

Mangroves are highly productive and protective ecosystem.’- Justify the statement

1. Introduction

Mangroves are salt tolerant forest ecosystems found mainly in the tropical and sub-tropical intertidal regions of the world. They encompass swamps, forest-land within, and the surrounding water bodies. It is a matter of great surprise that mangrove floral species can thrive luxuriantly in saline habitat (which is basically physiologically dry in nature) through orientation of their morphological, anatomical and physiological systems. Mangroves are salt-tolerant plants that as of today – cover more than 15 million ha of tropical coastal areas worldwide. Even though they make up only 0.1% of the global landmass, mangrove forests are one of the Earth’s most climate resilient, productive and biodiverse ecosystems. Thus, this vegetation is the most efficiently adapted biotic community in response to climate change induced sea level rise. Mangrove ecosystems have many values. Providing habitats for a wide range of species, coastal ecosystems are a source of food, medicines, and forestry products. In many regions, the tourism and recreational value of coastal ecosystems is significant, and if this value is realized can contribute

One key indirect value is the protective function of coastal ecosystems against wave and storm energy, both in terms of ongoing coastal erosion and from potentially destructive cyclones or typhoons. However, decision-makers often undervalue these shoreline protection services. In tsunami-affected coastal areas, however, there is an opportunity to assess the protective values of mangrove and coral ecosystems, supported by field-based evidence, to promote conservation of these ecosystems for the livelihoods of coastal communities.

2. Mangroves

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swamps, forest-land within, and the surrounding water bodies. It is a matter of great surprise that mangrove floral species can thrive luxuriantly in saline habitat (which is basically physiologically dry in nature) through orientation of their morphological, anatomical and physiological systems.

3. Mangroves are Highly Productive Ecosystem

Mangroves are highly productive ecosystems with various important economic and environmental functions. The uses of mangroves fall into two categories:

Firstly, the indirect use of the mangrove ecosystems is in the form of vital ecological functions such as control of coastal erosion and protection of coastal land, stabilization of sediment, natural purification of coastal water from pollution.

Secondly, the economic benefits which are many and varied. Apart from prawn fisheries, many other biological species of economic importance are associated with mangroves; these include crabs, shrimps, oysters, lobsters and fish.

Mangrove forests accelerate the siltation processes, check soil erosion and protect coastal areas from frequent tidal thrust, cyclonic storm and devastating surges from the bay.

Mangrove sediments are effective in retaining heavy metals and nutrients from seawater, but it is essentially anaerobic. All soil nutrients vary seasonally, in response to wet and dry periods of climate. Results of the previous studies show that most pollutants are accumulated in the top layer of the soil tray. The wastewater inputs and salinity would have more significant effects on the microbial activities in mangrove soils.

Mangrove plants intake nutrients from the tidal sea water, river courses and the mangrove ecosystems, as such, provide natural food to the mangrove dwelling fauna.

Mangrove is one of the fragile but highly productive ecosystem found along our Indian coast. Already vast mangrove areas have been degraded to wastelands as a result of deforestation, reclamation and pollution. It has also adversely affected the coastal fisheries.

Indian has approximately 700,000 ha of area covered by mangroves along the estuaries and major deltas. There are vast degraded intertidal wetlands which can be used for various purposes. These areas can be

brought to their pristine glory and high productivity by taking up large scale mangrove afforestation programs along the coast.

The mangroves are angiosperms, with 45 species in India. They have special characters like viviparous germination, pneumatophores, prop or knee roots and salt glands. These trees form a thick forest belt on the deltas, along major estuaries, and fringe the estuarine banks, as well as backwaters. This unique tree resources is used for various purposes like tannin extraction, paper and pulp, firewood, timber, charcoal, fodder and several other by-products. The mangrove swamps are rich in the larvae of many economically important fishes, prawns, crabs and bivalves. These are the most suitable area for feeding, breeding and nursery grounds of these marine organisms and hence important for aquaculture purposes.

When seedlings are collected, check these for any insect borer or other infections and injuries. Discard such seedlings. Select only healthy, non-infected and fully matured seedling.

Any intertidal area (between the high tide and low tide) where mangroves are absent and the substratum is of soft clay or mud and is inundated by regular tidal waters every day, are suitable for direct mangrove planting. Select the sites where intertidal expanse is more. Along the Gujarat coast and West Bengal, where intertidal expanse is very large with highest tidal amplitude of 6 to 8 m, the upper limit of 1 m tidal water level has to be selected.

4. Mangroves are Highly Protective Ecosystem

The highly specialized mangrove ecosystem also acts as the protector of the coastal landmass from storm surges, tropical cyclone, high winds, tidal bores, seawater seepage and intrusion. Large numbers of references are available in context to tsunami of 26th December, 2004 suggesting that mangroves both dissipated the force of the tsunami and caught the debris washed up by it, and thus helped to reduce damage (IUCN, 2005).

Bioaccumulation of heavy metals by certain mangrove species reveals a most surprising feature about these plants as they can act as bio-purifier or bio-filter. Few species of mangroves are highly efficient in detecting or assessing the change of ambient environment. The concentration of heavy metal pollutants in

different parts of mangrove plants may act as a pathfinder for water quality monitoring program (Mitra et al., 2004).

Mangroves are ideal nesting grounds for many water birds such as the great white heron, reddish egrets, roseate spoonbills, white-crowned pigeons, cuckoos and frigate birds. The excretory materials of these birds (rich in phosphorus) serve as the fertilizers of the adjacent water bodies on which the primary production of the aquatic phase depends.

Mangrove forests are the housing complexes for bees, birds, mammals and reptiles from which honey, wax, food etc. are obtained. The most commonly used methodologies for assessing the protective values of ecosystems are based on costs. There are two main types of cost-based methods:

1. The expected damages avoided by maintaining the ecosystems' protective functions, such as the costs of replacing infrastructure, or the losses to productive values of land.
2. The defensive expenditures required to replace the protective function of the ecosystem, such as the costs of constructing and maintaining sea wall or windbreak infrastructure.
3. The costs of relocating communities if protective functions are lost.

The mangrove vegetations and their associates are economically very important for their products like timber, fire-wood, honey, wax, alcohol, tannins.

Mangroves have immense ecological value. They protect and stabilize the coastal zone, fertilize the coastal waters with nutrients, yield commercial forest products, support coastal fisheries and provide a surprising genetic reservoir that are the sources of several bio-active substances and extracts having high medicinal values. Thus, this unique vegetation of the globe provides various direct and indirect benefits to the stakeholders. The direct uses focus mainly on the timber, fire wood and honey production. The indirect uses may be related to litter and detritus contribution by this ecosystem due to which a food web is generated and large spectrum of finfish and shellfish juveniles are attracted and nourished. Mangrove forests are among the world's most productive sites, producing organic carbon well in excess of the ecosystem requirements and thus, contributing significantly to the global carbon cycle. The carbon sequestration property of mangrove flora has added another feather to the crown of this vegetation particularly after the

Clean Development Mechanism (CDM) concept has been introduced. The mangrove ecosystem forms the backbone of coastal economy in certain pockets of the globe for its various benefits to coastal population.

5. Conclusion

Mangroves are highly productive ecosystems with various important economic and environmental functions. The highly specialized mangrove ecosystem also acts as the protector of the coastal landmass from storm surges, tropical cyclone, high winds, tidal bores, seawater seepage and intrusion. In the coastal areas affected by the Indian Ocean tsunami, there are opportunities to demonstrate the protective value of mangrove ecosystems, rigorously supported by field-based evidence. Although the probability of the tsunami occurrence is very low, the potential damage is high and could be related to the potential damage caused by extreme weather events, such as cyclones and typhoons. Substantial contributions could be made to assessing the protective value of coastal ecosystems to build infrastructure, productive values of land, and the values of other natural resources essential to the livelihoods of coastal communities. Mangrove forests accelerate the siltation processes, check soil erosion and protect coastal areas from frequent tidal thrust, cyclonic storm and devastating surges from the bay. The expected damages avoided by maintaining the ecosystems' protective functions, such as the costs of replacing infrastructure, or the losses to productive values of land. Mangrove forests are the housing complexes for bees, birds, mammals and reptiles from which honey, wax, food etc. are obtained. The most commonly used methodologies for assessing the protective values of ecosystems are based on costs. The defensive expenditures required to replace the protective function of the ecosystem, such as the costs of constructing and maintaining sea wall or windbreak infrastructure. The costs of relocating communities if protective functions are lost.

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