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Case Study

Assessment of Natural Resources for Conservation of Wetland in District Chamba – A Case Study of Manimehesh Lake

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Abstract: The Ramsar Convection of IUCN held in 1971 in Iran raised global attention on the conservation and management of wetlands. 3 wetlands in the Indian State of Himachal Pradesh have been declared a wetland of international importance. Thus it is felt necessary to reclaim and develop high altitude wetlands for its optimum potential use, but a reliable and accurate database is not available. The present endeavour aims at the generation of database in terms of physical aspects/ land use, the extent of water spread and its water quality, vegetation status of the catchment area and surroundings of the lake. The threats to high altitude wetlands have been identified and adequate measures for its conservation and management suggested.

1. Introduction

The Himalaya forms a shield of great importance right across the Northern facade of India from Jammu and Kashmir in the west to Arunachal Pradesh in east. But it is only one state, Himachal Pradesh, to which given the honor to derive its name from the Himalayas. By virtue of its extensive geographical extent, varied terrain and climatic conditions supports a rich diversity of inland wetland ecosystems. Wetlands are generally sandwiched between a terrestrial ecosystem and an open water system. Regions generally referred to, as wetlands are lakes, marshes, swamps, temporary ponds, riverbanks, mangroves and paddy fields. As a result of varied Physiographic and climatic condition-coupled with extensive water resource development project's wetlands, are abundant in the country. Wetland defines by Maltby (1986) as *a collective term for ecosystems whose formation has been dominated by water, and whose processes and characteristics are largely controlled by water*. The wetlands located in different physiographic, climatologically and geological regions are major sources of drinking water, irrigation, recreation and fishing. Increased human activating has an adverse influence on the hydrobiological regime and the lakes are fast deteriorating or even drying in some place. This is manifested in prolific weed growth, algal blooms, severe pollution and sediment infill. These developments have diminished their utility and pore a serious threat to their existence. In Himachal Pradesh, there are few natural wetlands and which have developed by movements, glacial activities and changing river course. Besides these, a few wetlands have developed by impounding large volumes of water. The wetlands development program is closely linked to food production, environmental protection, soil and water conservation, flood management, wildlife conservation, recreation and aesthetic setting.

Wetlands management, therefore, requires planning, system standardization, implementation, impact assessment and monitoring. The wetland ecosystems have not received deserved attention from the planners, although such systems have potential for high biological activity until the Ramsar Convection of IUCN held in 1971. Wetlands of Chamba have assumed national importance as it has a great sacred value to Lord Shiva. In the recent years, anthropogenic/pilgrimage pressure has created an ecological imbalance to a great extent. It is, therefore, felt necessary to reclaim and develop these lakes for its

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optimum potential use, but a reliable and accurate wetland data is not available. In this study, an attempt has been made to generate baseline information about spatial distribution of vegetation in and surrounding of lakes by using field survey, GPS for physical verification and water analysis for quality of lake water.

2. Study Area

Manimahesh Lake: At an altitude of 4088 meters, in district Chamba, 32 km from Bharmaur and 98 km from district headquarter. Manimahesh Lake lies between N 32° 232 44° 022 2† and E 76° 382 18° 092 2† in the Bundhil valley at the foot of Manimahesh ranges, in the interior of Bharmour. The eastern boundary contacts Kangra and Lahaul Spiti district, on the west most of the boundary line runs along with Chamba Tehsil, in the north by Pangi and the Churah Tehsil and at South by Kangra district.

3. Methodology

The studies were made during 2008-09 in order to know the current status of wetlands in district Chamba. This study was mainly focused on wetland namely Manimahesh Lake based on field survey of the lake and its surrounding area for its vegetation, physical parameter by use of GPS and water analysis for water quality of the lake were studied.

4. Results and Discussion

4.1 Physical Aspects

Rocks are sedimentary and the natural origin, cold water, mountainous soil, no land use pattern and it is used only as pasture land. This area is situated between the Dhauladhar and Zaskar ranges which run from the Southeast to the northwest of Chamba district. This region is separated from the Pangi valley by a mid-Himalayan range called Pir Panjal or Pangi Range. The climate of the area varies from the temperate to the semi-arctic. During summer, the weather is moderate and pleasant. Snowfall commences from September, though it is not quite regular till the month of October. However, from November to the end of March, the area generally remains covered under snow and all activities remain suspended.

4.2 Water quality

The water quality of the lake is good. No any type of threat is found. pH observed during the study period for different sites an average 7.35 Hydrogen ion concentration below 4.5 and above 9 is particularly injuries and unproductive. Besides being toxic to the aquatic life they react with the natural alkalinity of the water thereby increasing the carbonate hardness and thus rendering it unfit for further use. Electrical conductivity (EC) 75.0 is dependent on the temperature of the water and it increases with increase in temperature. EC is a direct indicator of total dissolved ions in water. Total suspended solids (TSS) are 0.1, with the increase in turbidity total suspended solids in the lake water increases. Alkalinity is 50, a measure of bicarbonates, carbonates and hydrates. Fluctuation in Alkalinity damages the aquatic environment. This also alters the pH of the water, which leads to the death of aquatic biota. Dissolve oxygen was observed above 4mg/L in all the study sites. The level of dissolved oxygen ranged between 8.9 to 10.5mg/L. The concentration of dissolved oxygen decreases with increase in temperature. Low concentration of DO indicates the presence of organic matter in water. With high organic load, dissolved oxygen is consumed rapidly during the putrefaction of organic substances contained in the lake bed. If vertical mixing of water is insufficient due to stratification, oxygen dissolves in the surface of water from the atmosphere air can't reach the bottom. In addition, poor clarity of water weakens sufficient penetration of the sunbeam and significantly photosynthetic reaction in the bottom water layer. Under these conditions, the DO in the bottom water will decrease ultimately leading 0-oxygen state. As a result aquatic fauna in that area seriously affected. Biological Oxygen Demand (BOD) is 0.7, demand of water has been a quantity related to the amount of water present in the water sample, BOD indicates the amount of dissolved oxygen used up during the oxidation of oxygen demanding waste. It could be found out incubating a sample of water for 5 days at 20^0C. Increase in BOD indicates higher organic matter contents in the lake water sample. Chemical Oxygen Demand (COD) is 1.75. The minimum of COD loading is in signification to cause any adverse impacts on water quality. COD values were found to be very low indicating absence of organic pollution load. Turbidity is zero Clear ponds with less than 25 ppm turbidity have 12-8 times more plankton and 5.5 times more fish production than ponds with a turbidity exceeding 100 ppm.

Table 1. Water Parameters and its values.

S. No.	Parameters	Values
1	pH	7.35
2	Electrical Conductivity µmhocm^{-1}	75.0
3	Total suspended solids, mg/l	0.1
4	Total Alkalinity mg/l	50
5	Dissolve Oxygen (DO) mg/l	4
6	BOD, mg/l	0.7
7	COD, mg/l	1.75
8	Turbidity NTU	0
9	NH_3-M	0.009
10	Silicates	36.6

Table 2. Some Common Plants of Lake's catchment area.

S. No.	Name	Families	Types*			Uses*			
			T	S	H	E	MU	Ti	F
1	*Abies pindrow* Royle.	Pinaceae	+				+	+	+
2	*Aconitum* Linn.	Ranunculaceae		+					
3	*Anaphalis margaritacea* Linn.	Compositae			+				
4	*Anaphalis triplinervis* (Sims) Clarke.	Compositae			+				
5	*Anemone obtusiloba* D.Don.	Ranunculaceae			+				
6	*Caltha palustris* Linn.	Ranunculaceae							
7	*Cedrus deodara* Roxb.	Pinaceae	+			+	+	+	+
8	*Clematis roylei* Rehder.	Ranunculaceae		+					
9	*Cotoneaster bacillaris* Wall.	Rosaceae		+			-	-	+
10	*Cyananthus lobatus*	Campanulaceae							
11	*Erigeron multiradiatus* Wall. exDC.	Compositae			+				
12	*Euphorbia* Linn.	Euphorbiaceae		+					+
13	*Gentiana argentea* D. Don	Gentianaceae			+				
14	*Impatien laxiflora* Edgew.	Balsaminaceae		+					
15	*Inula royleana* Linn.	Compositae		+					
16	*Juniperus macropoda* Bioss.	Cupressaceae							
17	*Leucas lanata* Wall.	Labiatae			+				
18	*Nepeta laevigata* D.Don	Labiatae			+				
19	*P. wallichiana* A.B.Jack.	Pinaceae	+				+	+	+
20	*Pedicularis hoffmeisteri* Linn.	Scrophulariaceae			+				
21	*Phlomis bracteosa* Royle.	Lamiaceae			+				+
22	*Picea smithiana* Wall.	Pinaceae	+				+	+	+
23	*Pinus roxburghiana*	Pinaceae	+				+	+	+
24	*Polygonatum spp.* Linn.	Liliaceae			+				
25	*Potentilla spp. Linn*	Rosaceae			+				
26	*Primula spp.* Wall.	Primulaceae			+				
27	*Pteracanthus alatus* Wall.	Acanthaceae		+					
28	*Quercus floribunda* Lindl.	Fagaceae	+				+	+	+
29	*Quercus leucotrichophora* A.	Fagaceae	+				+	+	+
30	*Ranunculus hirtellus* Royle.	Ranunculaceae			+				
31	*Rhododendron arboreum* Smith.	Ericaceae	+						
32	*Rosa brunonii* Lindl.	Rosaceae		+					
33	*Saussurea graminifolia*	Asteraceae							
34	*Bergenia ciliata* Royle.	Saxifragaceae			+				
35	*Sedum ewersii*	Crassulaceae							
36	*Selinium* Linn.	Selaginaceae			+				+
37	*Swertia petiolata*	Gentianaceae							

The increased silt in the lake increased turbidity and reduces the oxygen intake in the water leading to impact on all life in the lake. Water temperature in lake varied at a range of 4.0 to 10.0 ^{0}C. During the summer, and a decline in water temperature was recorded in the winter season. Increase in temperature accelerates the biodegradation of the organic matter, both in bottom deposits and overlying water. This enhances the BOD level. Some aquatic fauna remains active in near 0^{0}C temperature which prevails in streams of the lesser and greater Himalayas during Dec and Jan. Water temperature also regulates species composition, metabolism and reproduction of essentially poikilothermic aquatic life. It is an influential water quality characteristic of life in water. At higher temperature oxygen becomes less soluble and in order to cope with biodegradation, results in oxygen depletion. Dissolve oxygen has been a fundamental requirement of life of the plant and animal population. Their survival is dependent upon the availability of water to maintain certain minimal consideration. The disappearance of plant and animal life is an obvious result of the oxygen depletion.

4.3 Vegetation

There is alpine vegetation in the circle of 7 km from the lake. Above treeline, pasture vegetation of catchment has a verity of plants due to variation in climate and topography. Along an altitudinal gradient, *Pinus roxburghiana, P. wallichiana, Quercus leucotrichophora, Cedrus deodara, P. wallichiana, Cedrus deodara* mixed, and broad-leaved deciduous mixed forests; *Abies pindrow, Picea smithiana, Quercus floribunda, Q. semecarpifolia* and *Betula utilis* forests are distributed. The forest zone is followed by alpine scrubs and thatches (meadows). The alpine scrubs are dominated by the species of *Rhododendron, Rosa, Cotoneaster, Juniperus etc.* The alpine meadows are dominated by the species of *Anemone, Polygonum, Primula, Potentilla, Euphorbia, Cortia, Trachydium,*

Ranunculus, Selinium, Caltha, Phlomis, Lomatogonium, Nomocharis, Saxifraga, Polygonatum, Impatiens etc. Large numbers of medicinal plant are found scattered all over the catchment area and many of them are endemic to the region.

4.4 Fauna

The wild animals found in the study area are listed in Table 3. It is revealed that no any animals found here which included in the list of endangered species of the world. The development of the forest in the area will help protection as well as expand the habitat for these wild animals.

4.5 Cultural Heritage

Shiv Mandir, an old temple, was built by Local peoples. Lake water is a minor source of Budhil River, clear lake water no human habitation around the lake, so, water is considered as holy water and taken to home for worship. The religious importance of this lake is, people relate it to their social values because this lake sacred to Lord Shiva and have a high sacred significance.

4.6 Local Human Population

Only 7% of the total population of this block (Bharmour) is inhabited in this valley up to the Basecamp Hadsuar before 14 Km from the lake. They are mainly involved in rearing sheep and goat; in winter keep themselves busy with spinning and weaving of the locally available wool for their domestic use and occasional sale during the period of migration. Local people of this region migrate their herds to the lake's catchment area in summer season. These people played a role of Pujari or Priest at the time of the Yatra. Some people open sky shops at the time of Yatra by selling food, and necessary item for Yatri, they also collect wild (Bhojpatra) and medicinal plants (Saussurea) throughout the year and sell it at the time Manimahesh Yatra and earn money.

4.7 Visitors and Visitor Facilities

Bharmour block of Himachal Pradesh forms a unique socio-physical unit of the state. This area is endowed with a rich variety of visitor attractions in the form of trekking, mountaineering, art and culture, fairs and festivals, traditions customs of the peoples. And finally, Manimahesh Yatra which places the number of pilgrims increasing every year up to one lack in the months of August to September. Large number of people, young, old, man, women, handicaps and children, who faith in Lord Shiva comes here with lots of hurdles. But no one stops them to take a wish from Lord Shiva. Temporary facilities of Boarding and lodging are provided by government as well as by private businessmen at the time of the Yatra. Large number Langer (Free food camps) was also organized by many social and spiritual organizations.

4.8 Scientific Research and Facilities

There is no scientific research have been done in this region, except some secondary data was collected by WWF Shimla.

Table 3. List of Wild animals in the Study Area.

	S. No	Common Name	Scientific Name
Mammals	**1**	Jungle cat	*Felis chaus*
	2	Himalayan black bear	*Selenarctos thibetanus*
	3	Himalayan brown bear	*Ursus arctos*
	4	Himalayan fox	*Vulpes bengalensis*
	5	Goral	*Nemorhaedus goral*
	6	Red faced monkey	*Macaca mulatta*
	7	Himalayan languor	*Presbytis entellus*
Birds	**1**	Jungle fowl	*Gallus gallus murghi*
	2	Impeyan pheasant	*Lophophorus impejanus*
	3	Chakor	*Alectoris graeca*
	4	Gray Partridge	*Fancolinus pondicerianus*
	5	Whistling thrush	*Myophoneus caerulens*
	6	Himalayan pied woodpecker	*Cryobates himalayenensis*
	7	Red vented Bulbul	*Molpastes cafer*
	8	Blue bearded bee eater	*Alcemerops althertoni*
	9	Hill myna	*Gracula religiosa*
	10	Himalayan griffon vulture	*Gyps himalayensis*
	11	Himalayan barred owlet	*Glancidium cuculoides*

Source: Forest Department, Himachal Pradesh

4.9 Conservation values

From Last few years, concrete sheds have been made by the Government body near the lake. Other than it Land nearby lake is used by local migratory herds. The roads are going to be constructed. Large Pressure of solid waste by visitors and Langers (Free food camps), by leaving out all the rappers of packet food, toned milk, and all plastics packing material they have taken to the lake. In summer overgrazing by herds of local Gaddi community and medicinal plants collected by herb collectors increasing day by day as the demand of Ayurvedic or herbal product is increased. Most important thing is that every five to six year natural calamities has been occurring with vast losses of living things and government properties. Legally and religiously it is not allowed to through waste materials into the lake and surrounding area but it is not implemented by some peoples.

4.10Ethnobotanical Conservation Matrix

It is documented that the accomplishments of native people in understanding the plant properties so extensively must be simply that result of long and intimate association with their floras experimentation and their letter dependence on flora for a living. This area under study is such a hot spot which has pockets of tribal population along with areas of endemic centers. Plant diversity centers may form the mosaic of the conservation area matrix. A proper appreciation of Biodiversity and a meticulous cataloging of it are the essential first steps in any effort for its conservation, whether *in situ* or *ex-situ*.

5. Conservation & Management

Biodiversity conservation is essential not only for ecological and environmental rejuvenation but also for sustainable economic development. These forests control the water budget in the lands around them and influence the climate to a considerable extent. Apart from their ecological functions, they serve as a valuable gene pool. Manmade extinction of species and losses of habitat are the order of the day. However, in this area conservation efforts should be made to develop strategies for the protection of ecosystems, species, and gene, taking into consideration human population processes and developmental needs of tomorrow. The network of *in-situ* and *ex-situ* conservation strategies is to be supplemented using holistic or adaptable conservation of biodiversity strategies in the wildlife areas, managed forests and medicinal plants. No management plan is prepared or approved by the Government since the pilgrim begins. Government official comes here only at the time of the Yatra. But they have not taken responsibility after the completion of Yatra for dewberries removal and solid waste management. Otherwise, in the future, it will become a great cause of environmental pollution is this peaceful full area of Lord Shiva.

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