



The Role of Wetlands for Climate Change Mitigation and Biodiversity Conservation

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ABSTRACT: Wetland is crucial in supporting biodiversity conservation and climate change regulation. A wetland ecosystem has been influenced by anthropogenic driven climate change. The main objective of this paper is to analyze the role of wetlands for climate change mitigation and biodiversity conservation through literature review. Wetland is vulnerable to climate change through alterations of hydrological regimes that lead to changes in quantity and quality of water. Climate change is undoubtedly the most pervasive, complex and challenging of the global environmental issues facing contemporary society and it affects all aspects of development. Wetlands play a key role in hydrological and biogeochemical cycles, and provide a wide range of ecosystem goods and services to humankind. In spite of these facts, wetlands are considered as wastelands in the past, which contributes for deterioration of wetlands in several places. Thus, strong environmental policy is required for the conservation of wetland ecosystem.

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Wetlands play a key role in hydrological and biogeochemical cycles, and provide a wide range of ecosystem goods and services to humankind. Wetland has the capacity to retain water during dry season and keeping the water table high and moderately stable (Orimoloye *et al.*, 2018). It has a potential to regulate a microclimate (Simsek and Odul, 2018). Wetlands provide many ecosystem services that are critical to reduce the vulnerability of communities to climate change in general and to extreme weather events in particular. Wetland has a fundamental ecological function that plays an irreplaceable role in serving biological survival and human development (Chen *et al.*, 2019). The total carbon stock in wetlands was more than double as compared to converted cultivated as well as grazing lands (Kassa *et al.*, 2015). Climate change, sediment condition differences and human activities like agricultural practices, built up and deforestation are the major causes of wetland deterioration (Orimoloye *et al.*, 2018). Lee *et al.* (2018) justify that wetland function has mostly limited to individual wetlands and overall catchment functions have rarely been investigated.

Globally wetland ecosystems are under threats due to change in water regimes as a result of river regulation and climate change (Fu *et al.*, 2015). Global climate change is recognized as one of the key drivers of degradation of wetland ecosystems, causing considerable change of services provided by these

habitats (Mehvar *et al.*, 2019). Expanding agriculture leads to habitat loss and fragmentation, drainage of wetlands, and impacts on freshwater and marine ecosystems through sedimentation and pollution and is one of the greatest threats to biodiversity worldwide (World Bank, 2008). This study is aimed to review the role of wetlands for climate change mitigation and its potential in biodiversity conservation.

MATERIALS AND METHODS

This research work was conducted through scientific literature review. Various databases, Google scholar, Science direct, and Google web based search were used to review the role of wetland for climate change and biodiversity conservation. Finally, 23 most documents were selected for this review paper.

RESULTS AND DISCUSSION

Wetlands and Climate Change: Wetlands are among the most important natural resources on earth that provide a potential sink for atmospheric carbon but-if not managed properly, they become a source of greenhouse gases (Adhikari *et al.*, 2009). Wetlands are an important carbon sink, contributing for climate regulation (Villa and Bernal, 2018). Wetland systems worldwide have been influenced by anthropogenic change (Shand *et al.*, 2017). Wetlands are vulnerable to human-induced climate change (House *et al.*, 2016) but, if managed well, their ecosystems and

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biodiversity play a key role in the mitigation and adaptation of climate change and will be important in helping humans to adapt to climate change through their critical role in ensuring water and food security. Thus, it is sound to work on wetland restoration management, which is an important tool for stakeholders and practitioners to mitigate climate change and maintain ecological functioning (Dorau *et al.*, 2015). Wetland ecosystems are essential for climate change mitigation. Water and well-functioning wetlands play a key role in responding to climate change and in regulating natural climatic processes (through the water cycle, maintenance of biodiversity, reduced GHG emissions, and buffering of impacts). Conservation and wise use of wetlands help to reduce the negative economic, social and ecological effects (Ramsar, 2009).

Wetlands store higher carbon content relative to other terrestrial ecosystems (Naidoo *et al.*, 2019), they can function as either greenhouse gas sinks or sources depending on their type, their use and ambient conditions. Some wetlands are characteristically sources and others are sinks. Some have a different role at different times as determined by hydrology. Carbon sinks are ecosystems (the main ones being soil, oceans and forests) that store CO₂ in water, sediment, wood, roots, leaves and the soil.

Wetland Carbon Stocks: Wetlands cover 6% of the world's land surface but contain 14% of the terrestrial biosphere carbon pool. There is a significant amount of carbon stored in wetland soils, peats, litter, and vegetation (globally estimated 500-700GT). The amount stored in wetlands may approach the total amount of atmospheric carbon (estimated at 753GT) (IPCC,2002). Of various wetland types, peat land has been recognized worldwide as highly important for carbon storage since it accounts for nearly 50% of the terrestrial carbon storage with only 3% cover of world's land areal. Peat lands contain the most carbon (Guo and Gifford, 2002; Multiby and Immirz, 1993). The terrestrial biosphere is estimated to contain a carbon pool of 1943 Gt. Wetlands constitute a large global C reservoir at 230 Gt, exceeding agroecosystems (150 Gt) and temperate forests (159 Gt). Tropical wetlands store 80% more carbon than temperate wetlands (Bernal, 2008).

Wetlands play an important role in the regulation of global climate in two ways: through mitigation and adaptation. Mitigation, through reducing GHG emissions, largely concerns the protection and promotion of carbon sinks, through land-use and habitat management and also involves the encouragement of the use of non-carbon or carbon-

neutral energy sources, and the improvement of energy efficiency (Berry *et al.*, 2009). IPCC(2002) defined mitigation as an anthropogenic intervention to reduce net greenhouse gas emissions that would lessen the pressure on natural and human systems from climate change. Wetland ecosystems (including peat lands) also represent important natural carbon stores, and their restoration must be an essential component in climate change mitigation strategies. Based on these findings, the IPCC has subsequently concluded that the "restoration of drained and degraded peat lands is one of the key low-cost greenhouse gases mitigation strategies." Due to the rapid rate of vegetative growth and improved hydrology, wetland restoration is perhaps the most efficient (low-cost) method for sequestering carbon and reducing emissions in the short term (Bernal, 2008).

Required Actions for Improving Wetlands Conservation: Conservation of wetlands is a relatively recent priority, and it has seen more recent shifts from protection of remaining wetlands initially as a static biodiversity resource towards a focus on the many, formerly largely undervalued beneficial functions that these ecosystems provide to society (Maltby *et al.*, 2013). Policymakers have sufficient scientific information to understand the urgent need to take appropriate actions to conserve wetlands and their services to people (Gardner *et al.*, 2015). In order to reverse emerging problems and conserve these fragile but crucial wetlands, integrated problem solving approach through realizing the collaboration of relevant stakeholders from policy level down to grassroots community who have stake in wetlands should cooperate and contribute their part. Decision makers at higher levels are required to strengthen sustainable wetland management efforts through effecting policy and legislation, improving institutional arrangements and supporting capacity building initiatives.

Conclusions: Wetland played a crucial role in climate change mitigation and biodiversity conservation. Wetlands are among the world's most important-assets, providing the basis for human survival and development. Wetland has the potential to stabilize microclimates, retain and purify agrochemicals, toxicants and sediments; minimize the occurrence of drought and floods; and recharge ground water. However, because of over utilization, miss-understanding as well as lack of awareness from the public about the use of wetlands, wetlands are under threat. The over utilization of wetlands directly affects biodiversity conservation. For instance, study conducted in Ethiopia by Gameda *et al.* (2016) confirmed that the local communities are converting

wetlands for agricultural purpose which threatened the life of Black Crowned crane. Thus, proper management of wetlands is required from various sectors and organization.

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