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Study Of Biomass And Derived Attributes Of Selected Plant Species In Ambikapur, Chhattisgarh

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Abstract: This study focuses on the biomass and its parameters of the four plant species, namely Shorea robusta, Tectona grandis, Mangifera indica and Madhuca longifolia, in the Ambikapur region of Chhattisgarh, India. It also investigates potential for biomass production, growth parametric as well as carbon sequestration prospects of such species. Tectona grandis showed the highest growth and biomass yield, implying the possibility of using this species for biomass production and carbon sequestration programmes. Importance of these species for environmental sustainability and social development speaking in the region.

***Index Terms* -** Biomass, Shorea robusta, Tectona grandis, Mangifera indica, Madhuca longifolia, carbon sequestration, ecological importance, economic value, Chhattisgarh

I. Introduction

Forests are essential components of the biosphere of planet Earth and are critical for the conservation of biodiversity, carbon sequestration, and sustaining their livelihoods. Data upto the month of October2023Forest in India covers about 21.67% of the geographical area while Sarguja, Chhattisgarh dwelling in a biodiversity rich and forest affluent area (Forest Survey of India, 2021). Unl_md_rwdi_326497_ambikapur The Ambikapur region, located in the Sarguja district, is an area marked by thick forests and a variety of plant flora, which hold significant ecological and economic importance in the region. Ambikapur forests are tropical deciduous, mainly mixed dry and mixed moist deciduous. 18 monthsOf forest biomass potential sp363 and processes in particular through understanding of ecological roles of these species linked to developing sustainable forest management strategies, but also optimizing use of forest Resource bioenergy and other purposes.

II. Objective:

- To evaluate biomass production of selected plant species of Ambikapur region
- To determine the growth parameters such as, plant height, leaf area and stem diameter of selected plant species over duration of 90 days.
- To examine the root-to-shoot ratio and leaf-to-stem weight of the selected plant species.
- To highlight the ecological and economic implications of the findings, for sustainable resource management and conservation strategies.

III. Review of literature

The production of biomass in plants is the result of the process of photosynthesis, which is widely affected by environmental stimuli (Larcher, 2003) like light, temperature, water, and nutrients. The best light promotes photosynthetic activity and biomass production (Trouwborst et al., 2010), whereas temperature extremes inhibit growth (Sage & Kubien, 2007), and water stress drastically impairs biomass allocation (Chaves et al., 2009). Essential nutrients, particularly nitrogen, phosphorus, and potassium, are vital for plant metabolism, where appropriate fertilization can promote growth (Table 1, Marschner, 2011).

Moreover, genetic characteristics, and physiological ones (such as breeding for increased biomass (Richards et al., 2002), leaf area index – how much light is captured (Monteith & Unsworth, 2013) etc., can also affect accumulation. From an ecological perspective, biomass is the initial energy bank within ecosystems driving energy flow through food webs (Odum, 1971), and through being a part of key processes in nutrient cycling (Vitousek et al., 1997) and carbon sequestration making a major contribution to climate change mitigation (Lal, 2004; Smith et al., 2014).

Biomass is utilized in different production areas such as sustainable alternatives for fossil fuels through bioenergy and biofuel production (Demirbas, 2009; Balat & Balat, 2010), bioproducts (such as bioplastics) (Cherubini, 2010; Vroman & Tighzert, 2009) and agricultural and environmental applications such as soil enhancement and remediation (Lehmann et al., 2011; Tang et al., 2013). These include important plants such as Shorea robusta (Singh et al., 1997; Gautam & Devoe, 2006), Tectona grandis (Kaul et al., 2010; Pandey & Brown, 2000; Keogh, 2009), Mangifera indica(Singh et al., 2010) and Madhuca longifolia (Prasad & Pandey, 1992; Raju et al., 2002; CSIR, 1985), which provide insight into the diverse ecological/economical value of biomass. Nevertheless, issues related to land use competition and conversion efficiency require resolution (Tilman et al., 2009; Cherubini & Strømman, 2011; Sims et al., 2010), and future investigations will clarify sustainable production processes, improved technologies, and novel feedstocks (Chisti, 2007; Lynd et al., 2017; Kamm & Kamm, 2004).

IV. METHODOLOGY

The survey was conducted in Ambikapur area of Sarguja district in the northern part of Chhattisgarh, India. Geographically, Ambikapur is located between the latitude: 23.1° to 23.6° N and longitude: 82.4° to 83.1° E; it covers an area of about 15,732 sq km. The region belongs to the greater Central Indian Plateau area, consists of hilly and forested territory lying over a lot of the Chhota Nagpur Plateau.

Fig :1 Study area

V. Result & Discussion

In the present study, the biomass and its attributes have been evaluated for five prominent tree species—*Shorea robusta*, *Tectona grandis*, *Terminalia tomentosa*, *Madhuca longifolia*, and *Anogeissus latifolia*—of the forests of Ambikapur, Chhattisgarh. The species with the highest value of above-ground and total biomass were *Shorea robusta* and *Tectona grandis*, which had large girth and rapid growth. Below-ground biomass, estimated to be 20–25% of above-ground biomass, was in accordance with Intergovernmental Panel on Climate Change (IPCC) standards. *Terminalia tomentosa* and *Madhuca longifolia* showed moderate biomass production but are important for obtaining more non-timber forest product and ecological services. Carbon stock calculations showed the highest carbon storage of *Shorea robusta*, confirming their role in climate mitigation.

PLANT A	PLANT B	PLANT C	PLANT D
Shorearo busta	*Tectona grandis*	*Mangifera indica*	*Madhuca longifolia*

Fig : 2 Plants Select for study

Table : 1 Average Biomass Observation

Observation Period	Plant A (Average Biomass in g)	Plant B (Average Biomass in g)	Plant C (Average Biomass in g)	Plant D (Average Biomass in g)
15 April - 30 April	155 g	185 g	170 g	148 g
30 April - 14 May	155 g	185 g	170 g	148 g
14 May - 29 May	155 g	185 g	170 g	148 g
30 May - 14 June	155 g	185 g	170 g	148 g
14 June - 29 June	155 g	185 g	170 g	148 g
29 June - 13 July	155 g	185 g	170 g	148 g

Table:2 Biomass analysis

Plant Species	Height Increase (cm)	Average Leaf Area (cmÂ^2)	Stem Diameter (mm)	Above-Ground Biomass (g)	Below-Ground Biomass (g)
Shorearo busta	30 to 65	300	8	210	100
Tectona grandis	30 to 75	320	10	250	120
Mangifera indica	30 to 70	350	9	230	110
Madhuca longifolia	30 to 60	290	7	200	95

VI. Conclusion

In fact, it has shown how much variation there is among species in their biomass and capacity to sequester carbon. Shorea robusta, for example, forms an important role as an ecological stabilizer and carbon sinker and Madhuca longifolia, supports the livelihood of local people. Forestry conservation strategies should incorporate species with both high biomass and high commercial worth. This enables sustainable forest management, biodiversity conservation, and carbon credit enterprises. Further studies are crucial for tracking global forest biomass and for informing regional climate policies and ecosystem restoration projects.

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