Advances in life science research

Comparative assessment of soil nutrient retention capacity of mangrove and non mangrove areas of Perumba river of Kannur District, Kerala, South India

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ABSTRACT

In this paper an attempt has been made to compare the nutrient retention status of mangrove and non mangrove areas of Payyanur Municipality of Kannur District, Kerala. Mangroves are specialized ecosystems developed along the estuarine sea coasts and river mouths in tropical and subtropical regions of the world. The ecosystem is also considered as most productive and diverse, providing significant functions in the coastal zones as buffer against erosion, storm surge and tsunamis. The carbon fixed in mangroves is highly important in the coastal food webs and the litter from mangroves and the subsequent formation of detritus and its tidal export have also profound effect on promoting biodiversity richness. The property of nutrient retention capacity of mangrove and non mangrove areas were given special attention in the present study. The importance of soil in controlling elementary cycles is crucial. Inorganic nitrogen, phosphorus, and potassium are the most essential nutrients deposited in the mangrove system, which are then recycled and disseminated to surrounding areas. The study region area was classified into mangrove and non-mangrove areas and standard procedures were used to analyze the soil samples for organic carbon, nitrogen, phosphorus, and potassium. The total quantity of nutrients in mangrove areas was found to be higher than in non-mangrove areas. The findings demonstrate nutrient retention capacity of the mangrove soil and the importance of its preservation.

KEY WORDS
Mangroves, Nutrients, Ecosystem, Retention, Sediment and Biodiversity.

Introduction

Mangroves are attributed with ecological roles or processes at the global, ecosystem, and population levels. People benefit from a number of goods and services provided by mangrove ecosystems, notably safety from floods and storms, production of a diversity of plant and animal products, nutrient uptake and transformation and sediment trapping. Natural ecosystems perform fundamental life supporting services without which human civilization would cease to thrive (Daily, 1997).

Mangroves constitutes the preponderance of the worlds tropical and subtropical coastlines, spanning 15 million hectares of forest land and given that habitat for a diverse range of organisms, including fungi, algae, and bacteria, as well as birds, insects, and mammals. (FAO, 2004). Mangroves are extremely productive, capturing massive volumes of CO_2 and other greenhouse gases, which they subsequently trap and retain for millennia in their carbon-rich waterlogged soils (Duarte and Cebrian, 1996).

Despite their high carbon content, mangrove ecosystems are often nutrient deficient. The significant productivity is achieved by efficient nutrient cycling and its conservation methods in areas where nutrients hinder growth.

One of the most significant ecological variables is soil. The soil is where plants get their nutrients, water, and anchoring. Apart from regulating the water cycle, soil would provide five interrelated services: it shelters seeds through offering physical support, it preserves and supplies nutrients to the soil, it plays a key role in the decomposition of organic materials, the inorganic chemicals produced by decomposition return to the plant as nutrients, and it is a pivotal parameter that influences elementary cycles (Sreeja et al. 2009). The bulk of the nutrients in mangrove forests are retained in the soil rather than the trees (Alongi et al. 2003). Significant nutrients are released in water and sediments during tidal action, as well as intermittently in floodwaters connected with cyclones and hurricanes. (Davis et al. 2003). Mangrove environments are rich in organic matter due to the high amount of carbon allocation to roots, along with mangrove litter fall and low rates of decomposition enforced by anoxic soils (Nedwell et al. 1994). Decomposition of mangrove vegetative matter is an important source of nutrients in the mangrove ecosystem, as well as for nearby coastal ecosystems through tidal flushing, despite modest rates of decomposition in anoxic soils (Lee, 1995). The frequency and extent of tidal inundation is ascertained by topographic variables such as elevation, which directly effects nutrient availability, oxidation state, salinity of the soil, tends to result in complex forms of nutrient demand and supply that make a significant contribution to the variable structure of mangrove forests. The present study was conducted in the mangrove and non mangrove areas of Perumba river and nearby areas of Payyanur Municipality of Kannur district to compare the soil nutrition status.

Study Area

Perumba river, one of the west flowing river of Northern Kerala, originates from Pinkunnumala and has a length of 51 Kms. It passes through Payyanur in Kannur district. The area in which the river passes through Payyanur and nearby areas was selected for present study. The study area is located between12°23.42"-12°15'7. 22" N Latitude and 75° 10' 21.06" - 75° 24' 35.70" E longitude (Figure 1).

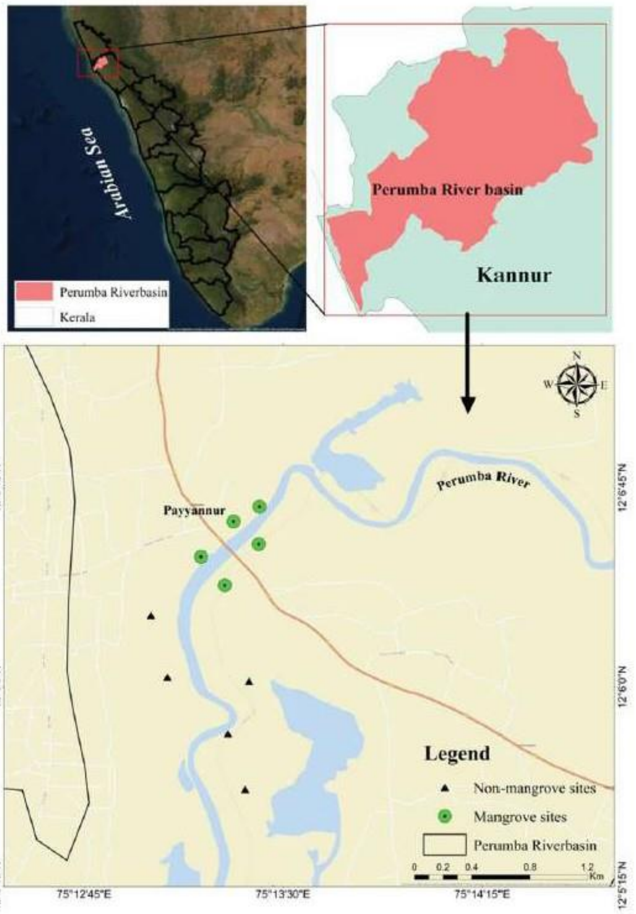

Figure 1. Location map of study area with sampling sites

Materials and Methods

A thorough reconnaissance survey was carried out in the study area during January 2018 to June 2018 to fix up the mangrove and non mangrove area for the present study. Discussions were held with stakeholders, field biologist and scientists to understand the nutrient retention associated with mangroves.

The study area was divided into mangrove and non-mangrove sites for the collection of soil samples. Sampling sites were selected in such a manner that the whole study area gets represented. The soil samples were collected from five points having 15 cm depth from each site. The collected samples were air dried and kept in plastic bags for laboratory analysis. The sieved fine soil was analysed.

The pH and electrical conductivity were measured by digital pH meter and conductivity meter respectively. The Organic carbon was measured by following Walkey and Black (1934) method. Nitrogen, phosphorous and potassium content of soil were analysed by following Subbiah and Asija (1956), Bray's method and Flame photometry respectively.

Results and Discussions

The present study revealed the variations in nutrient levels of soil in mangrove and non mangrove areas. In terms of pH, the soils from mangrove and non mangrove sites show acidic nature. There were no significant variations in electrical conductivity of soils of mangrove and non mangrove areas. The levels of nutrients in mangrove areas are greater than that of non mangrove areas (Table 1). The level of Organic carbon in the mangrove and non mangrove areas are l.71Kg/ha and 0.9 Kg/ha respectively. The status of total nitrogen, phosphorous and potassium in mangrove areas are in the order of 0.14Kg/ha, 0.09 Kg/ha and 23.94 Kg/ha and in the non mangrove areas are in the order of 8.5 Kg/ha, 490 Kg/ha and 104 Kg/ha respectively (Table 2, Figure 2 and Figure3).

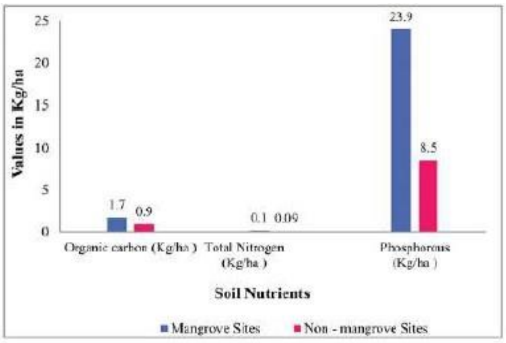

Figure 2. The variations in soil nutrients status of mangrove and non mangrove areas

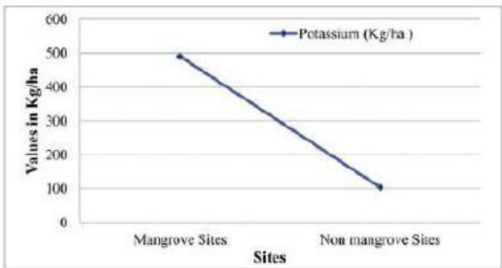

Figure 3. The level of soil Potassium in mangrove and non-mangrove areas

Figure 3. The level of soil Potassium in mangrove and non-mangrove ureas

From the study it was clear that the nutrient retention capacity of mangrove vegetation is the reason for high level of nutrients associated with soils of mangrove areas. The levels of pH and EC shows similarity in mangrove and non mangrove areas and the average pH of both the sites are acidic. It indicates that humic acid production in wetland is more or less similar irrespective of the presence of mangroves. The organic carbon and other organic matter production in mangrove area is higher than that of other wetland areas and the mangrove litter fall and low rate of decomposition due to anoxic condition accelerate the production process. Despite limited decomposition rates in anoxic soils, mangrove vegetative material breakdown is an important source of nutrients in the mangrove ecosystem.

Table I. The level of soil parameters in various sites of mangrove aad non mangrove areas

Sl. NO	Parameters	Mangrove site					Non mangrove site				
		MS-I	MS-2	MS-3	MS 4	MS-5	NS-1	NS 2	NS-3	NS-4	NS-5
1	pH	5.1	5	5.3	5.7	5.9	5.3	5.4	5.7	6.1	5.7
2	Electrical Conductivity (µmhos/cm)	.31	0.45	0.52	0.47	0.39	0.37	0.33	0.42	0.56	0.4
3	Organic cnrbon (Kg/ha)	0.91	2.01	2.51	1.63	1.48	0.72	0.84	1.1	1	0.73
4	Total Nitrogen (Kg/ha)	0.17	0.14	0.14	0.16	0.09	0.11	0.13	0.07	0.01	0.15
S	Phosphorous(Kg/ha	27.62	21.34	23.77	22.96	24.02	6.6	9.18	10.11	7.9	8.65
6	Potassium (Kg/ha)	510	488	476	484	491	97	108	119	81	113

Table 2. Average nutrients status in mangrove non mangrove areas

Sl. No	Parameters	Mangrove Sites	Nonmangrove Sites
I	pH	5.4	5.64
2	Elcclrical Conductivity (µhos/cm)	0.43	0.42
3	Organic carbon (Kg/ha)	1.71	0.9
4	Total Nitrogen (Kg/ha)	0.14	0.09
5	Phosohorous (Kg/ha)	23.94	8.5
6	Potassium (Kg/ha)	490	104

Summary

It can be summarized on the basis of result of the present study that mangrove vegetation is vital component of wetland ecosystem and the mangrove soil act as nutrient source and sink. The mangrove area contain high amount of Phosphorous and Potassium. It is not seen in other wetland areas. The other nutrient levels may also be high in mangrove areas. So in terms of nutrient retention and recycling process, mangrove vegetation has an important role. The alarming rate of wetland reclamation and associated human activities continuously threats the mangroves. Mangroves are our wealth, it should be protected.

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