Carbon Stocks of Eastern Ghats Ecosystems and Scope for Carbon Sequestration

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***Abstract*—After a decade of discussion series, most nations have realized the only cost effective and immediate option that can remove the accumulated CO2 and mitigate climate change, was carbon sequestration through land use sectors (croplands, forests, grasslands etc.). Forest degradation in India, has resulted not only in the decline of C sequestration potential, but also reduced the potential for biomass productivity and thereby livelihood opportunities of several forest dependent communities. This paper delineates the potential of Eastern Ghats forests and associated ecosystems, for C sequestration and discusses how C benefits can be derived as co-benefits to the ecological improvement of the forests and enhancing the livelihood opportunities of the forest dependent communities. The Eastern Ghats is one of the major geographical realms of India, running parallel to the east coast for about 1750 km passing through four major states, Odisha, Andhra Pradesh, Telangana, and Tamil Nadu, and has a spread around 75,000 km2. It supports various land use types such as croplands, forests, grasslands etc., on which 7% of the region's population is dependent. This paper, while delineating the forest types (Semi-evergreen to dry deciduous thorn types), presents the carbon stocks in various pools of different land use sectors, and compare with the similar situations of tropical forests information to assess the state of the carbon stocks and scope for the improvement.**

Keywords*— *Eastern Ghats, Land Use Categories, Forests and Agriculture, Carbon Sequestration

I. INTRODUCTION

In developing countries like India, the demand for forest products is quite pronounced as, more than 70% of the rural people in India, mostly rely on forests for their basic biomass needs, such as fuel wood, cattle feed, food and shelter. Unfortunately, little has been done to improve our understanding of potential sinks in tropical forests. Available information on the initial biomass and rates of regrowth as a function of age for the tropical forests is incomplete. Improved observations for identifying terrestrial sinks are necessary for quantifying regional contributions to terrestrial sources and sinks. An increase in annual productivity indicates an increase in the total standing biomass of Indian forests and its carbon uptake. (M. Lal and Roma Singh, 1998).

In this paper, we report the present status of forest cover in Eastern Ghats, and its carbon sequestration potential. Assuming an increase of 1.8 to 5Mhaper annum in forest cover with 3.2 tonnes per hectare productivity, projections of net annual carbon uptake by the Indian forests are also estimated for the future. In 2011, the CO2 removed from the atmosphere from the LULUCF sector offset about 14% of total U.S. greenhouse gas emissions. Forests (including vegetation, soils, and harvested wood) accounted for approximately 92% of this 2011 LULUCF CO2 flux. The total carbon sequestration by the LULUCF sector has increased by about 14% since 1990, largely as a result of changes in the land area of forests and improved forest management. (U.S. Climate Action Report 2010).The annual productivity of Indian forests is also reported to have increased from 0.7 m3 per hectare in 1985 to 1.37 m3per hectare in 1995 (FSI, 1988; 1996).As per current assessment, ISFR2013, total forest cover of the country is 697,898 km2 that is 21.23% of the geographical area of the country. In terms of density classes, area covered by VDF is 83,502 sq. km(2.54%), that with MDF is 318,745 sq.km(9.70%) and OF is 295,651 sq. km (8.99%).The recorded forest area of the Orissa state is 50,347 sq.km that is 34.91% of its geographical area. The recorded forest area of the Andhra Pradesh state is 46,116 sq.km that is 19.38% of its geographical area. The recorded forest area of the Tamil Nadu state is 23,844 sq.km that is 22.07% of its geographical area.

II. STUDY AREA

The Eastern Ghats constitute an important biogeographic region in the Indian region extending from Orissa, Andhra Pradesh to Tamil Nadu with an area of about 75000sq.km through a series of fragmented hill ranges. It supports various land use types such as croplands, forests, grasslands etc., on which 7% of the region's population is dependent.

The region supports evergreen, semi-evergreen, moist, and dry deciduous forest types that support a rich diversity of flora and fauna. An estimated 3000 species of flowering plants constitute the entire flora of the Eastern Ghats out of which at least 100 species are known to be endemic to the region. Increased economic activities along coastal region have led to exploitation of these forest ecosystems for fuel wood and fodder purposes. Eastern Ghats has suffered considerable degradation from pressures of deforestation and cyclonic destruction. (G. Areendran et. al, 2010)

Decimation of Eastern Ghats forests have not only affected the quality of the ecosystem and environment but also resulted in increased poverty among forest dependent communities by reducing the diversity and production capacities (Padmavathi, 2000). These communities are highly vulnerable to the climate change impacts and needed capacities for developing adaptation strategies. On the other hand the scope for carbon sequestration also is very high for this region.

III. METHODOLOGY

The basic methodology adopted in the carbon inventory assessment was carried out as described by Ravindranath and Ostwald (2008) which are compatible with IPCC guideline methodology.

IV. RESULTS AND DISCUSSION

The forest cover of the Eastern Ghats has been classified on the basis of tree canopy density into pre-defined classes, viz., very dense forest (VDF), moderately dense forest (MDF) and Open forest (OF).

Eastern Ghats is spread in three states ranging from districts Boudh to Malkangiri in Orissa, Srikakulam to Chittoor in Andhra Pradesh including telangana and Vellore to Theni in Tamil Nadu.

As per the FSI reports 2013, the total forest area of Eastern Ghats is 71,944 Sq. km out of which the Very Dense Forest is 5,488 Sq. km, Moderately Dense Forest is 35,249 Sq. km, and Open Forest is 31,207Sq. Km. VDF and MDF alone has a growing stock of 195.829 million cubic meters in Andhra Pradesh, 235.768 million cubic meters in Orissa and 116.042 million cubic meters in Tamil Nadu. The whole of open forest in Eastern Ghats constitutes an area of 31,207 Sq. Km, which has a scope for increasing the potential for carbon sequestration. With mean annual increment of 1.8 t B/ha/yr. the carbon stock will be 5.33 Million tones and with the best management practices the mean increment can range up to 5 t B/ha/yr. resulting in 14.8 Million tones.

According to the emission gap report 2013, the world's GHG's emissions for 2010, the latest data available stood 50.1 Giga tones which should reach a maximum of 44 Giga tonnes of carbon dioxide by 2020. India plays a vital role in contributing to this as it has a potential for growing forest stocks, which includes Eastern Ghats as major part of potential.

Eastern Ghats forests require urgent actions with regard to enhancing the potential for biological productivity through REDD++ approach in which all the forest products are developed on agricultural lands such a REDD++ system is a tree, crop, livestock joint production system of agro forestry (9). EG being one of the major sources for climate mitigation through land use sectors in India, the improved forest management practices of growing stocks in open forest helps reduce emissions.

TABLE I. VOLUME OF GROWING STOCK IN THE STUDY AREA

Physiographic Zone	Area of Physiographic zone (sq. km)	Volume of growing stock (m. cum)		
		Forest	TOF	Total
Eastern Ghats 2011	1,91,698	0	0	67.73
Eastern Ghats 2013	1,91,698	262.28	63.401	325.681

TABLE II. CARBON STOCK CHANGE IN THE STUDY AREA

Pools	Carbon stock in forests in 2004 as given in ISFR 2011	Carbon stock in forests in 2011 as given in ISFR 2013	Net change in carbon stock	Percent increase
Above ground	2,101	2,192	91	4.33
Below ground	663	694	31	4.68
Dead wood	25	27	2	8.00
Litter	121	130	9	7.49
Soil	3,753	3,898	145	3.86
Total	**6,663**	**6,941**	**278**	**4.17**

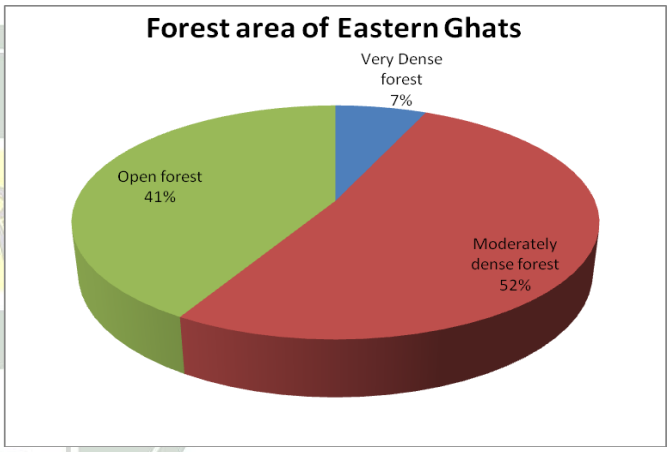

Fig. 1. Forest area of Eastern Ghats.

CONCLUSION

Owing to the results Eastern Ghats had a high scope of carbon sequestration potential and there is a need for assessing the carbon stocks and sequestration rates to understand the carbon dynamics to the land use conversions has assumed great importance.

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