Loss of carbon credit through radical change in land use pattern

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Abstract

Coastal vegetations comprise the blue carbon community of the planet Earth. The community is known for its carbon sequestering potential since long evolutionary period of time. However, rapid industrialization and urbanization have changed the landscape and land use pattern in the coastal zone that has significantly hampered the carbon storage potential of coastal producer community. It is thus a challenge of the era to restore the situation, and earn carbon credit with the primary aim to stabilize the greenhouse gas reservoir in the atmosphere. The present article is an approach towards this direction supported with few case studies and information.

Keywords: Blue carbon, carbon sequestration, carbon credit, land use change

Preface

The issue of mitigation and reduction of atmospheric carbon dioxide has floated the concept of carbon credit to the surface of the global community. Anthropogenic carbon dioxide started emitting to the atmosphere since the dawn of human civilization when man attempted to light fire by rubbing the stones. Today, the widespread use of fossil fuel to run the wheel of civilization has collapsed the atmospheric stability in terms of concentrations of greenhouse gases. Another dark chapter has also been opened up with the advent of civilization, which is basically changing the landscape and land use that
have caused an adverse impact on the climate of the planet Earth. Massive deforestation for urban and industrial development coupled with unplanned expansion of tourism and aquaculture have altered the hydrological cycle, albedo and carbon budget of the region. Forests play a crucial role in regulating the climate of the planet Earth by acting as important store houses of carbon. Forests plant and soils drive the global carbon cycle by sequestering (storing) carbon dioxide through photosynthesis and releasing it through respiration. When the uptake of carbon dioxide (photosynthesis) exceeds losses via respiration, harvest and management, then forests store carbon (C sinks). In an undisturbed forest ~ 74% of the carbon dioxide is stored in live stems and branches, 16 % is stored in roots and 10 % in soils. The global sink in forest vegetation and soils is estimated to be 1200 Gt of carbon (1 Gt = 10^9 tonnes). This is increasing at a rate of 1-3 Gt annually. The carbon sequestering capacity of the producer community has been greatly squeezed due to clearing of forests and grasslands.

**Major threats to blue carbon community**

Coastal vegetations are efficient carbon sinks that sequester and store large quantum of carbon in biomass (above and below ground biomass) and underlying sediments for a considerable long period of time. The carbon sequestration capacity of mangroves, seagrass beds, tidal marshes and other marine and coastal vegetated ecosystems has been a focus of considerable attention in recent times, and the carbon stored in their biomass and sediments is coined as ‘blue carbon’.

In context to contraction of the blue carbon domain, Ahmad and Suratman (2007) conducted a change detection analysis of mangrove forests utilizing a time series of Landsat TM imagery in Pulau Indah (literally translated means “Beautiful Island”) and its vicinity in Malaysia. This analysis was focused on determining mangrove reduction rates and identifying their spatial patterns within two interval periods, 1995 to 1999 and 1999 to 2005 (Fig. 1). Results from the analysis suggested that there has been a decline in mangrove forests during both intervals at the rates of 14.1% and 1.9%, respectively. The higher declining rate during the first interval was primarily due to expansion and land development for building seaport infrastructures on this island. The estimated reduction
The rate of mangrove forests for the 10 year-period was 1.6% per year, which is slightly higher than reported nationally by Ong (1982) over the past 20 years (i.e., 1% per year).

Fig. 1. Decline of mangrove forests in Pulau Indah, Malaysia. Area in dark green represents mangrove forests (Ahmad & Suratman, 2007)

The landscape alteration is significantly visible in the coastal regions throughout the world. In coastal areas and estuarine villages, modification of landscape is done in large scale to promote aquaculture and to a lesser extent tourism. The term aquaculture encompasses the culture of aquatic species ranging from seaweed to fish. Oyster culture, crab culture, mussel culture, clam culture etc. are all the vital components under aquaculture. The mangrove ecosystem offers a congenial, natural condition for the growth and survival of aquacultural species. The nutrient provided by mangrove litter and detritus promotes the growth of phytoplankton and subsequently the zooplankton which are the natural feed for the cultured species. This is the main reason why coastal aquaculture farms are constructed on salt marshes and intertidal mudflats of mangroves.

The rate of reclamation of marshes and particularly mangrove swamps has accelerated in recent years in some parts of the tropics due to the rapid expansion of pond farming of shrimps for export (Fig. 2). About 50% of the mangrove forests in the Philippines have been developed into brackishwater fish ponds (Saclauso, 1989). The area converted in Thailand is estimated to be about 27% and in Ecuador about 13-14%. Such large scale conversions have aroused considerable environmental concern among the public and development agencies.
Tabuchi (2003) estimated that on a global scale, the area under mangroves is shrinking by 100,000 hectares annually due to clear cutting of timber and conversion into aquaculture projects.

Fig. 2. Shrimp culture ponds in mangrove patches: A common scene in tropical mangrove ecosystem; Photograph taken on 04.12.2013 by Mr. Tanmay Ray Chaudhuri (Environmentalist and a researcher of Techno India University, Kolkata)

In many countries the coastal area is exploited for procuring salt from the seawater. About 30% world’s supply of salt comes from seawater. In order to keep the cost of production low, natural evaporation is used for extracting salt from the seawater. In the south of France, Puerto Rico, central California, the Bahamas, Hawaii, and the Netherland Antilles, sea salt is extracted and refined to produce table salt. The process begins by allowing seawater to enter shallow ponds. Evaporation of the water produces a concentrated salt solution to which more seawater is added. Finally, the water is allowed to totally evaporate, leaving a thick salt layer behind, which can be processed
commercially. In Indian sub-continent salt pans (Fig. 3) are developed in mangrove patches located along the coastlines of maritime states which causes vertical and horizontal migration of salts in the adjacent areas. This has profound negative impact on the survival and growth of coastal vegetation. High salinity reduces the growth of mangroves and even results in complete extinction of certain species like *Heritiera fomes*.

![Fig. 3. Coastal waters stocked in shallow ponds for procuring salt through evaporation; Photograph taken on 04.12.2013 by Ms. Ankita Mitra (Environmentalist, Asutosh College, Kolkata)](image)

The marshy areas and mangrove patches are also destroyed in few areas of lower Gangetic delta through development brick kilns (Fig. 4). The soil excavated for developing shrimp farms are used to manufacture bricks, which is a spin-off product of shrimp industry. The construction of brick kilns in swampy areas not only adds carbon dioxide to the atmosphere (a local level effect), but also clears the vegetation and modify the marsh soil, which otherwise are rich reservoir of carbon.
Loss of carbon credit: A challenge

The lead author Dr. Abhijit Mitra personally visualizes this issue as a challenge and not as a problem. If this is considered as a problem, the stakeholders become a part of the hindrances and obstacles, but if this is considered as a challenge, the local people and stakeholders can be brought under the loop of solution. A challenge is basically an adventure, a journey to eradicate the problems rather than highlighting the problems with an amplified form. It is undoubtedly a critical issue in the present world that how the blue carbon can be adapted to withstand the negative pressure of rapid and unplanned coastal development due to which the land use pattern is abruptly changing. Will it be wise to develop a policy so as to stop totally the developmental activities in the blue carbon dominated zone or permit the activities with precautionary measures like monetary
compensation, afforestation of similar magnitude to balance the deforestation or any other institutional mechanism that can afford both development and ecosystem productivity within the same frame? The authors believe that capacity building of the local stakeholders may be one of the important solutions in this context. The empowered local people can serve as an extension board of the KNOWLEDGE HUB after being properly trained in the HUB. The voting on this issue is invited from people of all walks of the society in the ballot mail box abhijit_mitra@hotmail.com.

References


