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Status of Biodiversity at Wetland Ecosystem of Parvati ARGA wetland (Ramsar Site)

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KEYWORDS

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ABSTRACT: Species are known to serve ecosystem in wetlands and protect the healthy environment for humans. Wetlands are most important part of nature which provides a huge range of functions as a source of drinking water for households, erosion control, agricultural purpose, weather stabilizers, flood control, water purification, groundwater source, and detoxification. Irrespective of this, wetlands across the world are facing a lot of challenges like loss in total land, pollutants added by industrialization, ignorance of locals on the value of wetlands, and desertification, which are indirectly degrading wetlands. Number of wetlands has been increased significantly to 37 which are globally important since 1981 when the first site was identified as per Ramsar Convention in 1971. The government of India has made a lot of efforts to protect and conserve wetlands exactly from covering the same as per various environmental acts to devise individual policies and rules related to wetlands, which have been revised again and again. This study conducts a review of recent studies related to status of biodiversity in Parvati Arga wetland. The finding suggests that biodiversity of wetland conserves ecosystem services as well as sustainable environment for conservation of species. Constant tracking of diversity of wetland is recommended as it might help conservation of species in the ecosystem.

Introduction:

Among water and land and most prolific ecosystems worldwide. Wetlands can be manmade or natural like fen, peat land, and marsh. Water under the wetland may be temporary or permanent, brackish or fresh, flowing or static, with marine water areas, and its depth doesn't exceed 6 meters at low ride [1].

Objectives: Wetlands are the most important and key aspect of nature which provide a wide range of capacities being the reserve of drinking water and hotspot for flood control, revival of ground water, erosion control, stabilizing atmosphere, detoxification, and refinement of water [6].

Methods: There is a huge chunk of Indo-Gangetic plains which have been drained by significant river systems of India in Uttar Pradesh with intersperse of vast natural wetlands. Some of them have become bird sanctuaries. The state is known for climate ranging from scorching hot during summers to chilly and icy winters all the year round with average temperatures from 45°C (highest) to 5°C (lowest) and it receives around 1200mm of average rainfall during southwest monsoon from July to September. Uttar Pradesh has a huge range of bird sanctuaries created for conservation and protection of unique habitats of wetland, aquatic greens, and other wildlife species.

Results: Wetlands are the most important and key aspect of nature which provide a wide range of capacities being the reserve of drinking water and hotspot for flood control, revival of ground water, erosion control, stabilizing atmosphere, detoxification, and refinement of water [6].

Conclusions: The Ramsar Convention is a diplomatic panel which was formed to create a blueprint for the sustainable use and conservation of wetlands. It was named as Ramsar Convention because the first "World Convention on Wetlands" was held in Ramsar city of Iran on February 2, 1971 [6]. The most desired

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convention was the "Ramsar Convention on Wetland." Article 1 defines wetland as "the area of fen, marsh, peatland of water, artificial, weather natural, or temporary with flowing water which is salty, brackish or fresh, including regions of marine water and its depth shouldn't exceed 6 meters at low tides."

1. Introduction

Wetland is known to have variable biodiversity in its ecosystem worldwide as it consists of various living beings, levels of genetic changes, and wealth of various habitats in a specific ecosystem.

The habitat of wetland is diverse from any terrestrial habitats on land and organisms in this ecosystem have various ecological challenges. However, a lot of those problems can be solved while developing distinct behavior of an animal or plant. The species of wetland can be seen in various climatic conditions because of their natural traits in different regions of the world. Wetlands are not limited to specific zones or areas of latitude as they are among the global biomes like savanna, rainforest, and deserts. Wetlands are the rich source of biodiversity in the key climatic belts because of a huge range of flora and fauna. Even though some species can survive environmental threats, species found in wetlands are still vulnerable. Extinction of species is very common in wetlands and global ecosystem. Since 1600, some of the species have been extinct because of destruction of their natural habitats, introduction of foreign species, deliberate killing or poaching, unsustainable consumption patterns, growth of human population, urban development, rising waste production, and global warfare [2,3]. India is India is a highly biodiverse land and it has been sensitive towards conservation while going through the path of development. Over the past few years, the strategies for sustainable use of natural resources and conservation of biodiversity included special protection and status to areas rich in biodiversity by announcing them as wildlife sanctuaries, national parks, and biosphere reserves, sensitive and environmentally fragile areas.

It has helped reserve forests' pressure by using alternative mediums of fodder and fuel wood, afforestation of wasteland and degraded regions, developing ex situ conservation like eco-development and gene banks. Along with sustaining the previous efforts, the challenge is also to add to those initiatives by engaging people in the mission for India. Some of the major biodiversity threats are alteration of habitat, pollution, overharvesting, exotic species and climatic change, and rise in cattle and human population. Changing habitat because of loss of habitat, deforestation, degradation, and fragmentation are some of the major causes of depleting biodiversity.

It is observed that there are greatest threats to the ecosystems/species in this day and age, especially because of exploitation of natural resources by mankind. However, due to extreme effects, natural hazards play a vital. role on the loss of biodiversity. Hence, conserving gene pool is urgently needed in situ before it is extinct for lifetime. Assessing the environmental sustainability by knowing the complexities of landscape/ecosystem and their diversity. The advancement of remote sensor and sensing and other technologies have helped in acquiring accurate mapping and classification of vegetation, while the potential of biodiversity of flora and fauna ahead of mapping needs should be discovered completely with in-depth field methods.

Spatial analysis methods like "geographic information system (GIS)" can be useful to derive several maps showing parameters of landscape. Modern technologies like geo-informatics, remote sensing, and bioinformatics tools apart from intensive data that can help in generating knowledge base. These can be analyzed at macro-level, micro-level, and meso-level with effective tools like "Geographic Information System (GIS)" and "Remote Sensing (RS)". Spatial data can be provided by RS while GIS can be helpful to create database for future retrieval and updation. Remote sensing offers synoptic coverage of surface of the planet Earth and it is also best for characterizing biodiversity at several levels. With technological advancements made over the years in spatial resolution of native satellites, there is a huge benefit of accurate mapping of regions for monitoring biological and spatial features for potential monitoring. In addition, GIS has been handy to perform spatial modelling as per the criteria. On wetlands and their environment, the spatial data on land use are created with remote sensing information using online classification [4].

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Stretched over 1084.47 hectares, Parvati Arga Bird Sanctuary is located in Gonda district of U.P. (Figure 1). The bird sanctuary is named after two lakes shaped as cow's foot, i.e., Arga and Parvati. These are also named after an old temple located nearby which is devoted to Lord Shiva and Parvati. Since this region houses various native birds and serves a lot of migratory and exotic birds during winters, it has become bird sanctuary on May 23, 1990. The sanctuary was transferred to "Forest Department" for monitoring. Earlier, it was managed by the Fisheries Department. The sanctuary houses a lot of birds a lot of birds like "northern pintail (seenkhpar), common sarus, little grebe (dubdubi), bar-headed goose (savan), Eurasian wigeon, red-crested pochard, mallard, tufted duck, tufted pochard, ruddy shelduck, comb duck, little cormorant, cotton pygmy-goose, common moorhen," and others. In addition, snakes and tortoises are also found over there [5].

Around 13 bird sanctuaries in the state are split in 4 eco-climatic zones like (1) Tarai region, (2) Indo-Gangetic plain, (3) Semi-arid region, and (4) Vindhyan region in various districts of UP. However, this study focuses on a Ramsar site, i.e., Parvati Arga Bird Sanctuary and its biodiversity.

1. Materials and Method

1.1. Study Area

. Around 13 bird sanctuaries in the state are split in 4 eco-climatic zones like (1) Tarai region, (2) Indo-Gangetic plain, (3) Semi-arid region, and (4) Vindhyan region in various districts of UP. However, this study focuses on a Ramsar site, i.e., Parvati Arga Bird Sanctuary and its biodiversity.

1.2. Data Collection

This study is based on secondary data collected from recent studies conducted on biodiversity Parvati Arga wetland in UP, India. Those studies have also published high quality digital remote sensing data for classification of those regions along with field data on biodiversity, which will also be covered in this study. This study will also cover distribution of wetlands in India, floral and faunal biodiversity, and properties of wetland ecosystem.

2. Results

Wetlands are the most important and key aspect of nature which provide a wide range of capacities being the reserve of drinking water and hotspot for flood control, revival of ground water, erosion control, stabilizing atmosphere, detoxification, and refinement of water [6]. Wetlands are among the most important components which protect the environment and these are the reasons behind the lives of over 125,500 freshwater species. However, they are equally vulnerable as other natural resources to environmental damage. Especially those wetlands in alpine and high latitude zones, coral reefs, mangroves, and swamps are highly in danger. Inland and freshwater wetlands are possibly be influenced with long-term rise in temperatures and precipitation changes and extremely dry seasons, floods, and tempests.

Only 3% of water in the world is safe to use and most of the water is frozen or solidified. Every human being needs at least 20 to 50 liters of water every day for cooking, cleaning, and drinking, on average. Wetlands play a vital role in meeting water needs and refilling the groundwater springs to provide freshwater to mankind [7]. Wetlands are categorized by four basic types of functions and activities, viz. regulation (environmental process to promote healthy environment), supporting and carrier activities (to provide a room for agriculture and human settlement), production (such as water, food, and raw material for building like wood, clay, etc.), and finally information (such as education, research, spiritual, and aesthetic values) [8].

The Ramsar Convention is a diplomatic panel which was formed to create a blueprint for the sustainable use and conservation of wetlands. It was named as Ramsar Convention because the first "World Convention on Wetlands" was held in Ramsar city of Iran on February 2, 1971 [6]. The most desired convention was the "Ramsar Convention on Wetland." Article 1 defines wetland as "the area of fen, marsh, peatland of water, artificial, weather natural, or temporary with flowing water which is salty, brackish or fresh, including regions of marine water and its depth shouldn't exceed 6 meters at low tides." Irrespective of the same, wetlands are facing a lot of issues globally like reducing complete territory, numbness of neighborhood

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population, and contamination due to industrialization [9].

2.1. *Wetlands in India*

Wetlands in India are distribution in various realms from mountain ranges to Deccan plateau [10]. Indian wetlands are stretched over 7.7 Lakh hectares across the South Asian countries, covering 4.6% of total geographical region of the nation and India follows only Japan and China a per the "Wetlands International South Asia (WISA)" [11]. As reported by the "National Wetlands Atlas 2011," India has total 201,503 wetlands as per the "Space Application Centre, Ahmadabad" [12]. There are only 37 internationally recognized wetlands in India as Ramsar sites stretched over 1,067,939 ha of total 2389 areas worldwide stretching 253,870,077 ha [9]. The convention has been effective since February 1, 1982, and 37 wetlands are specified as Ramsar sites since then. These 37 sites are stretched over 10679.39 sq. km. of the region accounting for only 0.32% of total geographical land cover of India, i.e., 3,287,469 sq. km. [6].

Indian wetlands have been declared as Ramsar sites in various timelines since 19th century. Figure 2 illustrates the cartographic representation of wetlands at Ramsar site. There are four time periods to designate 37 wetlands. There are 6 wetlands designated as Ramsar site during the decade of 1981-1991, no wetland was designated from 1992 to 2000, 19 wetlands have been designated from 2001 to 2011, and 12 wetlands have been designated from 2012 to 2020. From Figure 2, it is observed that 2001 to 2011 was the period of highest number of designations, when authorities focused highly on sustainable development and conservation. During this period, water crisis was also started for both groundwater and surface water all over the world. Areal classification has been performed in four categories out of 37 wetlands, i.e., 50,000 ha. (Figure 3). The areal extent of 1001 to 25,000 hectares covers the highest number of wetlands. Areal extent is declining from the wetlands in recent years due to climate change with higher drought intensity which is causing drying out of water bodies in surface level [13].

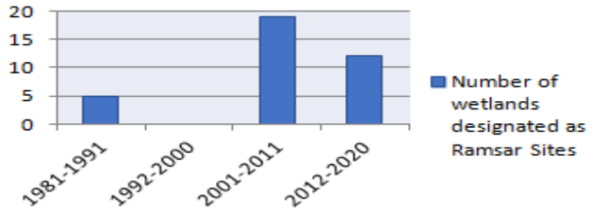

Figure 2 –Total Wetlands declared as Ramsar sites [13]

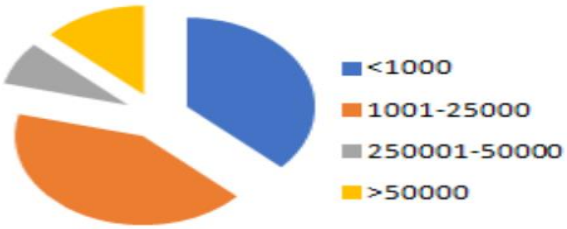

Figure 3 – Areas covered under wetland (in Hectares) [13]

2.2. *Properties of Wetlands*

All wetlands are considered to be natural in their study regions. The size of wetlands varies in both rainy and dry seasons. Significant environmental threats have been recorded in various ecosystems like commercial and residential land development, agricultural cultivation, pollution, alien species, climate change, hunting, water/dam management, intensive fishing, and service/transport corridors, human interference, and overuse of pesticides. These are some of the problems of biodiversity of wetland, sustainable lives, and ecosystem services (Figure 4) [14].

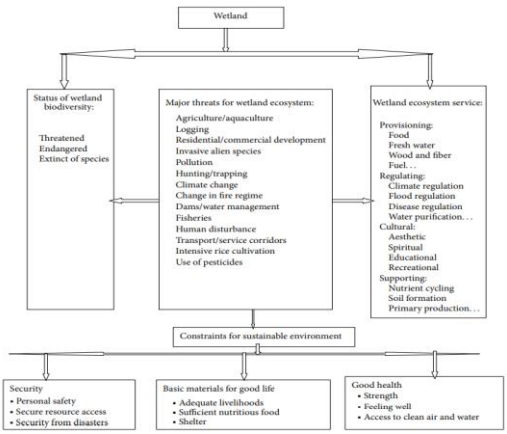

Figure 4 – Threats to wetlands ecosystem and biodiversity [14]

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2.3. Floral and Faunal Biodiversity of Parvati Arga wetland

Rajamani et al. [4] listed season-wise occurrence and observations of various flora species in Parvati Arga wetlands –

- Trees – 21
- Herbs and Shrubs – 30

Aquatic plants

- Free floating hydrophytes – 3
- Submerged plants – 4
- Emergent plants – 6
- Rooted floated leaves – 4

Table 1 – Season-wise Distribution of flora species in various seasons (2013-14) [4]

	Rainy		Winter		Summer	
	Species	Family	Species	Family	Species	Family
Herbs / Shrubs	21	13	24	16	28	17
Trees	21	14	21	14	21	14
Aquatic	25	21	18	15	16	13

Rajamani et al. [4] have also listed season-wise distribution of various fauna species. They conducted a field study in Parvati Arga Bird sanctuary and found 47 bird species which belong to 28 families. Here is the list of other fauna species –

Fish species in the wetland –

- Baam
- Rohu
- Nain
- Kochya
- Girai
- Parhan
- Taingan

Some of the species of Insecta butterflies are –

- Common Mormon
- Plain Tiger
- Rounded Pierrot
- Peacock Pansy
- Mammalia Nilgai

Some of the reptile species include –

- Garden lizard
- Brahminy Skink

Over the past few decades, humans have concerning relationship with wetlands because of growth of population apart from rapid urbanization and industrialization which have further polluted the wetlands by domestic waste, chemical waste, excessive use of insecticides, agricultural runoffs, and feedlot wastes. Problems have been ignored which resulted in the rise of threat of loss of wetlands and losing benefits [16]. Over 25% of all plants and animal lives are near extinction. Negative patterns have been detected for winged creatures, warm-blooded animals, water, land and coral creatures by the "IUCN's Red List Index", which determines the odds of endurance with accessible data [17]. Coral reefs are declining rapidly due to increasing ocean temperatures, while water and land creatures are highly threatened and have least numbers.

The total wetland area has been down by 64% across the world from 71 percent in 20th century. In inland wetlands, the extinction took place more significantly (61%) as compared to coastal wetlands (46%). In every region, 59% of wetlands have been extinct in Latin America, 35% of inland and marine wetlands were lost from 1970 to 2015 and there has been a loss of 12% in Oceania [9]. There has been a rise in the rate of loss of biodiversity while there were 3.7 times higher losses in the past century. On ecosystem services, there have been impacts like declining carbon sequestration, higher flood flows, lower coastal protection, more variable supplies of water, and habitat loss [15].

Over the past 40 years, over 33 percent of natural wetlands have been extinct to farming, over urbanization, and contamination in India as reported by a non-governmental body, i.e. WISA. As per the report published on "World Wetlands Day" before February 2, 2020, Mumbai recorded over 71% of wetlands which have been vanished from the year 1970 to 2014. Some of the major cities facing the loss of wetland are Bangalore (56%), Ahmedabad (57%), Delhi and NCR (38%), Hyderabad (55%), and Pune (37%). In Mumbai,

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wetland has been reduced to only 1.3 sq. km from over 4.58 sq. km., while it has been reduced to 1.36 sq. km from 2.21 sq. km. in Delhi. Satellite images were captured on land use to record this data from 22 towns and cities in India [11].

3. Discussion

Biodiversity in wetland is an important natural resource to hold sustainable growth. It conserves a lot of species in the long term and maintains helpful interaction among various ecosystem species. A lot of such wetlands have lost their ecosystem and biodiversity due to intensive aquaculture and agriculture, developing residential area, logging, water and soil pollution, invasive species, trapping/hunting, extreme climate, construction of dams, intensive production of rice, service corridors, and overuse of fertilizers and pesticides in the fields of wetland crop (Figure 4). Loss of land and habitats in wetlands are some of the effects of climate change, pollution, invasive species, and overexploitation of natural resources [18-20]. These issues have been rising extremely in the ecosystem since early decades [21]. Natural ecosystems have been conserved by connectivity of wetlands. It is also important for diversity of species in wetlands due to the growth of ideal habitats for conservation of species [22].

However, the sustainable agriculture has been based on expanding farming which is a key driver to the loss of natural resources and wetland connectivity [23-25]. There has been an extensive production of agricultural crops conducted by the people in the wetland. Various biotypes of pests have been increased by various cropping patterns in the crop fields and climate change. Pesticides have been applied in fields for preventing pests. This activity is considered vital for cultivation and it is a significant threat in the resiliency of wetland ecosystem [26-28]. In the same way, consistent changes in the land use affect biodiversity in wetlands. For instance, agricultural intensification has affected around 2/3rd of 333 species of farmland like butterflies, broad-leaved plants, mammals, birds, and bumblebees in late 20th century [29]. Some of the species are endangered, extinct, and threatened in the wetland ecosystem because of deep practices in sustainable agriculture.

In addition, industrial pollution is responsible for depletion of biodiversity in wetlands [30]. Foreign investment and economic development have led to the rise in industrialization in India. Industries are the major source of income, livelihoods, and employment for locals. Hence, no one cares about natural resources in wetlands, no matter how great they are in terms of availability of biological resources to protect sustainable environment. This insensitivity towards natural resources is the main reason behind this disruption. Fish and birds are key bioindicators to maintain aquatic vegetation in the ecosystem of wetland but these are being declined because of habitat change, industrial pollution, commercial exploitation of ecosystem, and introduction of foreign species [31]. In the same way, species of wetland are endangered, threatened, and extinct because of these ecological threats.

Anthropogenic activities worldwide have resulted in 35% decline in freshwater species, 14% decline in marine species, and 3% in terrestrial populations [32,33]. Since the last century, 60% of 1146 freshwater taxa are considered as threatening and 228 species have been lost due to water pollution in wetlands [34]. Biodiversity in wetland has been threatened significantly worldwide in this case [21]. There are around 9 million types of animals, plants, and fungi in the ecosystems across the world [35]. These problems are elevated in ecosystems of wetland due to significant threats in the environment. These threats also affect ecosystem services of wetland like fuel, food, aesthetic, climatic regulation, water, soil nutrients, and recreational activities. Some of the limitations are established well in wetlands like lack of security, good health, and basic needs which affected sustainable growth for conservation of species.

4. Conclusion

Biodiversity of wetlands is at very high risk because of significant threats to the environment. Species of wetlands have been considered endangered and threatened and some of them have been extinct completely in the ecosystem. Hence, it becomes very important to conserve wetlands for saving species and sustainable growth. Wetlands play various ecological roles for nothing. However, modern development and industrialization have pressured these features a lot and threatened their true existence. Ramsar Convention is known to take frame policies and activities to conserve

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the areas of global importance, while several strategies have been adopted at national level to achieve the purpose.

India has played a vital role in conservation and protection of wetlands, i.e., with various environmental acts for enacting wetland policies and regulations which have been through several amendments over the years. However, Indian government needs to do a lot to conserve and manage natural resources properly for a balanced environmental growth. Various laws and policies have been made for the conservation of Ramsar sites in India.

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