URBAN TREES FOR CARBON SEQUESTRATION AND MANAGEMENT OF CLIMATE CHANGE & DISASTERS

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Abstract

Climate change is responsible to increase the frequency of disasters and environmental protection is priority particularly for forests. Trees in urban area are important natural and cultural resources which provide many benefits. The tree canopy has greater impact and play vital role in reduction of carbon emissions released from industrial activities. The present study is carried out in industrial areas to screen the carbon sequestration potential of trees in relation with pollutant load. The carbon sequestration potential of a tree depends on biomass of a tree. Biomass can be estimated by tree height and DBH. In industrial area trees are considered as a green belt asset and are act as sinks for excess CO_2 in the atmosphere. The amount of carbon stored in a tree depending upon its biomass and growth pattern of a tree. In the present study the native species such as Fucus bengalensis, Artocarpus sps. and Mangifera indica reported higher rates of carbon accumulation. In addition these trees also help to strengthen the ecosystem services therefore alleviating global warming.

Keywords: *Carbon sequestration, Climate change, Biomass, Air pollution*

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1. INTRODUCTION

Climate change is responsible to increase the frequency and intensity of disaster events in the future and environmental protection is priority and being placed on forests and forest land. Evidence from the Asia-Pacific region demonstrated that forests can withstand and protect against natural disasters of varying degrees and types when managed properly (FAO and RECOFTC, 2013). Forest is effective contributor to disaster risk management especially with land-use planning, infrastructure, mitigation measurement and early warning systems (FAO and RECOFTC, 2013). Trees in urban area are important natural and cultural resources which provide many benefits. Trees are form of community green infrastructure and provide important ecosystem services such as storm water management, erosion control and energy conservation. As a result, trees should be considered as infrastructure in recovery and a challenge with the urban forest as infrastructure in a disaster event is that it takes years to grow and cultivate, but can be destroyed in a single storm. In management of urban forest and to improve to resilience towards disaster, urban tree canopy is an important tool (FEMA, 2007). The tree canopy has greater impact per area over non-urban forests because of its recovery effects particularly in reduction of carbon emissions released from thermal power plants and faster growing rate (Sarah M. and Forbes, 2003). Enhancing urban forest sequestration offers immediate environmental and consumer benefits. Thus there is a direct link between climate change and disasters. The scientific community, practitioners and policymakers have focused on climate change mitigation for a long time and recently the focus has been shifted to low carbon development (LCD). Low carbon development is by using less energy, promotes carbon sinks, promotes low or zero carbon technologies and introduction of policies which discourage carbon intensive practices (DFID, 2009). The present paper aims to study the potential of trees in carbon sequestration and tolerance to air pollutants from urban area which consist "green pockets" such as avenues and public places.

2. MATERIALS AND METHODS

Visakhapatnam is situated on the North-Eastern coast of Andhra Pradesh, at latitude of 17º 43N[1] and longitude of 83º20E[1]. The city stretches from north to south on a ridge and is located in a spoon shaped basin, surrounded by hills on three sides with Bay of Bengal on the East. The total city area is situated within a distance of 10 Km from the shore. All the residential areas fall within this area. The entire city lies within the two prominent hill ranges, namely Yarada and Adivivaram. The present study is carried out in industrial areas. In these areas different tree species were identified to screen the carbon sequestration potential of trees in relation with pollutant load. The carbon sequestration potential of a tree depends on biomass of a tree. Biomass can be estimated by tree height and DBH (Brown *et al.,* 1997; FAO, 1997; Zewdie *et al.,* 2009).

The tree height was measured by using Theodolite instrument at DBH. The height of a tree (H) is calculated by the following formulae:

$$H = h + b \tan \alpha$$

Biomass estimation in trees: The mathematical equation has been developed and used by many researchers for biomass estimation of trees. The equation used in the present investigation is as follows:

$$Y = Exp. \{-2.4090 + 0.9522 \, In \, (D2 \times H \times S)\}$$

Where, Exp. {....} is the "raised to the power of {....}"
Y = Above ground biomass (kg)
H = Height of the trees (meter)
D = Diameter at breast height in cm
S = Wood density (gm/cm^3).

Below ground biomass was calculated considering 20% of the above ground biomass.

The carbon content of a tree (C in tones) is estimated by using following formula:

$$C \text{ (tones)} = (0.475 * \text{Biomass})/1000$$

3. RESULTS AND DISCUSSION

The data related to carbon sequestered by trees were assessed from industrial areas of Visakhapatnam in both above ground and below ground plant parts is presented in Figure-1. Among the fifteen species Fucus bengalensis, Artocarpus sps. and Mangifera indica, Cassia bicapsularis. have shown good potential to maintain carbon stock.

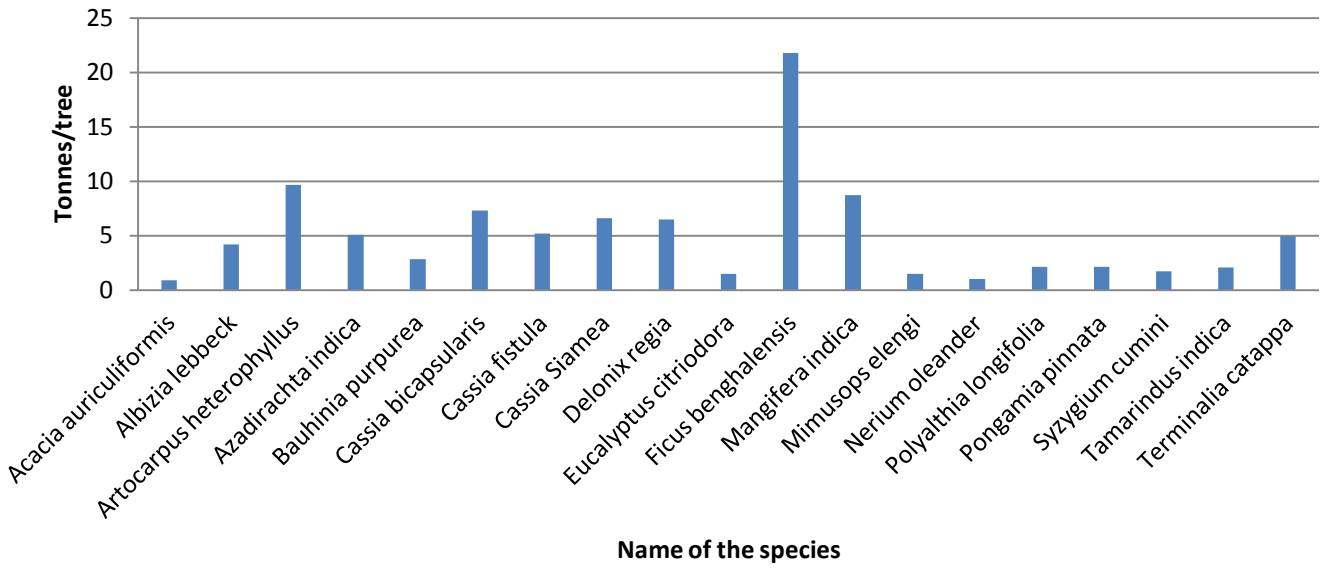

Fig 1: Carbon sequestration potential of different tree species

4. CONCLUSION

In industrial area trees are considered as a green belt asset and are act as sinks for excess CO_2 in the atmosphere. The amount of carbon stored in a tree depending upon its biomass and growth pattern of a tree. It is found that fast growing trees seize more carbon than slow growing trees (Montagnini. & Porras, 1998; Redondo- Brenes, 2007). In the long term the amount of carbon accumulated by slow growing species is larger than by fast growing species. This indicates faster growing trees may accumulate larger amount carbon in early stage of their life. While high specific gravity of slow growing trees to allow them to accumulate more carbon in longer. In the present study also the native species such as Fucus bengalensis, Artocarpus sps. and Mangifera indica reported higher rates of carbon accumulation compared to other species and help to strengthen the ecosystem services therefore alleviating global warming.

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