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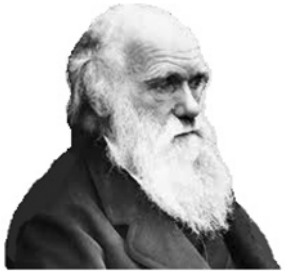

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The Impact on Wetlands: A Study Based on Selected Areas in Ampara District of Sri Lanka

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ABSTRACT

Wetlands are normally deemed areas where water covers soil all or part of the time. Wetlands are important because they protect and improve water quality, provide fish and wildlife habitats, store floodwaters and maintain surface water flow during dry periods. According to the Ramsar convention, wetlands are defined as "Areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters." (Ramsar convention, 1971). In Ampara District of Eastern Province, Kalmunai Municipality, the Karaitivu and Nintavur areas have some significant quantities of wetlands. However, increased population, construction works, town expansion and negligence have generated considerable damage to these. Thus, this research was conducted to identify the negative human impact on these wetlands. In so-doing, the following objectives were met: 'to find the challenges to wetland existence to note changes in the study area, to find the factors for the wetland deterioration and to suggest solutions to wetland conservation'. Primary and secondary data were used for this study. As primary data, questionnaire survey and direct observation were used. As secondary data, books, magazines, previous researches and statistics were used. The collected data were analyzed using SPSS and GIS software and suggest the practice of remedial measures such as creating proper waste management systems and enhancing the awareness of the value of the wetlands.

***Keywords*:** wetlands, Municipality, Settlement, and brackish

1. INTRODUCTION

Wetlands which contribute to the natural phenomena of a particular area have been facing many problems for years. All over the world, wetland is being declining. In the global context, coastal watersheds of the Atlantic, Pacific, the Gulf of Mexico and the Great Lakes' wetlands were lost at an average rate about 80,000 acres per year between 2004 and 2009 (United states Environmental Protection Agency, 2017). Conversion of wetlands for commercial development, drainage schemes, extraction of minerals and peat, overfishing, tourism, siltation, pesticide discharges from intensive agriculture, toxic pollutants from industrial waste, and the construction of dams and dikes, often in an attempt at flood protection, are major threats to wetlands everywhere.

In addition, unwise use of freshwater to feed these developments poses a further threat. In all too many places, the amount of water being taken from nature's underground aquifer is far outstripping its ability to replenish itself. The result is that as the water level drops, millions of trees and plants are dying because they are deprived of their life-sustaining supplies. Hundreds of thousands of hectares of wetlands have been drained for agriculture. Globally, agriculture accounts for 65% of the total water withdrawal on Earth.

In Sri Lanka, many of the wetlands are facing various threats, posed by harmful human activities. The most frequently reported threat appears to be siltation. It should be realized that this is usually not caused by factors in the wetland itself but by actions on lands adjacent or away from the wetland. The development of agriculture poses serious threats to wetlands. The present broad threats can be summarized under four major categories; habitat deterioration/ degradation, direct loss/exploitation of species, spread of invasive alien species and natural phenomena.

Wetlands are serving in many ways such as, it protects upland areas, including valuable residential and commercial property, due to sea level rise and storms, wetlands can prevent coastal erosion due to their ability to absorb the energy created by ocean currents which would otherwise degrade a shoreline and associated development, wetlands provide habitat for many living organisms, helps to improve small-scale fishery, filters chemicals and sediment out of water before it is discharged into the ocean , providing recreational opportunities in coastal wetlands such as photography, recreational fishing and hunting and certain coastal wetland ecosystems (such as salt marshes and mangroves) can sequester and store large amounts of carbon due to their rapid growth rates and slow decomposition rates.

The wetlands of Sri Lanka, which fit into the Ramsar definition, can be divided into three broad categories:

- Inland natural fresh water wetlands (e.g. rivers, stream, marshes, swamp forests and villus)
- Marine and salt water wetlands (e.g. lagoons, estuaries, mangroves, sea grass beds, and coral reefs)
- Man-made wetlands (e.g. tanks, reservoirs, rice fields and salterns)

The selected areas of Ampara District namely, Kalmunai Municipality, Karaitivu, and Nintavur have significant extend of wetlands. Many are elongated touching three areas and some are separated. The increased population, urbanization, resettlement and insufficient awareness among people about the wetland caused the wetland deterioration and extinction.

Due to the loss of them, there are many problems are arising in the area. Dwindling of nature quality, loss of bio diversity, land siltation, water quality contamination, land erosion, changes in water level availability and the loss of economic basis such as small-scale fishery.

Thus, the conservation of the wetland is the commitment of all the residents in the area. And all the people should take the responsibility to conserve the wetlands considering our posterity.

2. STUDY AREA

Study area, included in to the dry-zone of Sri Lanka in Ampara District of Eastern Province. And it is situated within the range of the North latitude 7° 25' to 7° 27' and the East longitude 81° 45' to 81° 50'. And the total extend of the study area is 57.9 km^2. The mean sea level of this area is 9 m. Annual rainfall 1577 mm registered in November and December due to the North-west monsoon. The subsistence of the area people is mainly the agriculture. The annual average temperature of this area is 32.5 °C. The selected areas to conduct this study are as follow:

1. Kalmunai Municipality
2. Karaitivu
3. Nintavur

3. OBJECTIVES

Primary objective

- To find the challenges of wetlands' changes in the study area.

Secondary objectives

- To find the factors for the wetlands' deterioration.
- To suggest the solutions to the wetlands' conservation.

4. RESEARCH METHODOLOGY

This study is all about the impacts on the wetlands which being a natural resource in selected areas. Kalmunai Municipality, Karaitivu and Nintavur are included in to the coastal areas in the Ampara District. Primary and secondary data were collected to conduct this study. Qualitative and quantitative data methods were used during the data collection. Collected data analyzed using the SPSS and GIS software to find the exact situation of these areas.

Data collection

Both, Primary and secondary data were collected to conduct this study.

Primary data

For this study, direct observation, field survey, questionnaire tools were used. 100 questionnaires were distributed among the residents who were selected with simple random sampling methods in the selected area. The distribution of the questionnaire was as follow, 50, 15, and 35 to Kalmunai Municipality, Karaitivu and Nintavur respectively.

Secondary data

As secondary data, books about the wetlands, books about Sri Lanka's wetland resources, researches, websites and statistical data were used. The result was derived using the analysis with the application of SPSS and GIS.

5. RESULT AND DISCUSSION

The decline of the wetlands in the selected area have been happening perpetually due to the road expansion, settlements, land-filling, industrial purposes and agriculture. Wetlands serve as a promoter to the human economy and the animals. The following diagrams shows the decline trend of the wetlands in its respective areas.

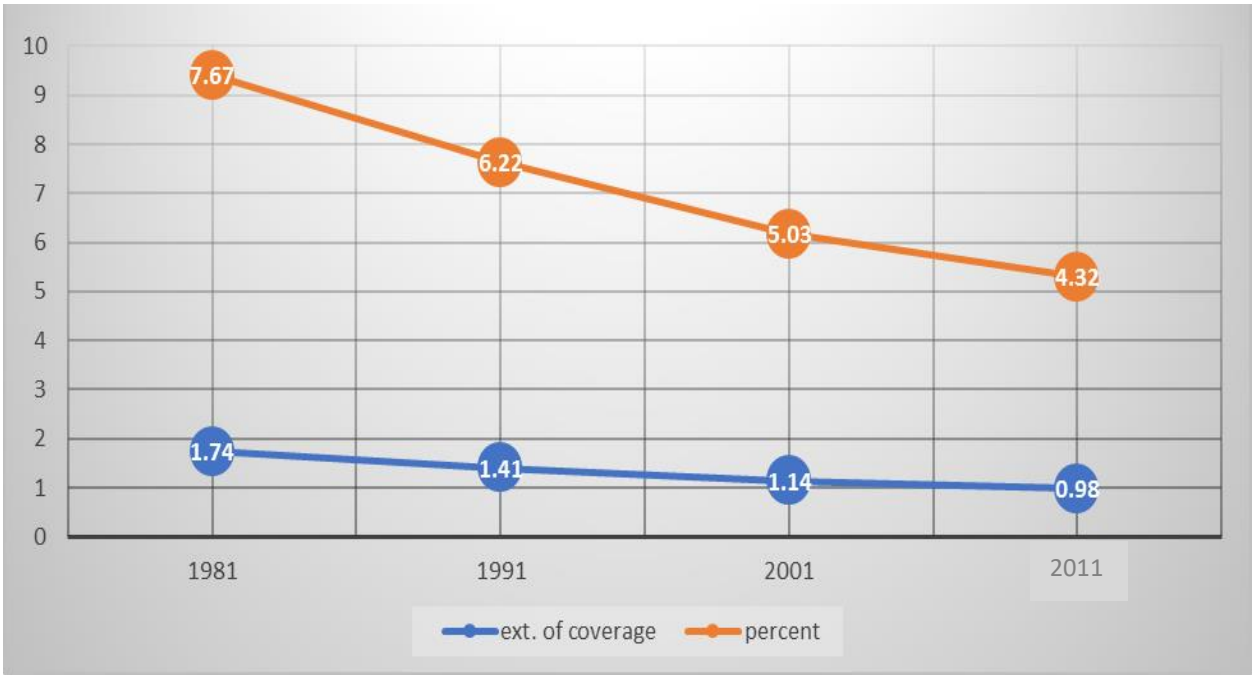

Figure 1. The wetland-decline of Kalmunai Municipality 1981 – 2011
(Source: Secondary and field data collection 2010)

For 25 years, land use pattern has been changing in this area. According to the statistics of 1981, the wetland's area was 1.74 km^2. This ratio equal to 7.67 percent comparing the extend of this area. In 1991, the extend of the wetland was 1.41 km^2 and this was 6.22 percent

of total land usage. And also, this extend turned as 1.14 km^2 with 5.03 percent in total land usage. In 2011, the extend again tuned drastically as 0.98 km^2 and 4.32 percent in total land usage. According to this graph, the wetland's decline trend drastically declined in the 10-year interval of 1981 – 1991.

The migration of fishermen's household due to the internal war in 1990, the expansion of the agricultural practices and business activities are the main factors to the decline of the wetlands extend in the period of 1981 – 1991. The increased temperature also dominating the extinction of the wetlands. In some places, negligence of wetlands by the improper wetland management and the negligence of the wetland of Kalmunai Municipal Council (KMC) causes the increasing decline of this area. Vendors from Kalmunai market throw the wastages in to the wetlands and it also leads to the water and air pollution. Some effluences from small factories such as vehicle service center, sewage from factories, and chemicals (oil and diesel) mix with wetlands' water. This activity is the major problem in this area.

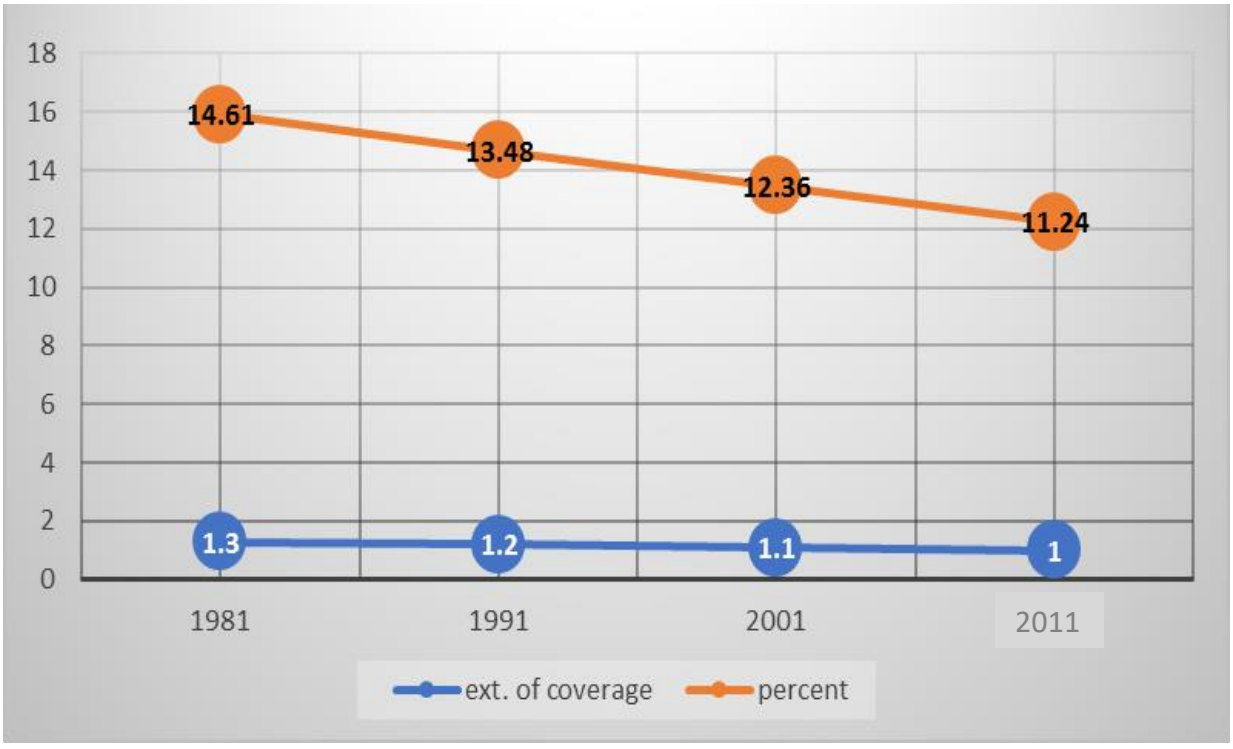

Figure 2. The wetland-decline of Karaitivu 1981 – 2011
(Source: Secondary and field data collection 2010)

Karaitivu which is very closed to the Kalmunai Municipality had 1.3 km^2 wetland in 1981. This amount actually was 14.61 percent in the land use in the area. In 1991, the wetland area was 1.2 km^2 whereas, in 2001, this amount was declined as 1.1 km^2. After the tsunami disaster, the wetlands area was declined as 1 km^2. The increase population, agricultural practices and tsunami impact were the main factors influencing to the reduce of the wetlands in Karaitivu area.

The declining trend of the wetland in Karaitivu area happen as 0.1 km^2 in the 10 years' interval. This is actually the slower decline than other areas comparatively.

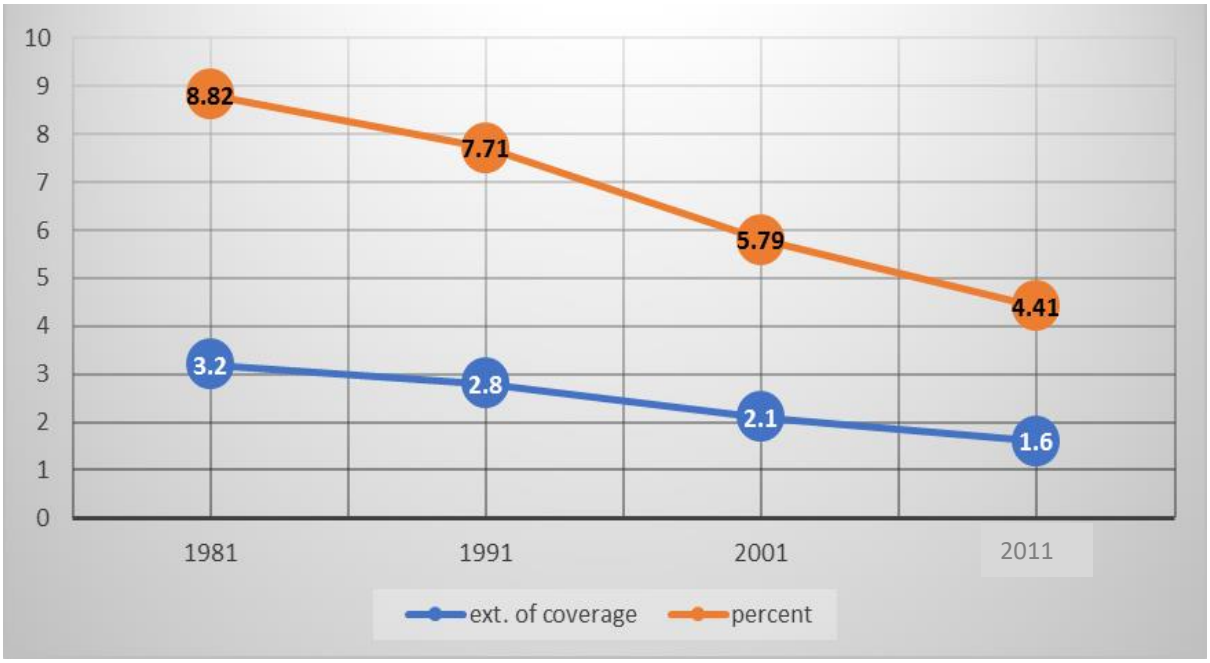

Figure 3. The wetland-decline of Nintavur 1981 – 2011
(Source: Secondary and field data collection, 2010)

In 1981, the extend of the wetland was 3.2 km^2 and this amount was 8.82 percent in total extend. Then, this amount turned as 2.8 km^2 with the percent of 7.71. In 2001, the extend of the wetland was 2.1 km^2 and the percent was 5.79. Finally, in 2011 the extend of wetland have been declined as 1.6 km^2 considering 4.41 percent. The trend of the each 10-year interval, the decline rate has been triggered and perpetually the rate have been increased. There was no fixed quantity of land which occupied by the mangroves and sea water for 25 years. Increased population, changes in land use pattern, ignorance of the wetlands, exploitation of the mangroves and agricultural activities have caused the continues decline of the wetlands in Nintavur.
According to the data analysis the following adversarial impacts for the wetlands were identified.

Loss of biodiversity

Wetlands which serve as a habitat to the birds and animals to satisfy basic needs of the living organisms. The destruction of wetlands caused downfall of biodiversity in the selected areas. For instance, In Kalmunai Municipality, a lot of creature and birds have been endangered and some have been destroyed totally. This activity causes adversarial impact on the food chain in this area. Some kind of crane which migrated from overseas to these areas for mating have stopped and chosen another place due to the downfall of the wetlands. In Paddy land area of Nintavur, it was easy to find the elegant peacocks roaming to the food but

now it is rare to find them frequently. They have altered the shelters one placed to another. And also, Drainage and run-off from fertilized crops and pesticides used in industry introduce nitrogen and phosphorous nutrients and other toxins like mercury to water sources. These chemicals can affect the health and reproduction of species, posing a serious threat to biological diversity.

Loss of fishery

Many kind of traditional fishing methods have been given up due to the loss of wetlands. The decline of salinity in the water, the decline of the prawn harvesting, the decline of its reproduction and all aforesaid lead to reduce the quantity of fishermen. Fishermen who totally depend on the fishing in wetland area have lost their subsistence. And it is fair to note that, fish from the lagoon area are tastier than other. The decreased number of the fish in wetlands which are situated near by the residential areas causes to increase the breeding of the mosquito because the mosquitos are one kind of food for the fish.

Groundwater contamination

Ground water is a main source of the residents. Wetlands helps to the groundwater availability. Ground water contamination has triggered due to the wastage from the household. The PH of well-water is 7.1, concentration of Nitrate is 47 mg/l, concentration of Florid is 1.2 mg/l, concentration of Phosphate is 1.27, and the total Iron concentration is 0.35. The Nitrate concentration is impermissible limit due to the wastage from the household. And also, the extinction of the wetland trigger to reduce the well-water level because wetlands serve to retain well-water level. In Nintavur area, the quality of water has been deteriorating due to the dumping of husk in the wetland areas.

Extinction of mangroves

Many kinds of mangroves are endangered in the area due to the felling for the timber and wood. Road and town expansion, resettlement, industrial constructions caused the decline of the wetlands extend and mangroves. The people who live in the nearby area fell the mangroves for the woods and fence making. Due to the destruction of the mangroves, the shelters of the birds, fish, turtles, crabs and snails, etc. are affected and the quantity of the endemism in a position to be collapsed.

Loss of natural scenes

Many natural places especially scenes are dwindling due to the loss of wetland in these areas. It is worth noting that, many wetland have been filled with sand to the construction activities. After the tsunami disaster, for the resettlement purposes and to build makeshift shelters to the victims much extend of wetland were filled. All the construction activities should be taken place considering environmental problems. The Kalmunai Municipality is the suitable example for this problem. The place in Kalmunai called Karaivahupattu is increasingly being filled for the settlement and construction activities. This situation is prevailing in Karaitivu and Nintavur area.

Air pollution

The air pollution is occurring due to the dumping of wastage and husks in to the wetland. The areas people near to the wetland faces this environmental problem. Bad smells from the wetlands causes intolerable difficulties to the residents.

6. CONCLUSION AND RECOMMENDATION

Wetlands which are important sources to the planet, now have been dwindling rapidly due to the human activities. The human activities which may lead to losses of coastal wetlands include urban and rural development, agriculture. These land use changes can also indirectly impact nearby wetlands by altering hydrology through increased runoff or water withdrawals in the watershed. Most of this loss occurs in freshwater wetland and natural processes are mainly impact on the coastal wetlands, especially estuarine and marine wetlands, are naturally altered by high energy events such as erosion and inundation from sea level rise and storms. The impacts of these processes may be magnified by climate change and shoreline armoring. Sri Lanka being one of the bio diversity hotspot in the world by its natural and endemic phenomena is now losing. Wetlands is partaking significantly to its endemism. According to this study, in selected areas, the wetlands have gradually been decreasing. The extend of wetland in 1981 have drastically decreased in 2011. If this situation prevails, in future we have to lose the wetland completely. This situation should be controlled using the mechanism. In these 3-selected areas, the increased population, urbanization, abundance of wastage, improper drainage system, resettlement due to the tsunami and the civil war and negligence of wetland caused the dwindling of them.

Recommendation

- Participating in programs, protect and restore wetlands. Contact local, and national agencies, community groups, stakeholders, environmental organizations and other non-government organizations.
- To mark the world wet land day in every February 2nd to show the importance of the wetlands. World wetland day is celebrated in each 2nd of February to show the importance of the wetlands and to conserve the extinction of the wetland in the world.
- Report illegal actions such as unauthorized wetland fill or dredging activities to government authorities, such as the Environmental Protection Agency or the Central environmental authority.
- Keep area always clean with the support of the Kalmunai Municipal Council (KMC). Keep surface areas that wash into storm drains clean from pet waste, toxic chemicals, fertilizers and motor oil, which can eventually reach and impair our wetlands.
- To use native species when planting trees, shrubs and flowers and preserve them to maintain the ecological balance of these area's wetlands.
- During the dry season, save the water from the wetland to sustain the living organisms in it. Some areas are turned as dry land during the dry season. Due to the fact that, the animals and birds faces water shortage problems.
- To protect the shoreline using the modern technologies, such as putting soil bags to the shorelines which are undergone to the tidal erosion.

- Use "living shoreline" techniques that make use of plant roots to stabilize soil if you own waterfront property and your shoreline or river bank needs to be stabilized. This stabilization makes to control the water flow from the coastal wetlands to sea.
- Avoid wetlands if you are expanding your house or installing a shed. When the construction work, consider the wetland and proceed the construction works not to harm the wetlands and its biodiversity. And to make development activities considering the nature. When the road expansion, considers the trees from the wetland to pave the way for the existence of the animals and birds.
- Use phosphate-free laundry and dishwasher detergents. Phosphates encourage algae growth, which can suffocate aquatic life. The algal blooming is a serious threat in the wetlands' water. It causes the suffocation to the aquatic living organism. This activity also one of the collapses of the biodiversity.
- Use the decomposable material for our day to day life. Non-decomposable materials such as plastics and polythene causes the chemical reaction with water after in long term basis. This activity also cause the imbalance of the nature of wetland
- Never spray lawn and garden chemicals outside on a windy day or on a day that it might rain and wash the chemicals into waterways and use non-toxic products for household cleaning and lawn and garden care to protect the living organism.
- Enjoy the scenic and recreational opportunities coastal wetlands offer, while preserving their integrity for future generations by minimizing the use of heavy equipment and staying in designated visitor areas where available. In the selected area, people in their holidays have fun with their families near the wetlands giving silence and entertain to them.
- To build the walls in both sides of streams to protect the soil erosion and keep the wetland perfectly. Soil erosion is one of the threats causing harm to the wetlands' nature. Therefore, the measures to control the soil erosion should be made.
- Restore the wetlands with water to conserve the living organisms from demise. During the dry season, the wetlands have been turned as drylands due to the increased temperature. In this juncture, restore the wetlands with the help of Municipal councils using the remedial measures to keep the nature of the wetlands.
- Circulating the ordinance to conserve the wetlands by the local and central government. For instance, the hunting of crane and turtoise in the wetland areas have been prohibited and fined.
- Fining the poaching activities to conserve and increase the arrival of the foreign birds. And control the deforestation near by the wetland area to uplift the migration of the foreign birds.
- Leaving small fishes to the wetland to enhance the small-scale fishery and to improve the subsistence of the dependents. Small-scale fishermen use this wetland for fishing and to satisfy their day to day needs.
- To make proper flood control systems by building drainages. During the flood, the storm water causing harmful impacts such as eliminate the cleanness of the wetlands.

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