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Why to Restore Mangroves? An Economic Assessment

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Abstract

Despite increasing pressures, the mangrove forest in India has increased by 181 sq. km in two years during 2015-2017. This increase is estimated here for ecological service values. The increased forest cover was likely to result in a storage of 14.38 million CO2 equivalent with economic value of 58 million USD for the carbon credit. Also, the increased forest had possibly added over 84,000 million individuals of commercial finfish and invertebrates to mangrove coastal waters with additional annual catch of 1 million ton and economic gain of 112 million USD. The increased forest cover is further estimated to have safeguarded 4.4 million people from flood damages. The economic benefits accrued as a result of the increased forest cover is multifold greater than the cost of plantation, and hence it is a cost-effective venture. However, 40% of mangroves in India are of open type and degrading and it is suggested to double the efforts of mangrove restoration and conservation, aiming to increase the annual forest cover of 181 sq. km so as to achieve the target of 6,000 sq. km within 6 year period and to contribute more to ecosystem services .

Keywords: Mangroves; India; Restoration; Ecosystem services; Carbon storage; Fisheries

Introduction

Mangroves are among the most valuable ecosystems on Earth in fish food production, carbon sequestration, coastal protection, tourism, water purification and coastal livelihood [1-5]. Long term survival of the mangroves is at a great risk, and the ecosystem services offered by the mangroves may totally be lost in the world within the next 100 years [6]. With increasing destruction and degradation, mangrove conservation and restoration are a matter of necessity especially with growing threat of climate change especially sea level rise. Hence, the mangroves have been of much focus in many countries. In India, the importance of mangroves in coastal protection against natural disasters has largely been realized only after the disasters of the 1999 super cyclone in Odisha and the 2004 Asian tsunami [3]. India is considerably successful in conservation and management of mangroves as evident by increasing forest cover in the recent years. However, impact of this increase on the ecological service values is largely unknown. Hence, it is difficult to convince the policy makers to support the mangrove programs with huge funding in the years to come. In this regard, the Nature Conservancy and IUCN, in collaboration with the University of Cambridge have prepared the global map on mangrove restoration potential with estimates of ecological service values in different countries of the world [7]. This forms the basis of the present article to analyze the trend of mangrove forest cover in India and its possible impacts on economic benefits.

Mangrove cover in India increased by 21.63% from 4,046 to 4,921 sq. km in the past 30 years from 1987 to 2017 at the rate of 0.72% per year. The mangrove cover decreased in two areas (Andhra Pradesh and Andaman and Nicobar Islands), while it increased in all other places of the country: by 168% in Gujarat; 117% in Maharashtra; 113% in Tamil Nadu; 22% in Odisha; 26 folds in Goa; 10 folds in Karnataka; 9 folds in Kerala; 3 folds in Daman and Diu; and, 2 folds in Puducherry (Table 1). Recently the mangrove cover increased by 181 sq. km at the rate of 1.9% per year during the two years between 2015 and 2017, significantly in the states of Karnataka by 2.3 folds, Maharashtra by 36.9%, Andhra Pradesh by 10.1%, Odisha by 5.2%, Tamil Nadu by 4.3%, and Gujarat by 3% [8]. The Sundarbans in West Bengal occupies the largest part of mangrove cover in India that is 43% of total, but there is only a marginal increase of 1.83% in the cover during the period 1987-2017 at the annual rate of 0.061% in the past 30 years, and recently at 0.2% during 2015-2017. The increase in forest cover can be attributed to the governmental efforts in implementing the management action plan in 38 selected mangrove areas of India, with legal and financial supports as well involvement of stakeholders [2].

Table 1: Long term and short-term changes of mangrove cover in different maritime states and union territories of India (SFR, 2017)

	Mangrove cover (sq.km)			Changes of cover (sq.km)	
	1987	2015	2017	Long term (30 years; 1987-2017)	Short-term (2 years; 2015-17)
Andhra Pradesh	495	367	404	–18.38	+8.4
Andaman and Nicobar	686	617	617	–10.05	0
Gujarat	427	1107	1,140	+167.98	+2.8
Maharashtra	140	222	304	+117.14	+21.2
Odisha	199	231	243	+22.11	+4.7
West Bengal	2,076	2106	2,114	+1.83	+0.4
Goa	0	26	26	+ 26 fold	0
Kerala	0	9 (0.2%)	9	+9 fold	0
Daman and Diu	0	3	3	+3 fold	0
Karnataka	0	3	10	+10 fold	+41.2
Tamil Nadu	23	47	49	+113	+3.9
Puducherry	0	2	2	+2 fold	0
Total	4,046	4,740	4,921	21.63	+3.7

In India, the mangrove cover has increased by 181 sq. km between the years 2015 and 2017. This increase is estimated here for ecosystem service values, following the Global map on Mangrove Restoration Potential [7]. This increased forest cover was likely to provide an additional total carbon stock of 3.92 million tons that included 2.65 million tons of carbon in soil and 1.27 million tons of carbon in above-ground biomass. This carbon stock is totally equivalent to the CO2 storage of 14.38 million tons. The increased forest is also estimated to have safeguarded 4.4 million additional people from flood damages. Further, the increased forest possibly added to a total of about 84,000 million individuals of commercial fishes that include 19,334 million individuals of finfish and 64,666 million invertebrate individuals during the two-year period (2015-17). The increased mangrove cover is estimated to support an additional annual catch of 1 million tons that included 0.72 million tons of shellfish and 0.28 million tons of finfish corresponding to the economic gain of 112 million USD that included 92.4 million USD for shellfish and 19.6 million USD for finfish, as calculated from our earlier report [9]. In addition, economic benefit of the increased mangrove cover for stocking 14.38 million tons CO2-equivalent of carbon credit is estimated at 58 million USD in the market value at the rate of $4/ton.

The economic value of restored mangroves in India would be much higher if other ecosystem services are also included in providing firewood, timber, cattle feed, honey, medicines, pollution abatement and tourism development as well coastal protection of lives and property against natural calamities. The fish and carbon values alone accounted for the economic value of 170 million USD for the increase of forest cover. However, the cost of restoration in 181 sq. km is only 7.49 million USD @ 41,400 USD per sq.km. The benefits accrued as a result of mangrove restoration is many folds greater than the cost of plantation, and hence it is a cost-effective venture. Indian mangrove cover is classified in terms of density of cover as very dense, moderately dense, and open types based on per cent of its green cover: >70%, 40-70% and 10-40% respectively. Based on this, the extent of very dense cover is 1,481 sq. km (30.1%), moderately dense is 1,480 sq. km (30.07%) and open type is 1960 (39.83%)[8]. Among these types, the open type of mangroves is degrading ones, which may be more vulnerable to climate change, especially sea level rise in Andhra Pradesh, Tamil Nadu, Kerala, Gujarat, Maharashtra and Puducherry, than other mangrove types. Hence, it is necessary to transform the open type into dense mangroves.

As per the global map on mangrove restoration potential [7], India has a total degraded area of about 12 sq. km that is 0.24% of the total mangrove cover in the country, and 0.83% of the total degraded area of 1388.56 sq. km in the world. The mangroves also degraded by 0.5% of unprotected areas and 0.1% of protected area. Since 1996, mangrove loss in the country is 7.1% in the forest outside protected areas and 3.6% in that inside protected areas. Hence, restoration of degraded mangrove areas deserves much attention especially in unprotected areas. Mangrove restoration can be a countermeasure for global warming as it reduces considerable emission of carbon to atmosphere (4.5), and it can also be utilized for carbon trading as well REDD (Reducing Emissions from Deforestation and Forest Degradation) [2]. Total restorable area in the country is estimated at 152.41 sq. km, that is 2% of the world restorable area of 8,120.03 sq km as per the global map on Mangrove Restoration Potential . However, this seems to be lower than restorable area in this country.

India had a mangrove cover of 6,000 sq. km during 1960s, and it reduced by 17.9% to 4,921 sq. km in 2017. However, since 1995, the mangrove cover has got stabilized closer to 4,500 sq. km with an increasing trend, despite increasing natural and man-made pressures [10]. It is necessary to achieve a target of 6,000 sq. km of mangrove cover by restoring the potential areas.

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This may be achieved only after 11 years at the present rate of 91 sq. km increase in a year. Hence, the effort of increasing the mangrove cover should be doubled to achieve at least 182 sq. km per year, so that the target of 6,000 sq. km can be achieved within a period of 6 years. This is felt important in view of India's target to create an additional carbon sink of 3 billion tons of CO2 equivalent through additional cover of all the forests by 2030.

Mangrove planting efforts are often a failure in several instances. There was 46% failure in 48 restoration sites with 1,27,832 hectares of area restored in south Asian countries being the highest failure of the restored sites in other regions of the world. In this regard, 'ecological restoration' is essential to provide right tidal water flow and land elevation for natural regeneration and planting with suitable species for accelerating recovery. A continuous monitoring of growth, and survival of mangrove species is necessary in addition to maintaining the normal tidal water flow, supplementary planting, weed/pest removal, trash removal, avoiding cattle grazing and desiltation in the restored areas [2,7,11]. Further, the best proven practices of participatory management for mangrove restoration can suitably be replicated.

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