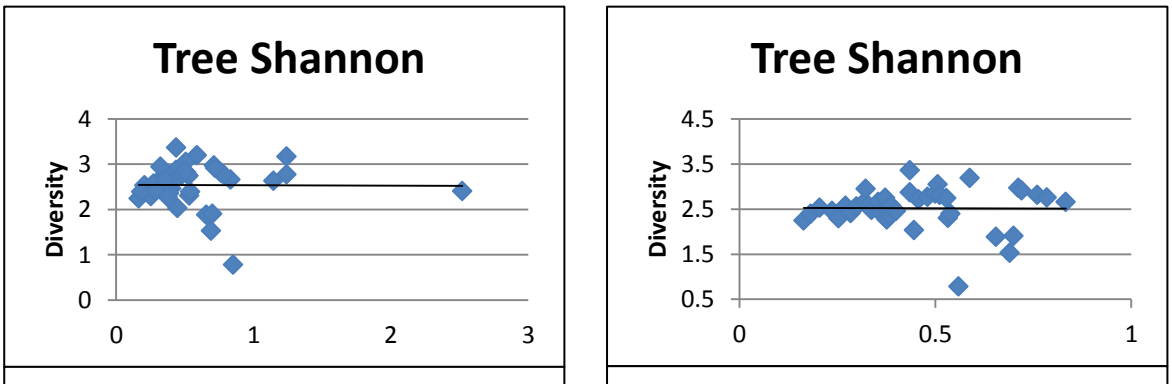


Figure 4.9 Distribution of Simpson's diversity index (D) of plant forms found in homegardens in regions of Ratnagiri



a) b)

Figure 4.10 a) Shannon Diversity area correlation. b) Shannon Diversity area correlation upto one acre.

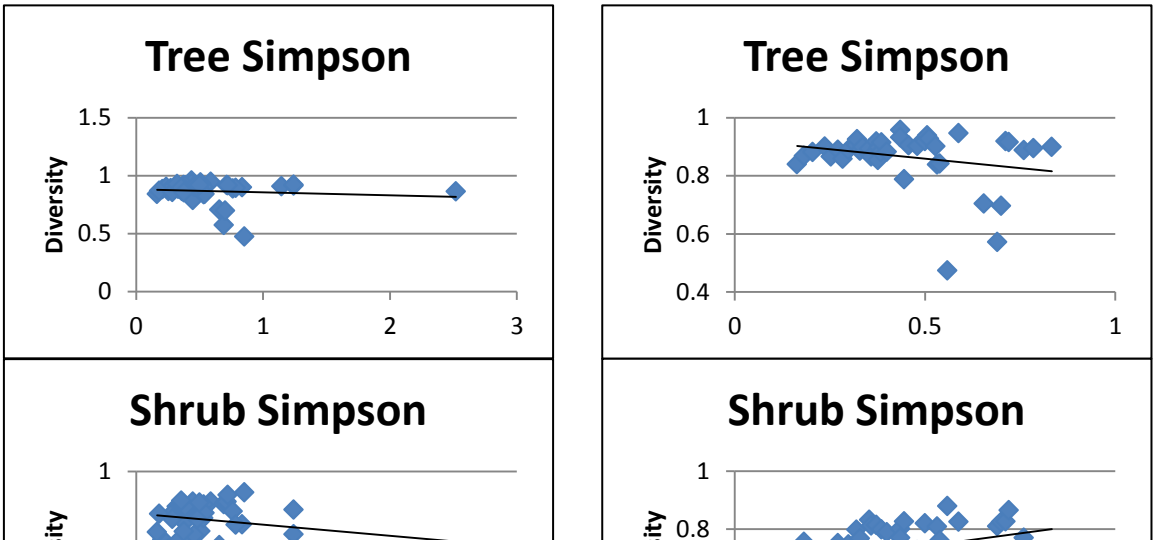


Figure 4.11 a) Simpson's Diversity (1-D) area correlation. b) Simpson's Diversity (1-D) area correlation upto one acre.

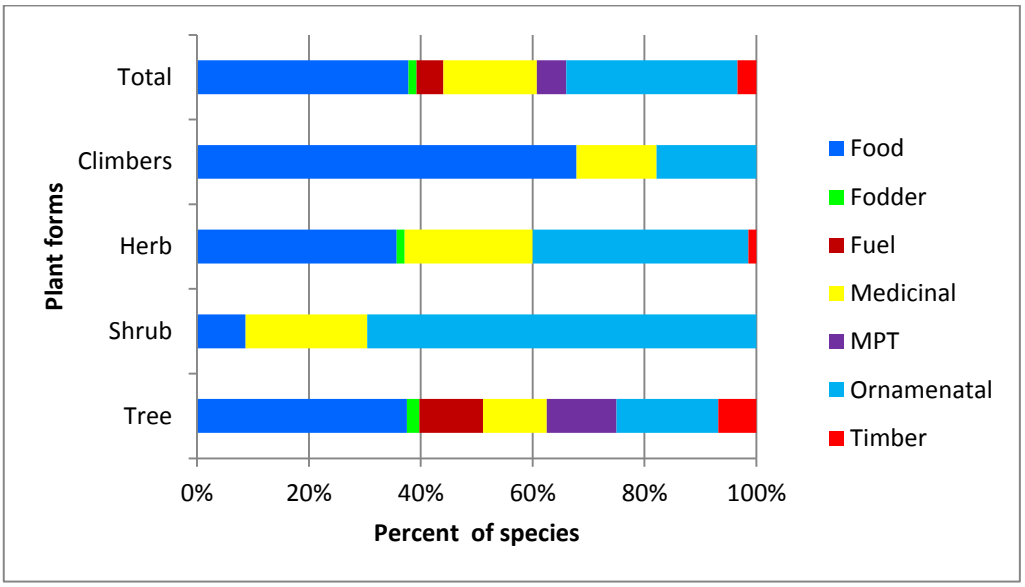


Figure 4.12 Uses of plant species found in homegardens

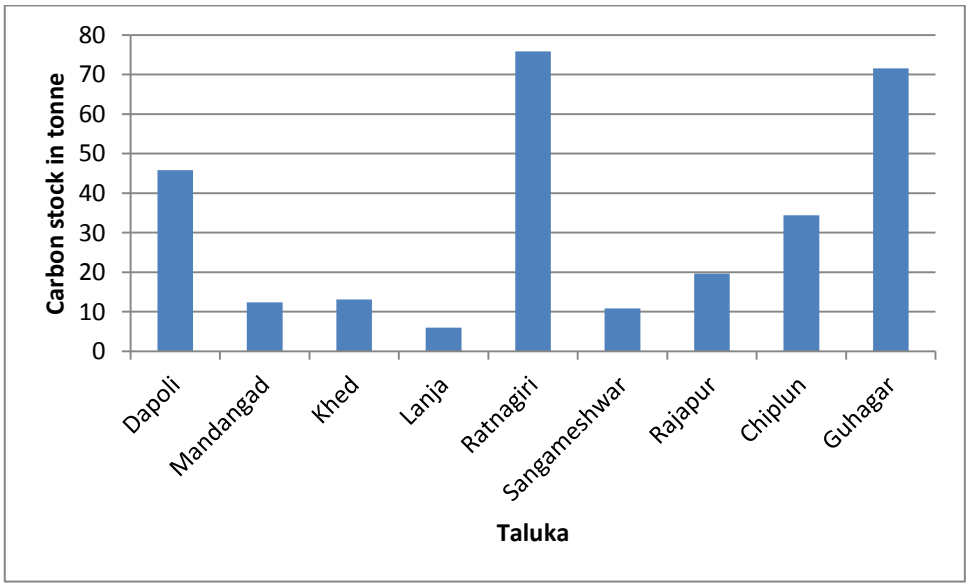


Figure 4.13 Taluka wise sequestration of carbon in homegardens of Ratnagiri district.

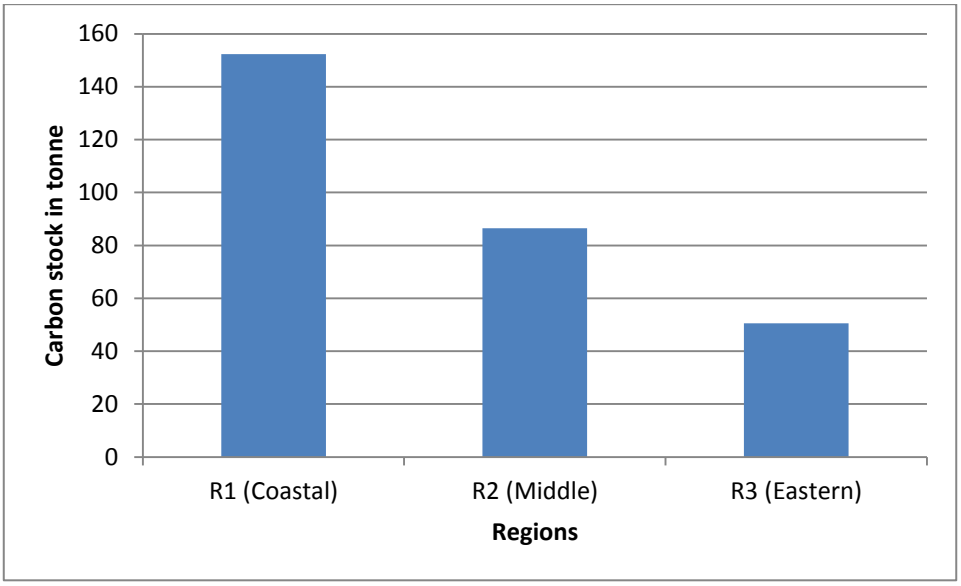


Figure 4.14 Region wise sequestration carbon in homegardens of Ratnagiri district.

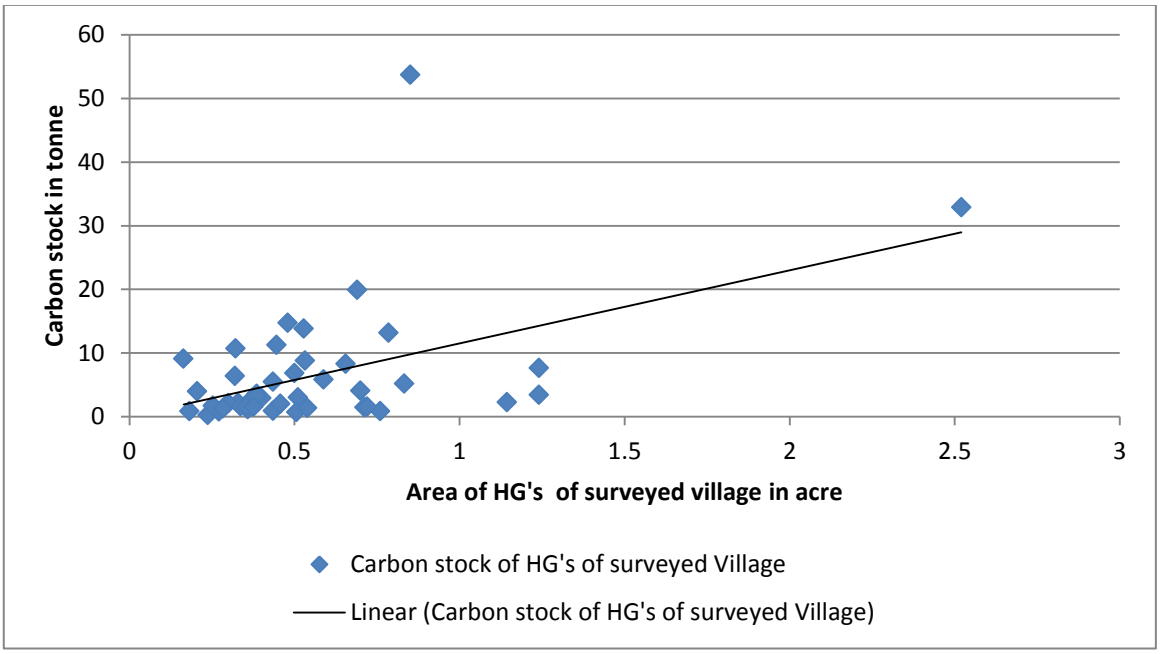


Figure 4.15 Area - Carbon stock relationship of homegardens in Ratnagiri district.

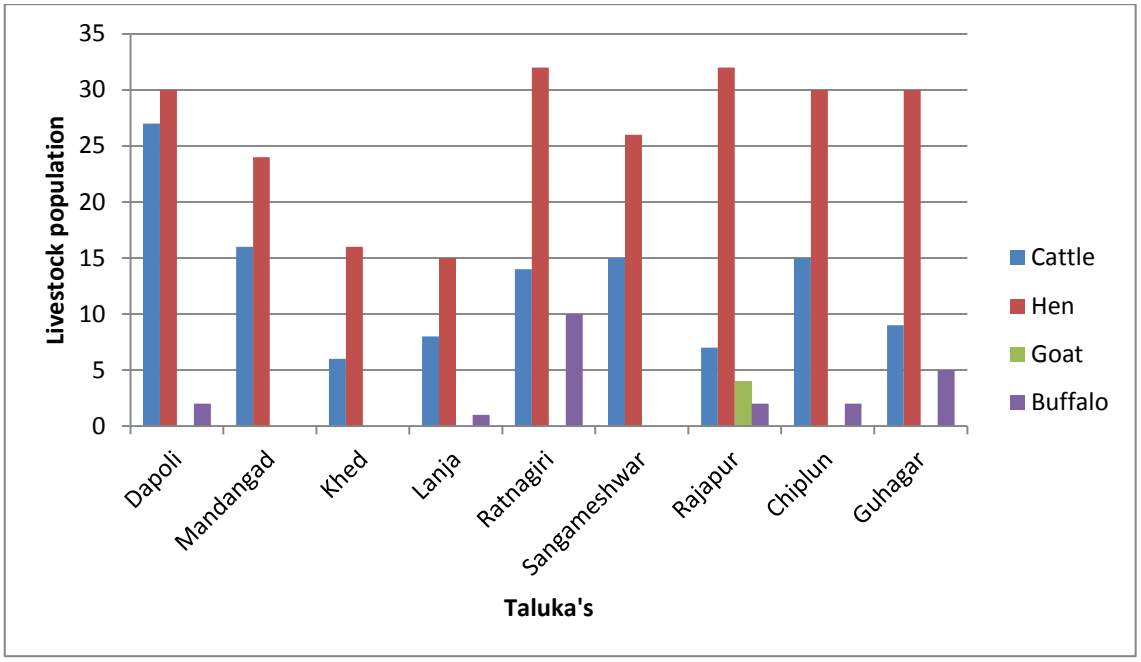


Figure 4.16 Distribution of livestock population in homegardens in taluka's of Ratnagiri district.

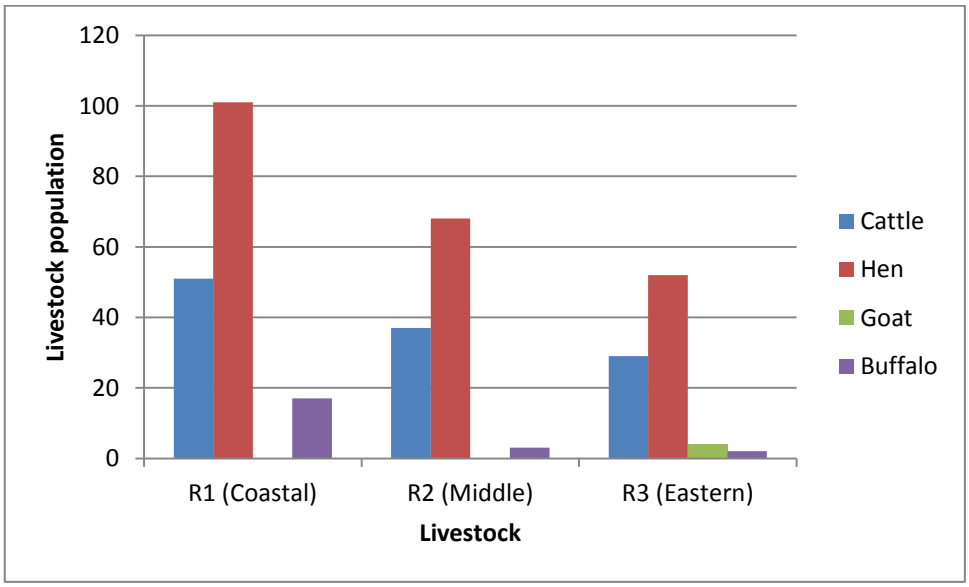


Figure 4.17 Distribution of livestock population in homegardens in regions of Ratnagiri district.

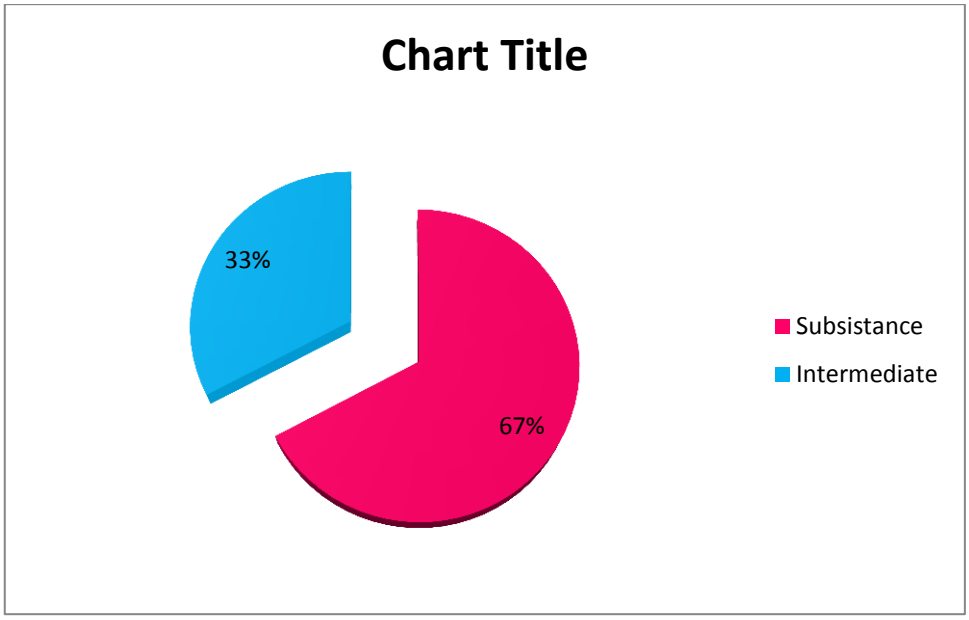


Figure 4.18 Commercial status of food products produced in the homegardens of Ratnagiri district.

a.

c.

e.

f.

Plate 3.2: a to d Collecting information about homegardens from owner. e measuring diameter of the trees of the homegardens. f Area calculation of homegarden with the help of GPS.

a.

e.

f.

Plate 4.1: a to c structure of homegardens. d traditional staging structure for the climbers in the homegardens. e & f traditional fencing methods in the homegarden.

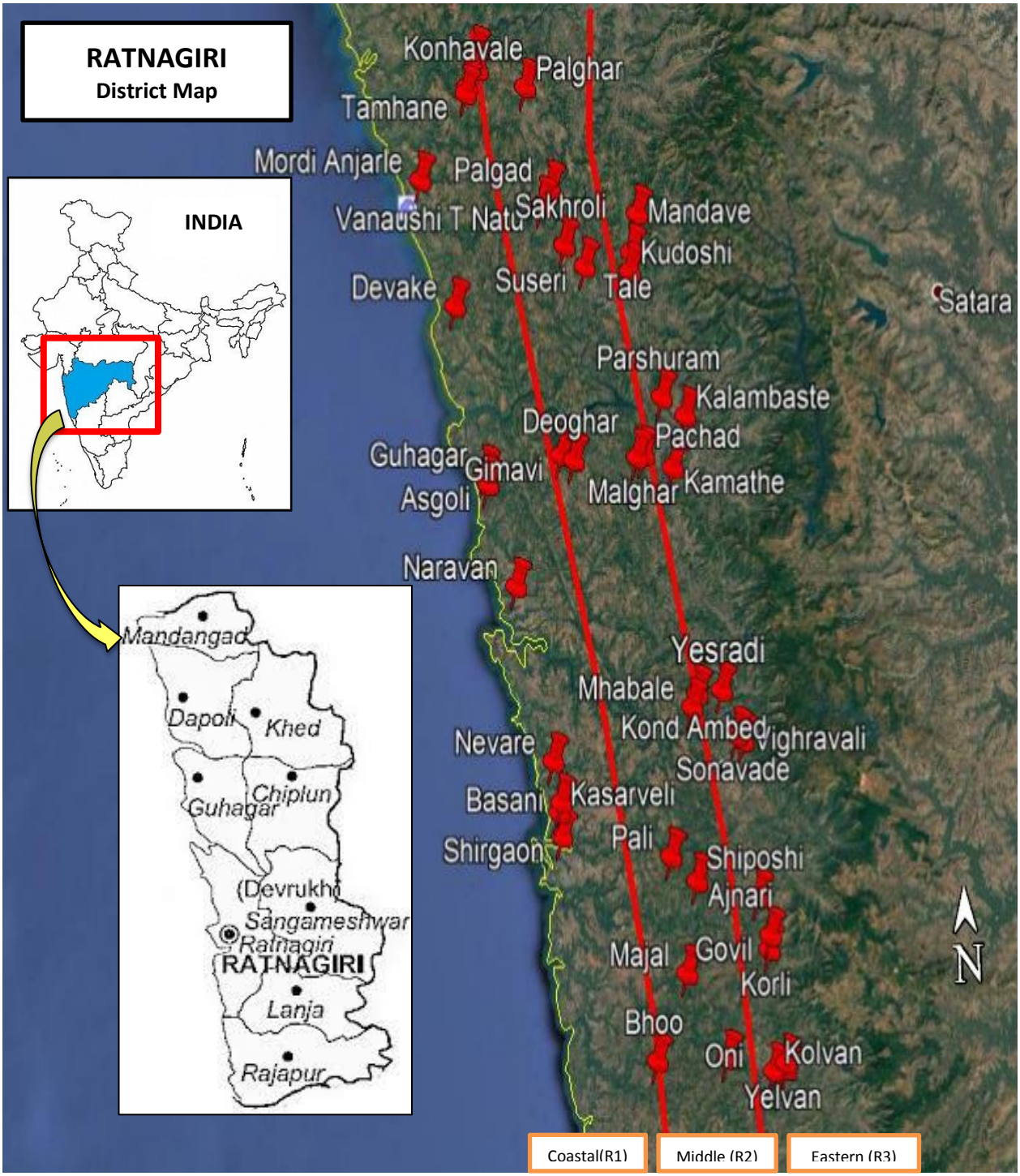


Plate 3.1: Map showing study area and location of surveyed villages. (Source google earth)

THESIS ABSTRACT

a) Title of the thesis	:	STUDY OF PLANT DIVERSITY, ABOVE GROUND CARBON SEQUESTRATION POTENTIAL AND FOOD VALUE OF TRADITIONAL HOMEGARDEN SYSTEM IN RATNAGIRI DISTRICT
b) Full name of the student	:	Mr. Sangare Siddhesh Manohar
c) Name and address of Major Advisor	:	Dr. S. S. Narkhede Dean (Agriculture) Dr.B.S.K.K.V. Dapoli 415712
d) Degree to be awarded	:	M.Sc. (Forestry)
e) Year of award of degree	:	2018
f) Major subject	:	Silviculture and Agroforestry
g) Minor subject	:	Agroforestry

Abstract

Homegarden is the multi-storey agroforestry system cultivated and maintained around the homestead by the members of family specialized by its complex structure. It provides basic things for the day to day life of the family. Homegardens are mainly found in humid tropical climate. Ratnagiri district also has humid tropical climate. Traditionally cultivated homegardens are commonly found in the Ratnagiri district and shows great variation in their composition and function in throughout the district. To document plant diversity, carbon sequestration and food value of the Ratnagiri district the present study was undertaken. For that I had divided the district area in 3 regions namely Costal (R1), Middle (R2) and Eastern (R3). Sampling units (Each homegarden) were selected in such a manner that one taluka contain five villages and each village contains six homegardens. Similarly for regions each region contains 15 villages. Finally total 270 homegardens from 45 villages of 9 taluka's of Ratnagiri district was surveyed.

Range of homegarden area of surveyed home gardens is 0.01 acre to 1.1 acre. Coastal region shows larger size homegardens than other to region.

Survey of homegardens revealed that total 209 plant species representing 178 genera and 81 families were recorded in survey of 270 homegardens of Ratnagiri district. Out of which 88 species of tree were recorded followed by 70 herb, 28 climbers and lowest 23 of shrubs. Fabaceae plant family contain highest (18) numbers of individuals

followed by Cucurbitaceae (10). Analysis of diversity shows that diversity of various life forms of the homegardens shows dynamics according to various locality of the Ratnagiri district. Dapoli taluka contain highest numbers of tree (56), shrub (16) and herb (42) species, maximum numbers of climber species were recorded in Chiplun (15) taluka. Maximum numbers plant species of all life forms found in the Middle region (R2) i.e. 168. Middle region (R2) has highest (68) species of tree and (62) species of herbs assemblages. Shrub species are highest in Coastal region (R1) i.e. (22). Eastern region (R3) has maximum numbers of the climber species (23).

Shannon diversity and Simpson's dominance indices were used to determine the diversity in the homegardens. Lanja taluka has maximum diversity of tree assemblage. Dapoli shows maximum diversity of shrubs. Chiplun shows more diverse herbs and climber assemblages. Guhagar has highest dominance of tree, herb and climber assemblage. Shrub dominance was highest in Sangameshwar taluka. Plant diversity in homegardens in region of Ratnagiri shows that Eastern region (R3) has maximum diverse tree assemblage. Coastal region (R1) has maximum shrub diversity. Herb diversity in Middle region (R2) shows slightly more diversity of herbs than other regions. Climber diversity is more in Eastern region. Dominance of trees is highest in Coastal region (R1). Shrub and herb dominance is more in the Eastern region (R3). Middle region (R2) has highest climber dominance.

Relation between homegarden size and diversity is correlated by plotting graph area against diversity and result shows that Tree diversity sows stability even the area increases. This is because of increase in plantation one or two species in homegardens. Shrubs diversity shows increasing trends upto one acre after that decreases as area increases. Diversity of herbs and shrubs shows increasing trends as area increases.

Plants having food and ornamental value has highest demand shown in graph of uses of plants. Importance value index (IVI) of trees shows Arecanut has highest value in tree assemblages. Jaswand has maximum IVI value in shrubs. Highest IVI value of herbs has Alu. Lima beans show highest IVI value in climber assemblage. Species having food value show maximum IVI values except shrub assemblage.

Above ground sequestrate carbon stock of taluka's shows homegardens of Ratnagiri (75.8 tonne) taluka has maximum carbon stock followed by Guhagar (71.56 tonne). Region wise carbon stock distribution shows Coastal region (R1) shows maximum

carbon stock (152.31 tonne), followed by Middle region (R2) (86.47 tonne). Area-Carbon relationship shows that as area of homegardens increases then carbon stock of the homegardens is also increases.

In the homegardens of Ratnagiri district total 117 cattle's, 235 hen and 22 buffalos were recorded. Only 4 individuals of goats were recorded in Rajapur taluka of Eastern region (R3).

Nutritive profile of food products produced in the homegardens shows that they help to nourish family of the owner. Commercial status of food products of homegardens shows that homegarden system is subsistence level agroforestry system.

Date: Signature

Place: Sangare Siddhesh Manohar

Vita

1. Name : Mr. Siddhesh Manohar Sangare

2. Contac no. : 7738665604

3. Address of corresponds : 453, S. P. Compound, Dr. S. S. Rao Road, Parel Mumbai 400012

4. Date of Birth :12th July 1994

5. Educational Qualification :

Degree/Exam	Name of University/ Board	Year of passing	Percentage/ CGPA	Class
S.S.C.	Mumbai	2010	82.36	First
H.S.C.	Mumbai	2012	60.17	First
B. Sc. Forestry	Dr. BSKKV, Dapoli	2016	7.61	First
M.Sc. Forestry	Dr. BSKKV, Dapoli	2018	7.73	First

6. Published Paper / Abstract :

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Date: Signature

Place: Dapoli Mr. Siddhesh Manohar Sangare