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Introduction to Wetlands of Nepal: The Case from Betana Belbari Municipality, Morang

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Abstract
Wetlands are considered as one of the most diverse ecosystems of the world, providing irreplaceable ecological functions and economic values. This paper is entitled "Wetlands of Betana, of Morang district, Nepal. The research has been done based on secondary data and review. Biologically wetlands become the most productive when they dry out periodically. There are four types of wetlands in Nepal. They are Marshs, swamp, Bogs and Fens. The global importance of Nepal's wetlands is manifested by the presence of the rare and endangered species of flora and fauna, rest place for migratory birds, waterway for the migratory fishes and availability of wild native rice. Nepal has already designated wetlands in the Ramsar list and adopted a National Wetland Policy. The Department of Agriculture Development (DOAD) 1992 [5] has roughly estimated that wetlands occupy 743,500 ha or roughly five percent of Nepal's land area. The Wetland Community Forest User Group was founded in 2061. Nepal's wetlands have been the victim of human conversion, over-exploitation, and pollution of water, invasion of invasive species, human encroachment and deposition of sediments. The paper suggests that the loss of wetlands can be ameliorated by developing a national wetland act and national inventory, forming an interdisciplinary body to look over the issue, controlling invasive species.

Keywords: Wetlands, Ecosystem, Importance, Area of Wetland, Number of Wetland and Ramsar

1. Introduction

Nepal is a small and landlocked country, situated between Tibet (China) to its north, and India to its east, west and south. It is covered an area 26°22′-30º27′ latitude and 80°4′- 88°12′ longitude. It is part of Asia and the northern hemisphere. It is located in the Himalayas and contains eight of the world's ten highest peaks. Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season**.** Water saturation (hydrology) largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. Wetlands are home to diverse flora and fauna around the world. The Convention on Wetlands also known as Ramsar Convention defines Wetlands as "Areas of marsh, fen, peat land or water, natural or artificial, permanent or temporary where the water is static or flowing, fresh, briny or salty, including areas of water logging made by man like paddy fields, the depth of which at low tides does not exceed 6 meters." (Conservation and Sustainable Use of Wetlands in Nepal, 2010) [4] Wetlands ecosystems cover about 6% of the total global land area (Turner, 1991) [17]. They are considered to be one of the most threatened of all the major natural ecosystems and are argued to deserve a high priority for conservation. Invasion of alien species, unsustainable harvesting of wetlands and nearby ecosystem products, overgrazing, water and industrial pollution, excessive use of agrochemicals draining to nearby streams and discharge of industrial effluents are identified as major problems of wetlands. Wetlands are crucial for human survival and economic well-being, for ecosystem functions and for earth's life support system. Wetlands are amongst the most productive life support systems on earth and are of immense socioeconomic importance by providing food, fodder, fuel and water for domestic, irrigation and industrial purposes (Kaul, 2003) [9]. They are critical for contributing to poverty reduction if managed and used properly. Nepal possesses wetlands diversity covering a total of 0.42 million hectares, which represents 5% of the total landmass of the country (CBS, 2008) [3]. Wetlands of Nepal is categorized as Rivers, Lakes, Reservoirs, marshy Lands, Ponds and Irrigated paddy fields. Many wetlands of Nepal are situated in a similar geographical location are affected by comparable anthropogenic activities. A wetland is typically an area of land that is completely saturated with water, whether all throughout the year or only during certain seasons. Because these areas of land are covered in water as well as a variety of different land and water dwelling plant life, they are well known to have rich and distinct ecosystems from, for instance,

waterways or the dry land. As a direct result of this rich ecosystem, wetlands are especially important to the world because they are the homes of some of the plant life in the world. Wetlands are important to us as they remove pollution, recharge groundwater supplies, control floods, and provide home for variety of plants and animals. Wetlands include swamps, marshes, bogs and fens. According to Wikipedia, "A wetland is a land area that is saturated with water, either permanently or seasonally, such that it takes on the characteristics of a distinct ecosystem. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil. Wetlands are the most productive habitats on the planet as they contain high number of plant and animal species including mammals, bird, fish and invertebrates. Wetlands hold ecological, cultural and economic values and are significant for the wellbeing of the natural ecosystem and communities. Most of the rural communities of Nepal are dependent on wetland resources for their livelihood. For marginalized and indigenous communities such as Majhi Jalari, Tharu and Mallah wetlands are important income generating resource. This article focuses the one of the wetlands of Morang district. Morang District is located in Province 1 of the eastern part of Nepal. It borders with Bihar (India) to the South, Jhapa to the East, Dhankuta and Panchthar to the North and Sunsari to the west. Morang has one Metropolitian (Biratnagar), eight municipalities and 8 rural municipalities. The total area of Morang is 1,855 km ^{2} (716 sq. mi). The lowest elevation point is 60 meter and highest elevation point is 2,410 meter above sea level. The headquarter of Morang is connected by Koshi National High way to the East-West Mahendra National Highway at Itahari, Sunsari, and Morang is also connected to the Hill parts of the eastern region of Nepal. Morang is the core Industrial sector for the eastern region of Nepal. The Betana Wetland Area, also known as Betana Simsar, is a popular regional tourist attraction of Eastern Nepal located on Belbari municipality in Morang district.

2. Method and materials

The research methodology is the process of doing research. Kitchen and Tate (2000) observe that it is a coherent set of rules and procedures which can be used to investigate or way for solving the problem. This study was based on a number of documents such as term papers, research reports, proceeding papers, scientific articles. There are two types of data. I.e., primary and secondary. It is based on secondary / library data collected and reviewed. Secondary data refers to data that is collected by someone other than the primary user. Common sources of secondary data for social science include censuses, information collected by government departments, organizational records and data that was originally collected for other research purposes. Similarly, related to the objectives of review of national and international papers, journal, books, official websites, research reports, proceeding papers, scientific articles, and abstract, field visit reports related to wetlands.

3. Discussion and results

Types of wetlands

There are a number of different types of wetlands that occur all over the globe. They are usually split into four distinct categories with further distinctions depending on location and other factors.

Marshes: Marshes are periodically saturated, flooded, or ponded with water and characterized by herbaceous (non-woody) vegetation adapted to wet soil conditions. Marshes are generally filled by surface water run-off or groundwater. Marshes are wetlands that are always inundated, rather than being submerged under water just during the summer or a couple of months over the year, for instance. Marshes can be freshwater or saltwater and amount of water in the marsh can change with the seasons. They boast a great variety of vegetation that has adapted specially to live in saturated soil. There are a number of sub-categories of marsh including freshwater, saltwater, inland and coastal. Each of these distinct ecosystems and can be found all over the world. Marshes wildlife includes beavers, alligators, newts, shrimp and turtles.

Fig 1: Marshes

Swamps: A swamp is a type of wetland that includes an abundance of woody plants. It is change from marshes in that, typically, they are dominated by woody plants (rather than soft-stemmed plants). There are two types of swamps: forested swamps and shrub swamps. Forested swamps are filled by water from streams and rivers. Shrub swamps are found along floodplains that keep the soil saturated for much of the year. Swamps are typically the home to various birds and fish as well as smaller creatures. Swamps like Everglades in Florida are found in low-lying areas near rivers or coastal areas. Swamps are home to variety of animals like snakes, bobcat, alligators, beaver, large diversity of birds.

Fig 2: Swamps

Bog: type of wetland ecosystem characterized by wet, spongy, poorly drained peaty soil, dominated by the growth of bog mosses, Sphagnum, and heaths, particularly Chamaedaphne. Bogs are characterized by more acidic waters and spongy peat deposits as well as a covering of sphagnum moss. Bogs receive water exclusively from rainfall. Unlike marshes and swamps, bogs tend to get their wetness from precipitation rather than waterways such as streams or runoffs from rivers. Plants that are commonly found in bog wetlands are evergreen trees and shrubs, while animals' species include black bears and woodpeckers.

Fig 3: Bogs

Fens: Fens are, like bogs, peat-forming wetlands, although they usually get their wetness from ground water rather than precipitation, which means that they are slightly less acidic. This means that they tend to support a greater array of wildlife, from plants to fish to birds and everything in between. Plant life in a fen includes tamarack trees and wildflowers, while animals that live in fens include turkey, deer, and a vast array of insects.

Fig 4: Fens

Importance of Wetlands

Wetlands are important because they offer habitat for thousands of species of aquatic and terrestrial plants and animals. Wetlands are valued for flood safety, water quality enhancement, coastline erosion regulator, natural products, recreation, and aesthetics. The importance of wetlands is given below:

Prevent Flooding

Wetlands function as natural sponges that trap and slowly release surface water, rain, snowmelt, groundwater and flood waters. Most importantly, wetlands are best known to prevent flooding. The holding capacity of wetlands helps control floods and prevents water logging of crops. Preserving and restoring wetlands together with other water retention can often provide the level of flood control otherwise provided by expensive dredge operations and levees. This can have a positive impact not only on the environment as a whole, but is very useful for people who have built their settlements next to rivers or other waterways that might otherwise have been prone to flooding.

A Home for Animals

Many animals have wetlands as their homes. Birds such as herons, fish and amphibians all make their homes in these sorts of places. They offer the perfect place for animals to be safe and hidden from predators – perhaps from the air – as well as providing a great deal of diverse foodstuffs such as grasses, mosses and other plant life. Amphibians may hunt and scavenge away from the wetlands, but they always return to find a good place to mate and breed because wetlands offer a lot more safety than other places.

Water Purification: As a direct result of having wetlands, the water in the surrounding areas will be a lot cleaner and purer than in other areas. This is because the water is filtered through the wetlands. Fish and other animals may eat vegetation, plants may strain out rubbish that may be in the water because of humans or things like twigs that have fallen from nearby trees, meaning that these things do not make it into streams or rivers further down the line. Wetlands decompose vegetative matter (for the most part – some of it makes its way into streams and rivers to provide food for fish) and even convert various chemicals to make the water even cleaner for the creatures that live both in the wetland and in other water systems. This makes them one of the most productive and critical natural filtering systems in the world.

Erosion Control: Sediment is a natural problem that usually originates in rivers. As the water flows past drier earth, it will sometimes sweep sediment away. This sediment will eventually end up in the sea, which is not hugely problematic, but erosion can be an issue. With earth disappearing, animals may find they have less space to hunt, mate or live. Wetlands act as a sort of erosion control. Emergents – plants that are firmly rooted in the ground but that have stalks that rise up out of the water into the air – grow almost exclusively in wetlands, and it is this that slows the flow of water. This means that the strength of the water is lessened anderosion occurs less powerfully in these sorts of areas, as well as in lakes and rivers where the water is slower.

Water Quality: Wetlands act as natural water purifiers, filtering sediment and absorbing many pollutants in surface waters. In some wetland systems, this cleansing function also enhances the quality of groundwater supplies. Therefore, wetlands provide a cost-effective alternative to traditional wastewater and storm water treatment options.

Reduction of Coastal Storm Damage: Coastal wetlands help to blunt the force of major storms. For example, mangrove forests in south Florida and salt marshes along the Atlantic and Gulf Coasts reduce flooding, coastal erosion, and property damage during major storms.

Flood Control: Wetlands can play an important role in flood abatement, soaking up and storing floodwater. The rivers and streams absorb energy and store water during storms, which reduces downstream flood damage and lessens the risk of flash floods. The slow release of this stored water over time can help keep streams flowing during periods of drought.

Erosion Control: Wetland vegetation binds the soil on stream banks and riparian wetlands, preventing excessive erosion and sedimentation downstream. The roots of wetland plants hold soil in place and can reduce velocity of stream or river currents (Gwin, Kentula, &, Shaffer, 1999) [6].

Ecosystems: Some wetland types are among the most productive ecosystems on earth. The releasing of vegetative matter also provides an essential in the amount of nutrients, seeds and other matter going into streams and rivers, not to mention other creatures. Nutrients and plant material flushed from some wetland systems during storms provide essential food for plants, fish, and wildlife in estuaries and other downstream ecosystems.

Recreation: Wetlands can become a destination for outdoor activities such as hiking, fishing, bird watching, photography, and hunting. It provides beautiful places for sightseeing, hiking, fishing, hunting, boating, bird watching, and photography.

Water Supply: Some wetlands help provide clean, plentiful water supplies. It can positively impact water supply, serving as reservoirs for the watershed and releasing retained water into surface water and groundwater.

Education: Wetlands protection activities provide meaningful opportunities to educate the public regarding wetlands science, wetlands protection, and the value of water resources.

Partnerships: Wetlands protection can allow communities, individuals, businesses, organizations, and others to build partnerships through protection activities and provide various entities access to data and resources that otherwise would not be available.

Aesthetic Appeal: Wetlands provide a certain visual value and are often incorporated as features within landscape design.

Area of wetlands in Nepal

The Department of Agriculture Development (DOAD) 1992 [5] has roughly estimated that wetlands occupy 743,500 ha. or roughly five percent of Nepal's land area (Table 1). Lakes in Nepal are estimated to hold 3 percent of all available water in Nepal (Sharma, 1997) [15]. However, the IUCN Nepal (1998) inventory of 19 Terai districts alone estimated that wetlands cover some 724,257 ha. in these districts alone. Neither DOAD estimate nor the IUCN Terai wetland assessment takes into account all the diverse wetland types that occur in Nepal. The total extent and diversity of wetlands in Nepal is still unknown (IUCN Nepal 2004)

Table 1: Area of wetlands in Nepal

Wetland Types	Estimated Area (H)	Percent
Rivers	3,95,000	53.0
Lakes	5,000	0.7
Reservoirs	1,380	0.2
Village Ponds	5,183	0.7
Paddy Fields	3,25,000	43.6
Marshlands	12,000	1.6
Total	7,43,563	100.0

Sources: DOAD, 1992 [5], Fisheries Development Division

The Numbers of Wetlands in Nepal

There are 19 types of natural and 10 types of man-made inland wetlands in Nepal. Nepal has 10 wetlands listed as Ramsar sites and have international recognition. Which is given below:

Shey-Phoksundo National Park: A glacial lake near Ringmo in the Dolpo region, the deepest lake in the country, that is the centre of endemism in the eastern Himalayan region and a vital source of freshwater for downstream, with the highest waterfall (167m) in Nepal 500m from the lake. There are different types of wildlife found in in this National parks. Such as Sheep, ghoral, musk deer, leopard, wild dog, marmot, weasel, mouse hare, rhesus and langur monkeys, Himalayan tahr, Himalayan black bear and jackals; 6 species of reptiles. Similarly, over 200 species of birds including yellow-throated marten, Tibetan partridge, wood snipe, white-throated tit, wood accentor and crimson-eared rose finch, impeyan pheasant, cheer pheasant, chough, raven, Tibetan snow cock, Tibetan twit, Himalayan griffon and lammergeyer and 29 species of butterflies. Likewise, 286 floral species of ethno-botanical importance: pine, walnut, willow, oak, cypress in the lower altitude and pine, spruce, juniper and birch at higher regions; berberries, wild rose and caragana are seen in alpine areas while the regions higher up are mostly arid with grass alpine meadows with barely any trees.

Fig 5: Shey-Phoksundo Lake

Koshi Tappu Wetlands

The Koshi Tappu wetland is the largest in Nepal and was established as a wildlife reserve in 1978 to protect the country's remaining population of the wild water buffalos. It is covering 175 km^2 (68 sq mi) of wetlands in the Sunsari, Saptari and Udayapur Districts. It comprises extensive reed beds and freshwater marshes in the floodplain of the Kosi River, and ranges in elevation from 75 to 81 m (246 to 266 ft. (Bhuju *et al*., (2007) [2]. It was established in 1976 and designated as a Ramsar site in December 1987. It is also the country's most important site for migratory and wintering waterbirds. There are Elephants, wild buffalo, wild boar, hog deer, spotted deer, blue bull and jackal; reptiles include gharial crocodile; Gangetic dolphins are found in the Koshi River; the wild buffalo species in Koshi Tappu is one of the last surviving population. Similarly, 441 species of birds, some of which migrate all the way from Siberia during winter and Grassland with patches of scrub and deciduous riverine forests found in this area (Limbu, & Karki, 2003) [11].

Fig 6: Koshi Tappu Wetlands

Jagadishpur ReservoirWetlands

The Jagadishpur Reservoir, with an area of 225 ha, was declared a Ramsar site in 2003, in recognition of the fact that it supports vulnerable, endangered, and critically endangered species as well as threatened ecological communities (MFSC, 2014) [12]. Situated in Kapilvastu, Jagadishpur Reservoir is an artificial lake previously constructed for irrigation purpose. The water is fed from the Banganga Lake and river in the Churia Catchment. There are large number of species of flora and fauna including some rare species like Morning Glory (Ipomea carnea ssp. fistulosa); water velvet, storks and others.

Fig 7: Jagadishpur Reservoir Wetlands

Gosaikunda Wetland

An alpine freshwater oligotrphic holy lake situated in Langtang National Park is one of the famous religious tourist destinations of the country. The lake is visited by thousands of pilgrims throughout a year and has special crowd of visitors during Janai Purnima. The wetland is a home of more than 100 species of flowering plants, birds and animals including rare species Red Panda and Musk Deer.

Fig 8: Gosaikunda Wetlands

Wetland Series Gokyo

Gokyo Lake is an oligotrophic lake in the Everest Region which lies on the head of the Dudh Koshi River descending from world's 7th highest mountain- Cho Oyo. There are six main lakes in Gokyo wetland series.

About 80 species of flowering plants and other numbers of flora and faunas are found in the region. Ice skating is a prime attraction among snow sport lovers in the Gokyo region (www.online)

Fig 9: Gokyo Wetlands

Ghodaghodi Lake Area

The Ghodaghodi lake area was included in the Ramsar Wetland list of global importance in 2003. The wetland area covers 10,570 hectares of land that comprises 24 lakes, including Ghodaghodi, marshes and a national forest (The Kathmandu Post, 11 August, 2022) [16]> There are found 360 bird species—both native and migratory—are found in the sanctuary. Various species of aquatic birds migrate to the sanctuary from Siberia in Russia and Mongolia among other countries each winter season. Ghodaghodi is a natural freshwater oxbow lake situated in Kailali. There are thirteen associated lakes and ponds, and some streams situated on the periphery of Ghodaghodi. The area is known as wildlife corridor between the lowland and the Siwaliks. The wetland area provides habitat to more than thousand species of flora and faunas.

Fig 10: Ghodaghodi Lake Area

Beeshazar and Associated Lakes

Beeshazar and Associated Lakes, situated in the inner Terai, are surface and ground water fed natural lakes in Chitwan

National Park. Designation date is 13-08-2003 and with more than 3200 hectares area, Beeshazar and Associcated lakes are one of the largest wetlands of the country. The vegetation within the lakes makes it an attractive place and the wetland welcome high number of visitors throughout a year. There are wide range of flora and fauna found in the wetland.

Fig 11: Beeshazar Lake

Maipokharai Wetlands

It is declared that the National Parks and Wildlife Conservation at a program organized during the 10th Conference of Parties to the Ramsar Convention (COP10) at Changwon, the Republic of Korea on 28 October 2008. Maipokhari, a midhill wetland with religious significance, is situated in Ilam. The wetland has catchment of 12 hectares and is located 13 kilometres away from Ilam bazaar. Maipokhari Lake, a lake situated in the wetland holds special cultural and religious significance for Buddhist and Hindu pilgrims.

Fig 12: Maipokharai Wetlands

RARA Wetlands

In September 2007, it was declared as a Ramsar site, covering 1,583 ha (6.11 sq mi) including the surrounding wetland (Bhandari, 2009) [1], Rara Lake at 2,990m, is the deepest lake in Nepal and also one of the most pristine. Surrounded by green hills on all sides, covered in juniper trees, one can camp by the sparkling waters of the lake. Go boating in the clear waters, hike to nearby hills for a closer view of the mountains and lake, get acquainted with the charming local people, or just walk around the large lake watching out for wild flowers or a rare bird along the way. The park is surrounded by alpine coniferous vegetation and offers a representative sample of the region's flora and fauna. More than 500 different kinds of flowers, 20 species of mammals and 214 species of birds can be observed in the Rara National Park. As for life in the lake, the snow trout is one of the fish varieties recorded here so far.The rich vegetation of the park supports diverse species of wildlife including the endangered red panda, musk deer, Himalayan black bear, leopard, jackal, Himalayan tahr, Yellow-throated martin, wild dog, wild boar, common langur, rhesus macaque and the common otter. During winter the park abounds in bird varieties like coots, great-crested grebe, black-necked grebe, red crested pochard, mallard, common teal, merganser and gulls. Migrant water fowl and gallinaceous birds can also be seen during certain seasons.

Fig 13: RARA Lake

Phewa and Cluster Of 9 Lakes

Pokhara owes much its popularity to the enchanting fresh-water Cluster of 9 Lakes which include the popular Phewa, Begnas, Rupa, Khaste, Dipang, Maidi, Gunde, Neurani, Kamalpokhari and Pokhara Seti Catchment, lakes. The lakes give Pokhara its name and also play a vital role in sustaining the biodiversity, ecosystem and the local livelihood. The Pokhara Valley Cluster was listed as Ramsar Site on Feb. 2, 2021.

On the eastern shore of Phewa Lake is Lakeside or Baidam, a thriving resort town of hotels, restaurants, bars and souvenir shops popular among travelers. Phewa Lake is a great place to relax with various leisure and water activities. Boaters usually also make it a point to visit Taal Barahi Temple dedicated to Ajima or Shakti, on a little strip of island in Phewa Lake. Equally popular are the Begnas and Rupa lakes which are a little out of town and offer refreshing breaks from the city humdrum. Boats can be hired in the lake vicinities.

Fig 14: Phewa Lakes

Map of Ramsar site of Nepal National parks, Wildlife Reserves.

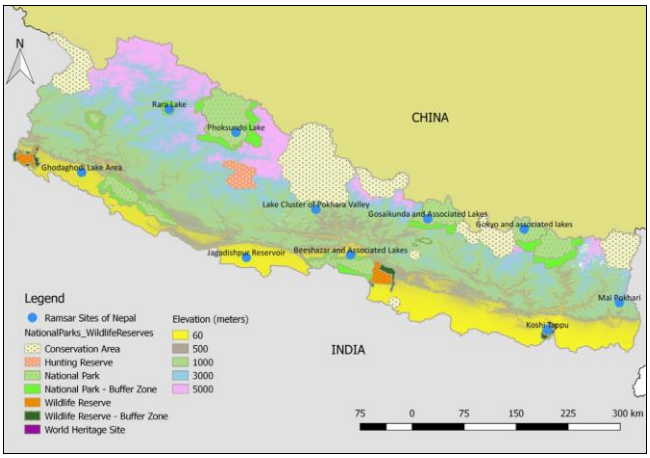

Fig 15: Ramsar site of Nepal National parks, Wildlife Reserves

Wetlands of Betanas

Betana wetland is a freshwater ox-bow pond situated between 26°39′47.8″ N to 87°26′02.8″ E and 26°39′33.5″ N to 87°26′02.9″ E. The pond is surrounded by Sal Forest of Char-Koshe-Jhadi from east, north and west sides whereas East West highway lies adjacent on its south. Betana wetland or Betana Simar is located in Belbari Municipality of Morang district of Nepal. It lies about 15 km East of Itahari. Geographically, the wetland lies at an altitude of about 123 m. (Rai, 2011) [14]. The lake has an area of about 5.5 ha. The forest area is about 175 ha and it is a part of *Charkose Jhadi* (Kharel, 2018) [10]. The wetland homes various species of tortoises, fishes, birds, and a collection of flora and faunas. The Wetland Community Forest User Group was founded in 2061. The Betana forest, spread across 174.91 hectors, the region also includes an additional 16 percent wetland. 98 percent has been occupied by the forest while 6 percent of the forest is infertile. The conversation committee plans to adopt a 20-year master plan for the development and promotion of the region. Soil is alluvial type and the meteorological records are: average annual rainfall 1312 mm, average annual minimum and maximum temperatures 14.2°Cand 30.6°C respectively (Jha, & Kargupta, 2001) [8]. There is fond the subtropical climate and evergreen forest especially, covered by saal trees, khair-sisoo trees, satisaal. A small portion of the forest area is filled with tombstones of the Kirati people. The huge forest area is home to different species of flora and fauna including some species that are rare in the whole world. In conjunction with the locals and government bodies, the committee aims at enlisting Betana wetland as a major tourist destination. The main attraction of this place is a large lake which is itself a part of the wetland where you can do boating as well. Being covered among forests, it is a great spot for a picnic and get-together with friends. There are various picnic spots marked for picnic goers. This wetland features a scenic landscape including a lake, saal (*shorearobusta)* trees, and also is a habitat to various endangered flora and fauna of Nepal. This place is famous mainly among the local people as an ideal destination for spending some peaceful time in nature, carrying out refreshing recreational activities, boating, as a picnic spot and is also favored by couples for spending some moment together.

Fig 16: Betanas Wetlands

This wetland is designed and managed in a very attracting and captivating way to attract a same visitor more than once. Betana wetland region is also rich in its biodiversity and is home to many endangered plants and animals such as tortoise, fishes, variety of birds, and a collection of indigenous and rare flora and faunas. A zoo has been constructed inside the area and other statues and structures like bridges have been added to make the whole area more attractive. The huge forest area is home to different species of flora and fauna including some species that are rare in the whole world. The pond's depth varies from 0.5 to 1.5 m during the dry season to 1 to 2.5 m during the monsoon season. Fishing is strictly banned inside the terrain and feeding fish for fun is a common practice here. A glimpse of rare tortoise can be seen sometimes, if one gets too lucky. Similarly, the marshland region is home to a variety of birds species including migratory birds. A total of 49 different species of birds have been said to be reported from this wetland area. This profusion of green lush vegetation along with beautiful lake and wetland herbs and shrubs creates a captivating view while adding to the ecological importance of the region.

Location map of Betana Wetlands

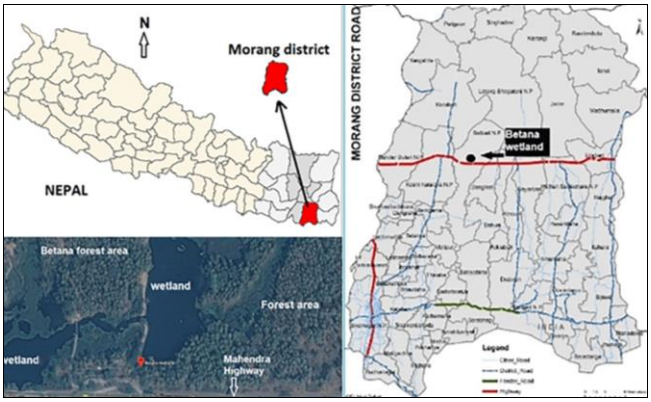

Fig 17: Betana Wetlands

4. Conclusion

Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Wetlands also known as Ramsar Convention defines Wetlands as "Areas of marsh, fen, peat land or water, natural or artificial, permanent or temporary. The paper based on secondary / library data are collected

and reviewed. There are four types of wetland and ten types of manmade inland found in Nepal. This may be due to easy availability of food, suitable climate, temperature and migration of species. During the present survey, 49 species of birds belonging to 30 families and 15 orders have been recorded from the Betana wetland, which proves that the study area is one of the suitable habitats for avifaunal abundance. About 70 % of total bird recorded was found to be the resident type and about 35% of total recorded bird species were found fairly common. The major threats to the avifauna in the study site were found to be deforestation, overgrazing, bird killing by using catapult and pollution due to recreational activities.

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