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Assessment of Plant Diversity and Soil Quality Management in Forest Land of West Godavari District, Andhra Pradesh, India

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Authors' contributions

This work was carried out in collaboration among all authors. Author RB designed the study, performed the statistical analysis. Author HK Managed the analyses and did literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The field experiment was set in home-garden areas under forest land of eight small towns viz. Borampalem, Venkatapuram, Gundugolanukunta, Ramannapalem, Abdullapuram, Tirumaladevpeta, Venkatakrishnapuram, Appalarajugudem in West Godavari, Andhra Pradesh during November to March in 2021–22 assess the Plant and Tree Diversity and Soil quality parameters. The plant/tree species *Phoenix sylvestris,* reported the highest frequency (245.00), dominance (3.27), and basal area (7542.96 cm^2). *Plumbago zeylanica* had the highest relative density (6.96) and relative abundance (6.81) among all the shrub species. *Plumbago zeylanica*

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reported the highest Important value index (IVI) 17.10 while Herb species with highest density was found in *Centella asiatica* (0.95), frequency (35), and highest Important value index (IVI) 14.60. Soil quality parameters reflects that at the depth 0-15cm the average value of pH is found to be7.52, organic carbon is 0.56%, the amount of available nitrogen is 213.78 kg/ha, amount of available of phosphorus is 41.25 kg/ha and available potassium is 38.22 kg/ha. At the depth of 15-30 cm the Average value of pH is found to be 6.61, organic carbon is 0.39%, the amount of available nitrogen is 189.51 kg/ha, amount of available of phosphorus is 34.75 kg/ha and available potassium is 31.37 kg/h.

Keywords: Agro-forestry models; forest land; plant and tree diversity; soil quality; relative density; West Godavari District.

1. INTRODUCTION

Since trees make up a significant portion of the vegetation, it is vital to continuously monitor and manage them to ensure that the diversity of species and habitats is maintained through successional processes [1,2,3,4,5]. Diversity in tree species is essential to tropical forest biodiversity [6,7] and a significant component of forest ecosystem diversity [8,9]. To track the dynamics of tropical forests over time and evaluate the impact of disturbance and climate change on plant demography, tree census plots have been set up in a variety of forest types [10,11,12,7]. The diversity of tree species affects the climate, stand structure, species composition, and geomorphology of the forest. Understanding the structure of forest stands is crucial for understanding forest ecosystems, since it plays a significant role in the biodiversity of stands [13]. Our capacity to maximize biodiversity conservation as a result of deforestation and degradation will be strengthened by an immediate inventory of tree species that offers information on diversity [14]. Plant species diversity is complex in nature, and its structure and composition vary depending on climatic conditions and topography [15]. Tropical forests are the most complex of all terrestrial ecosystems and the most heavily exploited ecosystems in the biosphere [16]. It only accounts for 7% of the earth's land surface yet is home to more than half of the world's plant and animal variety [17]. Despite their direct benefits to human survival, they are disappearing at a rate of 0.8 to 2% every year [18,19]. and dry deciduous forests in particular are the most damaged and least protected ecosystems on the planet [20,21,22,23]. Biodiversity is still declining despite a national policy focused at preserving and enhancing nature. The rapid decline of tropical forests worldwide has been accelerated by habitat destruction, deforestation, human settlements, globalization, agricultural expansion, and other development-related infrastructure over the last century. These factors have adversely affected biodiversity, climate change, ecological services, soil productivity, and the livelihoods of both forest dwellers and those living in rural areas [24,25,26,27]. Considering the importance of plant diversity and their role in improvement of soil quality parameters, present study was conducted and findings are presented in this paper.

2. MATERIALS AND METHODS

Experimental areas are situated on the southeast coast of the nation, alongside the Bay of Bengal, is Andhra Pradesh, the eighth largest state in the nation. The State's geographical area is 1,62,968 square kilometers, or 4.96% of the nation's total area. One of Andhra Pradesh's most significant districts, the West Godavari, is located between 16° 15' 00" and 17° 30' 00" of north latitude and between 80° 50' 00" and 81° 55' 00" of east longitude. It covers an area of 8506 sq. km with a coastline that is roughly 23.00 km [28].

2.1 Analysis of the Plant and Tree Diversity and Analysis of Data

Quadrate methods used for collection of data for analysis of parameter of plant and tree diversity [29,30]. In this species are enumerated within random quadrate of different size as per on the size and nature of plant community. 10m, x10m., 5mX5m and 1mx1m for trees, shrubs and herbs respectively were laid out at selective sites [31]. Nearly all types of vegetation can be quantified using the quadrate approach to determine the plant community. The numbers and names of each plant recorded when the sample pits are created. The frequency, density, and dominance of the flora were then determined and evaluated by formula suggested by Curtish and McIntosh [32]. The important value index, relative density, relative dominance, and relative frequency were analysed using formula suggested by Philips [33]. The following formulas were used to determine frequency, density, and dominance.

Density=(Total number of individuals of the species)/(Total number of sample unit studied)

Frequency =(Number of sample plots in which species occurred)/(Total number of samples plots studied) X100

dominance =(Total cover basal area)/(Total area sampled) X100

Basal area: The area that a tree's base occupies is thought to be a reliable measure of the size, weight, or volume of the tree. The formula was used to determine the basal area.

$BA = Cbh^2/4\ \pi$,

Were, Cbh diameter measured at breast height

2.2 Important Value Index

A measure of a species' dominance in a particular study area is called an important value. Foresters use it as a common tool to inventory a forest. Instead of counting every tree in a forest, foresters typically identify key locations inside the forest and sample a predetermined area surrounding those locations. Relative frequency, relative density, and relative dominance are the three types of data that are gathered; each of these values is expressed as a percent and spans from 0 to 100. The sum of these three measurements is the significant value, which can be anywhere between 0 and 300.

The value of the Important Value Index (IVI) was 300. It covers three essential components.

Relative Density=(Total number of individuals of the species)/(Total number of sample unit studied) X100

Relative Frequency =(Number of sample plots in which species occurred)/(Total number of samples plots studied) X100

Relative dominance =(Total cover basal area)/(Total area sampled) X100

Simpson's index (1949): It is calculated by a particular formula, which examines the species dominance of a specific area of study:

$Cd = \pi(ni/N)$ ^2

ni = Total number of the individuals in each species
N = Total number of the individuals of all species

Shannon – wiener index (1963): Whenever assessing the species diversity within a community, the Shannon-Weiner index (H) is often utilised. Shannon's Index takes into consideration the evenness and richness of the species that are there. It's calculated by using this formula.

$H = \Sigma\ (ni/N) \log (ni/N)$
ni = The overall number of individuals in the collective that belong in the I^{th} species

2.3 Soil Sample Analysis

Eight locations in the West Godavari District provided soil samples, which have been gathered for physical-chemical research at depths of 0–15 cm and 15–30 cm. After the samples were correctly mixed, let to air dry, crushed, and sieved through a 2-mm screen to remove any remaining foreign material, the samples were stored in preparation for their physical and chemical analysis. The mechanical characteristic of the soils is determined by using Bouyoucous Hydrometer method [34] and physical property is done by cylindrical methods (Muthuvel et al. 1992). Soil parameter analysed for pH and EC dSm – 2 at 25° C or mmho/m at 25° C) % organic carbon, available Nitrogen (N) kg/ha, Phosphorous (P_2O_5) kg/ha, Potassium (K_2O) kg/ha) [35,36].

Chart 1. Physio – Chemical properties of the Soil

S. No.	Parameter	Method	Reference
1	pH	Digital pH meter	Jackson, [37]
2	EC	Method no.4 USDA Handbook no.16	Richards, [38]
3	Organic Carbon	Walkley and Blackman Method	Walkley and Black [39]
4	Available Nitrogen.	Alkaline pomegranate Method	Subbiah and Asija [40]
5	Available Phosphorous	Olsen's Colorimetric Method	Olsen's et al. [41]
6	Available Potassium	Flame Photometric Method	Toth and Prince, [42]

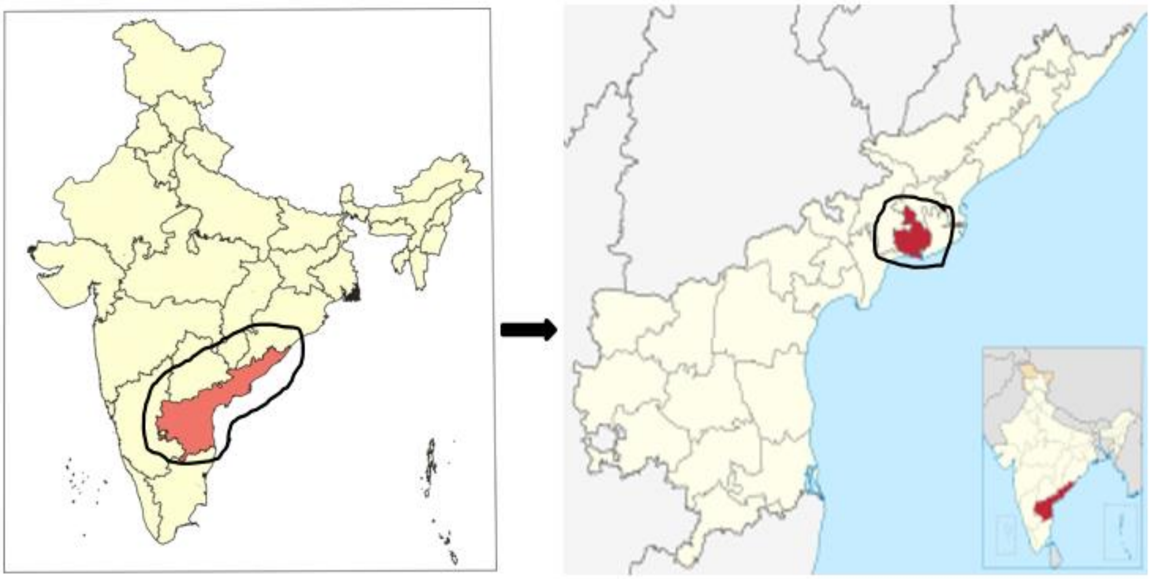

Fig. 1. Experimental areas of West Godavari district, Andhra Pradesh

3. RESULTS AND DISCUSSION

Table 1 shows that 239 individuals in all, representing 41 tree species across 35 groups, were taken into consideration. Among all the species, *Phoenix sylvestris (49)* followed by *Salix babylonica* (14), *Tamarindus indica* (10)*, Lannea coromandelica* (8) reported the maximum number of individuals while *Azadirachta indica* (2), *Moringa oleifera* (3), reported with the least number of individuals was *Terminalia elliptica* reported the smallest basal area (314.16 cm²), while *Phoenix sylvestris* recorded the highest basal area (7542.96). *Phoenix sylvestris* was found to have the highest density (2.45) *Sterculia urens* has the smallest density (0.1). *Phoenix sylvestris* had the highest frequency (245.00), while *Sterculia urens* had the lowest frequency (10.00). *Phoenix sylvestris* has the highest Dominance (3.27), while *Sterculia urens* had the lowest (0.25). The relative density was highest in *Phoenix sylvestris* (20.33) followed by *Salix babylonica* (5.81) whereas the lowest was *Moringa oleifera* (0.83). The relative frequency was found to be the highest in *Phoenix sylvestris* (20.50) whereas the least was reported in *Moringa oleifera* (0.84). The species with the highest Important value index (IVI) was *Phoenix sylvestris* (50.25) whereas the least was *Terminalia elliptica* (2.89) [43,44].

Table 2 shows that a total number of 230 individuals belonging to 30 shrubs species and 19 families reported in study areas. *Plumbago zeylanica* had the highest relative density (6.96) while *Carissa spinarum*, *Maytenus emarginata* had the least (1.30). The relative frequency was found to be highest in *Clerodendrum phlomidis* (7.50), while it was lowest in *Carissa spinarum, Maytenus emarginata*, *Calotropis gigantea* (1.67). The relative abundance was highest in *Plumbago zeylanica* (6.81) while it was lowest in *Phyllanthus reticulatus* (2.38). *Plumbago zeylanica* reported the highest IVI (17.10), followed by *Clerodendrum phlomidis* (16.24) whereas *Carissa spinarum* reported the least Important value index (IVI) (5.53).

Table 3 shows that a total number of 321 individuals belonging to 35 herbs species and 25 families. *Centella asiatica* had the highest number of individuals (19) while the least was *Tephrosia purpurea* (2). *Centella asiatica* had the highest density (0.95) and *Tephrosia purpurea* had the lowest density (0.1). *Centella asiatica* (35) had the highest frequency, while *Commelina benghalensis* had the lowest. *Withania somnifera, Tridax procumbens* (10). *Centella asiatica* reported the highest IVI (14.60) followed by *Indigofera trita* (12.80) whereas *Tephrosia purpurea* reported with the least Important value index (IVI) (3.35) [45].

3.1 Soil Nutrient Status

Table 4 Revealed that the chemical characteristics of various soil samples collected from the studied area is reported in the Tables 1 and 2, respectively, at a depth of 0–15 and 15–

30 cm. The chemical parameters are studied by the help of suitable methods. At the depth of 0-15 cm: The mean value of the organic carbon is (0.56%) which means the soil is comparatively fertile and good for the cultivation. The organic carbon is greater in the top soil due to continue mixing of leaf litters and high value of vegetation decomposition. The primary nutrient for vegetation growth and an important factor that determines the quality of the soil is nitrogen. The mean value of available Nitrogen in the soil is (213.78 kg/ha) which means that the nitrogen content in the soil is good enough. The mean value for the available Phosphorous is (41.25 kg/ha) it is quite low for that reason recommendable amount of SSP is to be used for the phosphorous. The mean value of the available potassium is (38.22 kg/ha) Potassium availability is generally low. The pH of study areas is slightly alkaline.

3.2 Soil Analysis at the Deep of 15-30cm

Table 5 revealed that as the organic carbon content in the deeper layer of soil (0.39%) was found to be lesser than top soil. Nitrogen content decrease with increases in soil depth and also due to decrease in the organic carbon the mean value of nitrogen at 15 – 30cm is (189.51 kg/ha) [46,47]. The same trends of decrease in available Phosphorous and Potassium (34.75 P kg/ha and 31.37 K kg/ha, respectively) was recorded with in soil depth. The decreased availability of organic matter in the soil's deeper layers may be the cause of its nutritional loss [48,49].

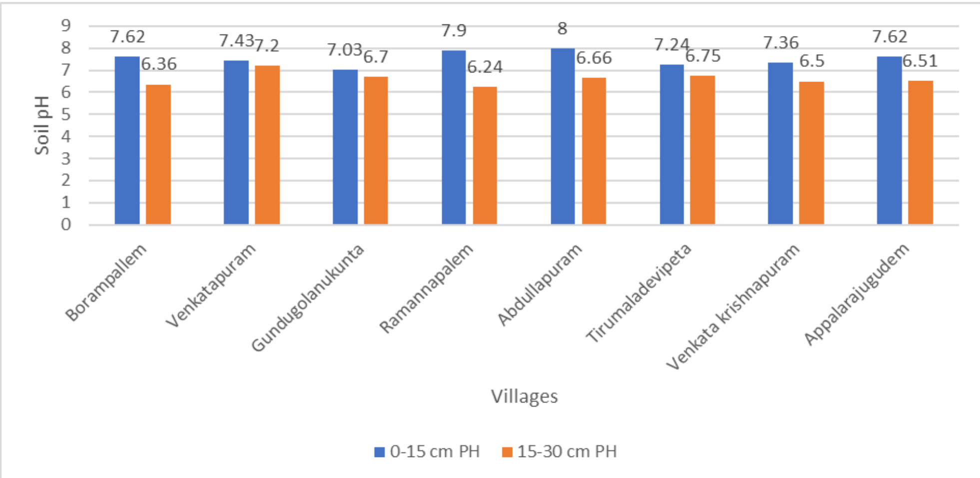

Fig. 2. pH of soil sample at 0-15cm and 15-30cm

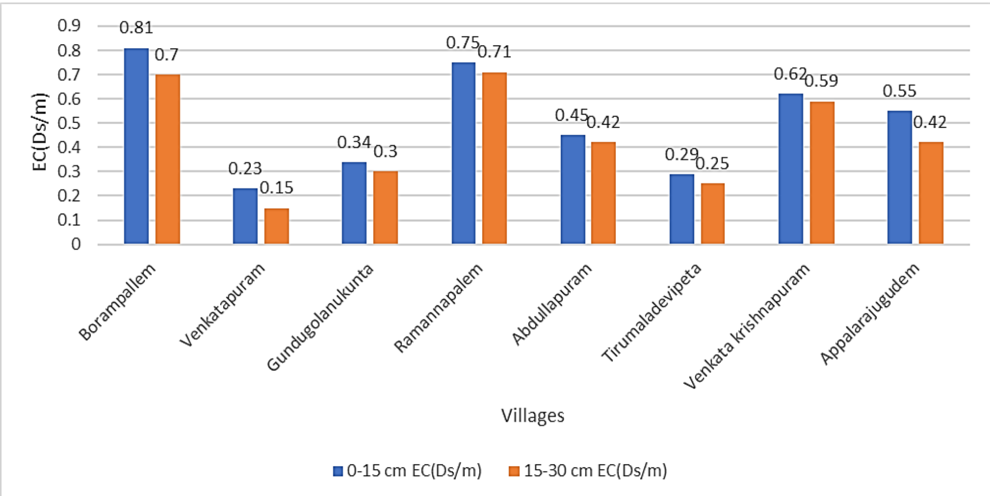

Fig. 3. Electrical conductivity of soil sample at 0-15cm and 15-30cm

Table 1. Phyto-sociological analysis of trees in 8 villages of West Godavari District, at Andhra

S. No	Name of plants	Total no. of individuals	Density	Frequency	BasalArea (cm^2)	Abundance	Relative Density	Relative Frequency	Relative Dominance	IVI
1.	*Azadirachta indica*	2	0.2	20	1385.44	1.33	1.66	1.67	1.73	5.06
2.	*Bombax cieba*	7	0.35	35	804.25	2.33	2.90	2.93	1.00	6.84
3.	*Ficus benghalensis*	6	0.3	30	1590.43	2.00	2.49	2.51	1.99	6.99
4.	*Mangifera indica*	4	0.2	20	490.87	1.33	1.66	1.67	0.61	3.95
5.	*Psidium guajava*	6	0.3	30	706.86	2.00	2.49	2.51	0.88	5.88
6.	*Prosopis cineraria*	3	0.15	15	490.87	1.00	1.24	1.26	0.61	3.11
7.	*Ficus religiosa*	6	0.3	30	1256.64	3.00	2.49	2.51	1.57	6.57
8.	*Tamarindus indica*	10	0.5	50	1134.11	2.00	4.15	4.18	1.42	9.75
9.	*Eucalyptus globulus*	3	0.15	15	3318.31	1.50	1.24	1.26	4.14	6.64
10.	*Elaesis guineensis*	7	0.35	35	4417.86	1.75	2.90	2.93	5.52	11.35
11.	*Cocus nucifera*	4	0.2	20	1963.50	2.00	1.66	1.67	2.45	5.79
12.	*Phoenix sylvestris*	49	2.45	245	7542.96	3.27	20.3	20.50	9.42	50.25
13.	*Jasminum spp*	7	0.35	35	1590.43	1.75	2.90	2.93	1.99	7.82
14.	*Moringa oleifera*	2	0.1	10	1256.64	1.00	0.83	0.84	1.57	3.24
15.	*Indian mahogany*	4	0.2	20	3848.45	1.33	1.66	1.67	4.81	8.14
16.	*Terminalia arjuna*	4	0.2	20	1963.50	2.00	1.66	1.67	2.45	5.79
17.	*Shorea robusta*	4	0.2	20	4071.50	1.33	1.66	1.67	5.08	8.42
18.	*Delonix regia*	3	0.15	15	3318.31	1.50	1.24	1.26	4.14	6.64
19.	*Saraca asoca*	3	0.15	15	5026.55	1.50	1.24	1.26	6.28	8.78
20.	*Murayya koenigii3*	6	0.3	20	1134.11	1.50	2.49	1.67	1.42	5.58
21.	*Leucaena leucocephala*	3	0.15	15	804.25	1.00	1.24	1.26	1.00	3.50
22.	*Terminalia catappa*	3	0.15	15	1385.44	1.00	1.24	1.26	1.73	4.23
23.	*Carica papaya*	6	0.3	30	1590.43	1.50	2.49	2.51	1.99	6.99
24.	*Anacardium occidentale*	4	0.2	20	1809.56	1.33	1.66	1.67	2.26	5.59
25.	*Acacia nilotica*	6	0.3	30	1075.21	1.50	2.49	2.51	1.34	6.34
26.	*Dalbergia latifolia*	3	0.15	15	2922.47	1.50	1.24	1.26	3.65	6.15
27.	*Phyllanthus emblica*	5	0.25	25	2290.22	1.25	2.07	2.09	2.86	7.03
28.	*Pongamia pinnata*	4	0.2	20	1590.43	2.00	1.66	1.67	1.99	5.32
29.	*Salix babylonica*	14	0.7	70	2827.43	2.33	5.81	5.86	3.53	15.20
30.	*Pterocarpus*	5	0.25	25	3848.45	1.25	2.07	2.09	4.81	8.97
31.	*Terminalia bellirica*	4	0.2	20	706.86	1.33	1.66	1.67	0.88	4.22
32.	*Wrightia tinctoria*	3	0.15	15	660.52	1.33	1.24	1.26	0.82	3.32
33.	*Sterculia urens*	4	0.2	20	1963.50	0.25	1.66	1.67	2.45	5.79
34.	*Madhuca longifolia*	5	0.25	25	1452.20	0.29	2.07	2.09	1.81	5.98
35.	*Bauhinia racemosa*	6	0.3	30	1590.43	1.20	2.49	2.51	1.99	6.99
36.	*Senegalia chundra*	3	0.15	15	1075.21	1.00	1.24	1.26	1.34	3.84
37.	*Boswellia ovalifoliolata*	3	0.15	15	660.52	1.00	1.24	1.26	0.82	3.32
38.	*Lannea coromandelica*	8	0.4	40	1017.88	1.33	3.32	3.35	1.27	7.94
39.	*Alstonia scholaris*	4	0.2	20	1734.94	2.00	1.66	1.67	2.17	5.50
40.	*Erytherina suberosa*	3	0.15	15	1452.20	1.50	1.24	1.26	1.81	4.31
41.	*Terminalia elliptica*	3	0.15	15	314.16	1.00	1.24	1.26	0.39	2.89
	Total	239	12.05	1195	80083.9	61.7	100	100	100	300

Table 2. Phyto-sociological analysis of Shrubs in 8 villages of West Godavari District at Andhra Pradesh

S. No	Name of plants	Total noof Individual	Density	Frequency	Basal Area	Abundance	Relative Density	Relative frequency	Relative dominance	IVI
1.	*Memecylon umbellatum*	14	0.7	35	283.5	2.0	6.09	5.83	3.41	15.3
2.	*Phyllanthus reticulatus*	7	0.35	25	153.9	1.4	3.04	4.17	2.38	9.59
3.	*Piper hooglandii*	10	0.5	25	254.5	2.0	4.35	4.17	3.41	11.9
4.	*Plumbago zeylanica*	16	0.8	20	113.1	4	6.96	3.33	6.81	17.1
5.	*Ricinus communis*	8	0.4	20	314.2	2.0	3.48	3.33	3.41	10.2
6.	*Senna alata*	7	0.35	15	415.5	2.3	3.04	2.50	3.97	9.52
7.	*Vitex negundo*	10	0.5	25	113.1	2	4.35	4.17	3.41	11.9
8.	*Woodforidia fruticosa*	7	0.35	15	572.6	2.3	3.04	2.50	3.97	9.52
9.	*Maytenus emarginata*	3	0.15	10	201.1	1.5	1.30	1.67	2.55	5.53
10.	*Acacia farnesiana*	7	0.35	20	346.4	1.75	3.04	3.33	2.98	9.36
11.	*Azima tetracantha*	8	0.4	15	314.2	2.7	3.48	2.50	4.54	10.5
12.	*Balanies roxburghii*	6	0.3	15	254.5	2	2.61	2.50	3.41	8.51
13.	*Bambusa vulgaris*	6	0.3	20	452.4	1.5	2.61	3.33	2.55	8.50
14.	*Calotropis gigantea*	5	0.25	10	380.1	2.5	2.17	1.67	4.26	8.10
15.	*Canthium parviflorum*	6	0.3	20	490.9	1.5	2.61	3.33	2.55	8.50
16.	*Capparis aphylla*	8	0.4	20	283.5	2.0	3.48	3.33	3.41	10.2
17.	*Capparis zeylanica*	6	0.3	20	346.4	1.5	2.61	3.33	2.55	8.50
18.	*Carissa spinarum*	3	0.15	10	415.5	1.5	1.30	1.67	2.55	5.53
19.	*Catunaregam spinosa*	7	0.35	20	283.5	1.75	3.04	3.33	2.98	9.36
20.	*Clerodendrum phlomides*	14	0.7	45	113.1	1.6	6.09	7.50	2.65	16.2
21.	*Dichrostachys cinerea*	5	0.25	10	452.4	2.50	2.17	1.67	4.26	8.10
22.	*Dodonaea viscosa*	6	0.3	20	201.1	1.5	2.61	3.33	2.55	8.50
23.	*Flacourtia indica*	9	0.45	20	490.9	2.25	3.91	3.33	3.83	11.0
24.	*Gmelina asiatica*	5	0.25	15	201.1	1.7	2.17	2.50	2.84	7.51
25.	*Helicteres isora*	12	0.6	35	572.6	1.7	5.22	5.83	2.92	13.9
26.	*Ixora arborea*	7	0.35	20	346.4	1.8	3.04	3.33	2.98	9.36
27.	*Jatropha curcas*	7	0.35	20	254.5	1.75	3.04	3.33	2.98	9.36
28.	*Justicia adhatoda*	6	0.3	15	254.5	2.0	2.61	2.50	3.41	8.51
29.	*Lantana camara*	6	0.3	15	254.5	2	2.61	2.50	3.41	8.51
30.	*Lawsonia inermis*	9	0.45	25	314.2	1.8	3.91	4.17	3.07	11.1
31.	Total	230	11.5	60	9443.6	58.7	100	100	100	300

Table 3. Phytosociological analyses of Herbs in 8 villages of West Godavari District of Andhra Pradesh

S. No	Name of plants	Total no. of individual	Density	Frequency	Abundance	Relative Density	Relative Frequency	Relative Dominance	IVI
1.	*Cassi tora*	8	0.4	15	2.7	2.49	2.46	2.89	7.85
2.	*Centella asiatica*	19	0.95	35	2.7	5.92	5.74	2.95	14.6
3.	*Cheilocosttus speciosus*	9	0.45	15	3	2.80	2.46	3.26	8.52
4.	*Cleome viscosa*	11	0.55	20	2.75	3.43	3.28	2.98	9.69
5.	*Commelina benghalensis*	5	0.25	10	2.5	1.56	1.64	2.71	5.91
6.	*Cyperus rotundus*	9	0.45	15	3	2.80	2.46	3.26	8.52
7.	*Dendrophthoe falcata*	10	0.5	20	2.5	3.12	3.28	2.71	9.11
8.	*Elytraria acaulis*	12	0.6	20	3	3.74	3.28	3.26	10.2
9.	*Hygrophila auriculata*	9	0.45	15	3	2.80	2.46	3.26	8.52
10.	*Hyptis suaveolens*	12	0.6	20	3	3.74	3.28	3.26	10.2
11.	*Indigofera trita*	16	0.8	30	2.7	4.98	4.92	2.89	12.8
12.	*Martynia annua*	8	0.4	15	2.7	2.49	2.46	2.89	7.85
13.	*Pentanema indicium*	7	0.35	20	1.75	2.18	3.28	1.90	7.36
14.	*Phyla nodiflora*	12	0.6	20	3	3.74	3.28	3.26	10.2
15.	*Phyllanthus amarus*	6	0.3	15	2	1.87	2.46	2.17	6.50
16.	*Rauwolfia serpentina*	7	0.35	15	2.3	2.18	2.46	2.53	7.17
17.	*Senna obtusifolia*	3	0.15	10	1.5	0.93	1.64	1.63	4.20
18.	*senna occidentalis*	11	0.55	20	2.75	3.43	3.28	2.98	9.69
19.	*Senna tora*	3	0.15	10	1.5	0.93	1.64	1.63	4.20
20.	*Sesamum alatum*	7	0.35	15	2.3	2.18	2.46	2.53	7.17
21.	*Tephrosia purpurea*	2	0.1	10	1	0.62	1.64	1.09	3.35
22.	*Tridax procumbens*	7	0.35	10	3.5	2.18	1.64	3.80	7.62
23.	*Vanda tessellate*	13	0.65	30	2.17	4.05	4.92	2.35	11.3
24.	*Withania somnifera*	9	0.45	10	4.5	2.80	1.64	4.88	9.33
25.	*Acalypha indica*	13	0.65	30	2.17	4.05	4.92	2.35	11.3
26.	*Achyranthus aspera*	11	0.55	15	3.7	3.43	2.46	3.98	9.87
27.	*Acorus calamus*	10	0.5	20	2.5	3.12	3.28	2.71	9.11
28.	*Aerva lanata*	5	0.25	15	1.67	1.56	2.46	1.81	5.83
29.	*Agava americana*	11	0.55	20	2.75	3.43	3.28	2.98	9.69
30.	*Anisomeles indica*	8	0.4	15	2.7	2.49	2.46	2.89	7.85
31.	*Argemone mexicana*	4	0.2	15	1.3	1.25	2.46	1.45	5.15
32.	*Bacopa monnieri*	10	0.5	15	3.3	3.12	2.46	3.62	9.19
33.	*Biophyum sensitivum*	13	0.65	20	3.25	4.05	3.28	3.53	10.8
34.	*Byttneria berbaceae*	12	0.6	15	4	3.74	2.46	4.34	10.5
35.	*Xanthium strumarium*	9	0.45	15	3	2.80	2.46	3.26	8.52
36.	Total	321	16.0	610	92.1	100	100	100	300

Table 4. Nutrient status of the soil sample at 0-15cm in West Godavari District of Andhra Pradesh

Name of the village	pH	EC(Ds/m)	Organic carbon (%)	N(kg/ha)	P(kg/ha)	K(kg/ha)
Borampallem	7.62	0.81	0.87	245.6	96	55.1
Venkatapuram	7.43	0.23	0.76	232.2	19	50
Gundugolanukunta	7.03	0.34	0.23	223.2	53	40.1
Ramannapalem	7.90	0.75	0.45	212.1	33	35.1
Abdullapuram	8.00	0.45	0.20	232.1	34	40.2
Tirumaladevipeta	7.24	0.29	0.81	152.1	20	35.1
Venkata krishnapuram	7.36	0.62	0.35	222.9	45	20.2
Appalarajugudem	7.62	0.55	0.81	190.1	30	30.0
Average	7.52	0.50	0.56	213.7	41.2	38.2

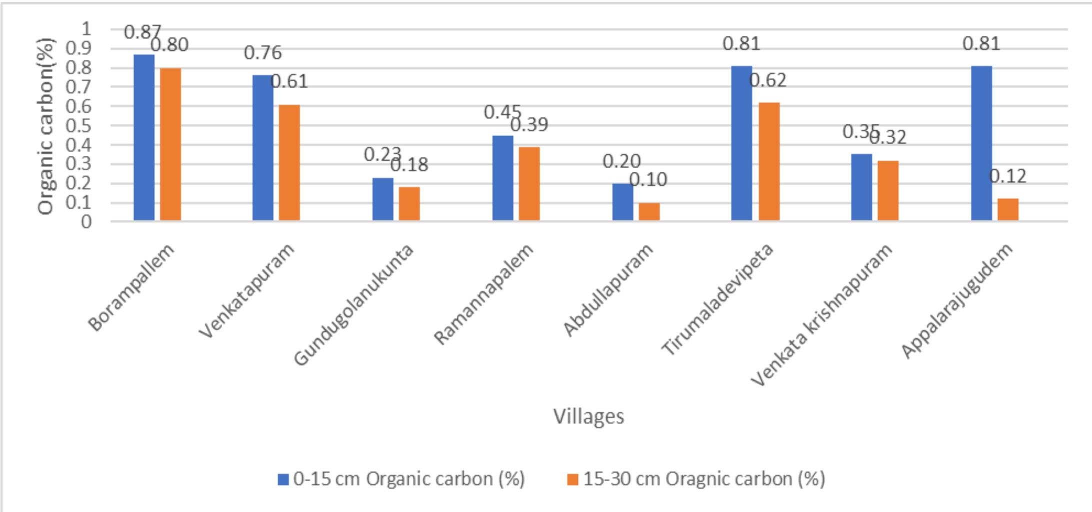

Fig. 4. Organic carbon of soil sample at 0-15cm and 15-30cm

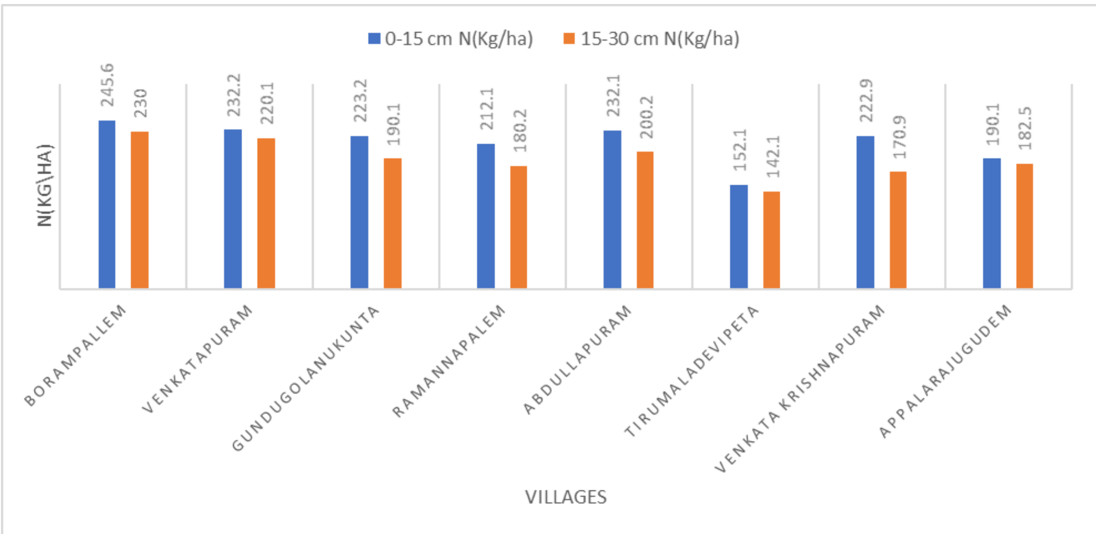

Fig. 5. Nitrogen of soil sample at 0-15cm and 15-30cm

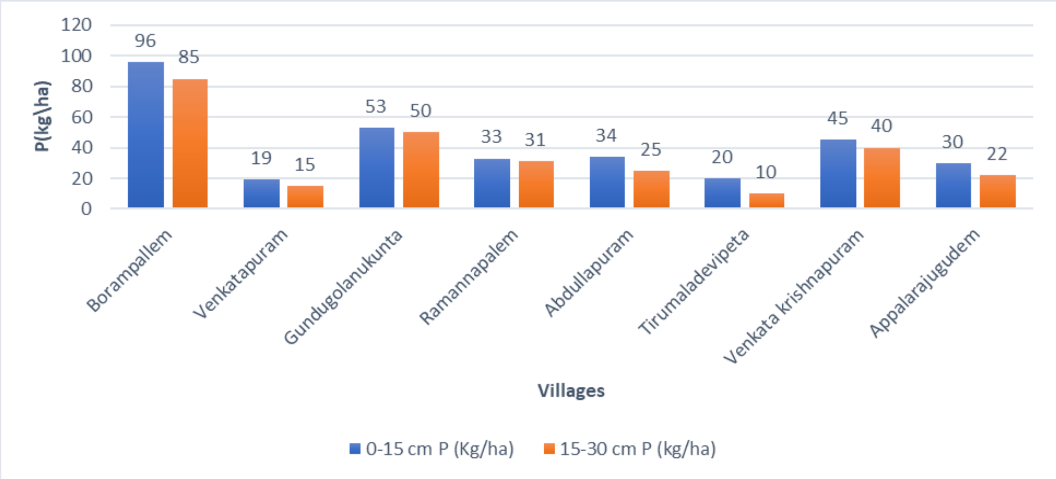

Fig. 6. Phosphorus of soil sample at 0-15cm and 15-30cm

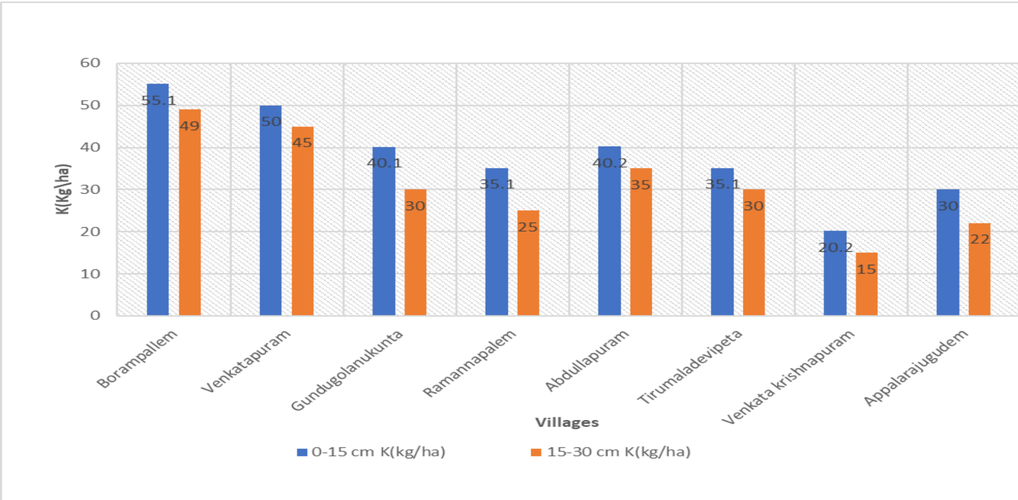

Fig. 7. Potassium of soil sample at 0-15cm and 15-30cm

Table 5. Nutrient status of the soil sample at 15-30cm

Name of the village	pH	EC(Ds/m)	Organic carbon (%)	N(kg/ha)	P(kg/ha)	K(kg/ha)
Borampallem	6.36	0.7	0.80	230	85	49
Venkatapuram	7.2	0.15	0.61	220.1	15	45
Gundugolanukunta	6.7	0.3	0.18	190.1	50	30
Ramannapalem	6.24	0.71	0.39	180.2	31	25
Abdullapuram	6.66	0.42	0.10	200.2	25	35
Tirumaladevipeta	6.75	0.25	0.62	142.1	10	30
Venkata krishnapuram	6.5	0.59	0.32	170.9	40	15
Appalarajugudem	6.51	0.42	0.12	182.5	22	22
Avg	6.61	0.44	0.39	189.51	34.75	31.37

4. CONCLUSION

Present research work concludes that villages of West Godavari district are mainly composed of 41 tree species belonging to 35 families. *Phoenix sylvestris* (7542.96) is the largest populous species with highest basal area, the highest density, frequency (245.00), and the highest dominance (3.27). Shrubs species *Plumbago zeylanica* had the highest relative density (6.96), relative abundance (6.81) and the highest Important value index (17.10). Herbs species with highest density was found for *Centella asiatica* (0.95), highest frequency (35) and highest IVI (14.60). The diversity of the study region shows the disturbance due to soil quality variation, environmental factors and human intervention. As the soil nutrient status shows the remarkable low content of phosphorous and potassium. On the basis of questionnaire survey, it can be concluded that the compensation of diversity loses due to human activity in the study region can be achieved by adopting various Agro-forestry model by the farmers especially home garden.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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