CONSERVATION VALUES OF WETLANDS

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ABSTRACT

Wetlands are regarded as direct or indirect life supporting system of millions of people in a diverse way. Increased anthropogenic activities over time have significantly contributed to the deterioration of these wetlands. The catchment area of Sharavathi river basin has treasured numerous ponds / tanks with varying use potential. The present study was carried out in four tanks namely Ulluru, Kaspadi, Govatooru and Nagara to analyse the present status of these wetlands and assign conservation values in terms of their direct and indirect benefits. These tanks aid in groundwater recharge apart from being used for irrigating agriculture and horticulture crops. Despite these direct and indirect benefits, these tanks are neglected by the local people and the concerned authorities. These tanks are on the verge of extinction due to lack of sufficient conservation. The study attempts in quantifying the conservation values based on the direct and indirect benefits of wetlands.

KEY WORDS : **Wetlands, Eutrophication, Conservation, Ecology, Land use, Sharavathi, Western Ghats**

Introduction

Wetlands are regarded as direct or indirect life supporting systems of millions of people in many ways. It is known that ancient civilizations had their origin and growth on the banks of major rivers. People use wetland soil for agriculture, catch fish in the wetland for food, cut wetland trees for timber and fuelwood and wetland reeds to make mats and thatch roofs. Other uses include recreation, such as bird watching or sailing, or scientific study, flood control, nutrient recycling, and many more (Barbiei et al, 1997). Extinction of these wetlands is a growing concern all over the world. The human induced threats and improper management systems are reducing the number of these wetlands. In Karnataka, about 35% wetlands are threatened due to sedimentation, 43 % are subjected to encroachment and 22 % have rampant growth of exotic weeds.

The catchment area of Sharavathi river basin has treasured a good number of small wetlands (swamps, tanks/ponds, etc,). The downstream areas of these wetlands are highly valuable due to continuous water availability and suitability of land for areca cultivation. The villagers in the surrounding area are dependent on these tanks for washing of clothes, animal washing, and many other domestic needs. These tanks serve as groundwater recharging sources and presently the tanks of Kaspadi, Ulluru and Govatooru are in bad condition due to various anthropogenic stresses. Increased macrophytic growth and unhygienic conditions prevailing in the tanks have created nuisance. The marshy areas are the places for mosquito breeding and these areas are being turned into paddy fields by the encroachers. The water holding capacity of these tanks seems to be decreasing due to these activities.

In this connection, the present study has been undertaken to illustrate the present status of wetlands and the stresses acting upon them In order to highlight the requirement of restoration, economic valuation of these wetlands has been carried out.

Methodology

In order to quantify the direct and indirect benefits of wetlands, four tanks namely Ulluru, Kaspadi, Govatooru and Nagara in Sharavathi river basin of Western Ghats were chosen. Physico-chemical analysis was done to assess the present status and economic valuation is done to quantify direct and indirect benefits.

Water samples were collected from three different locations comprising inlets and outlets. The sample analysis was carried out as per the procedures prescribed by APHA and NEERI for water analysis. Totally, 22 parameters were considered to represent the physico-chemical status of the tanks. In order to identify various end uses and the use potential of the tank, local people were surveyed with structural questionnaires. For secondary information, the concerned village accountants were consulted. Remote sensing data (Nov 2003 and March 2004) was used to assess the spatial extent of each tank and its catchment area.

Ulluru Tank : The tank has been constructed for irrigating the agricultural crops around northern part of Ulluru. The total area of the tank is 3.99 ha, out of which nearly 0.5 ha is under encroachment. One third of the area is under weed coverage, dominated by species of *Nymphea*. As such there are no records of de-silting the tank in the past. About 25.5 ha of catchment area is more or less dry and dominated with moist deciduous forests.
Kaspadi Tank : Major use being irrigation, this tank spreads over an area of 1.7 ha. Presently slush and weeds cover a major portion of the tank. In this case also there are no records of desiltation.
Govaturu Tank : Total area of this tank is estimated to be 0.955 ha as per satellite imagery of the study area. The tank is situated in a relatively dry area compared to the former two. During summer season this tank dries up due to silt deposition and lack of inflow.
Nagara Tank (Shanthi Kere) : As per the local people, the tank was constructed about 500 years ago. The tank is situated on the bank of the historical Nagara Fort. It spreads over an area of 3.58 ha as estimated by satellite imagery. The major use of this tank is irrigation.

Table 1. Features of sampled tanks

Parameter	Ulluru Tank	Kaspadi Tank	Govaturu Tank	Nagara Tank
Total area (Ha)	3.99	1.7	0.955	3.58
Average water spread (%)	80	70	50	85
Maximum depth (ft)	8.00	4.00	3.00	8.00
Catchment area (Ha)	25.49	4.86	8.8	1.4
Extent of slush and weed coverage (Ha)	2.394	1.19	0.6685	0

Results and Discussions

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Present status :

The physico-chemical analysis of the tank samples (Table 2 and 3) showed that the dissolved oxygen concentration was around 4 mg/ L. When the dissolved oxygen at the surface is ranging around 4 mg/L, it may decrease with the depth due to lack of sufficient mixing. The dissolved oxygen less than 3.5 mg/L is harmful to aquatic life and there is every possibility of such a case in Ulluru, Kaspadi and Govaturu tanks. Even the coliforms have shown their presence in almost all the tanks revealing organic pollution.

Table 2. Physico-chemical and Biological analysis of tank samples

Sl.No	Tank Name	Ulluru			Kaspadi		
	Sample No	1	2	3	1	2	3
	PHYSICAL PARAMETERS						
1	Transparency (cm)	-	-	-	20	21	45
2	Temperature (°C)	26	27	26	27	27	26
3	EC (ms/cm)	0.0576	0.064	0.064	0.083	0.089	0.089
4	Total Suspended Solids(mg/l)	70	105	75	-	-	-
5	Total Dissolved Solids(mg/L)	50.1	53.98	48.91	71.53	69.25	72.9
6	Turbidity (NTU)	45	50	35	25	50	20
7	Colour *	Brownish	Brownish green	Brownish green	Blackish green	Blackish green	Blackish green
	CHEMICAL PARAMETERS						
8	pH*	7.26	6.9	7.2	6.83	6.6	6.9
9	Alkalinity (mg/l)	98	107	90	20	24	20
10	Acidity (mg/l)	20	35	25	-	-	-
11	Chlorides (mg/l)	39.98	44.98	34.98	36.92	34.08	36.92
12	Total Hardness (mg/l)	65.4	82.84	87.2	-	-	-
13	Dissolved oxygen (mg/l)	3.7	4.3	3.5	4.5	3.5	4.3
14	Sodium (mg/l)	-	-	-	190.3	161.1	163.7
15	Potassium (mg/l)	1.62	4.84	1.23	10.43	10.35	10.039
16	Sulphate (mg/l)	15.25	15.99	12.59	9.866	21.6	7.466
17	Nitrates (mg/l)	-	-	-	1.735	3.749	2.3226
18	Phosphate (mg/l)	0.02	0.0125	0.0233	0.0024	0.008	0.0032
19	Iron (mg/l)	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
20	Ammonia (mg/l)	1.0-3.0	1.0-3.0	1.0-3.0	3	1.0-3.0	3
21	Residual Chlorine (mg/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	BIOLOGICAL PARAMETER						
22	Coliforms *	Present	Present	Present	Present	Present	ND

Table 3. Physico-chemical and Biological analysis of tank samples

Sl No	Tank Name	Nagara			Govaturu		
	Sample No.	1	2	3	1	2	3
	PHYSICAL PARAMETERS						
1	Transparency (cm)	28	8	15	<10	<8	<10
2	Temperature (°C)	28 8	28	29	27	28	27
3	EC (ms/cm)	0.0192	0 03136	0 01856	0.05248	0.064	0 0531
4	Total Suspended Solids (mg/L)	68	95	75	-	-	-
5	Total Dissolved Solids (mg/L)	15.2	42	14 89	33.32	43.27	35.85
6	Turbidity (NTU)	45	50	40	20	20	18
7	Colour	Greenish green	Brownish	Greenish Brown	Light	Brownish green	Blackish
	CHEMICAL PARAMETERS						
8	pH	7 37	6.5	6.85	7.11	6.93	7 1
9	Alkalinity (mg/L)	90	95	90	16	20	16
10	Acidity (mg/L)	15	20	10	20	20	20
11	Chlorides (mg/L)	19 99	14 99	19.99	25 56	36 92	25.56
12	Total Hardness (mg/L)	52 32	74 12	47.96	48	64	60
13	Dissolved oxygen (mg/L)	7.1	7	7.1	4.5	4	5
14	Sodium (mg/L)	14.6	15.24	14 59	19.11527	35.99	14 128
15	Potassium (mg/L)	1.83	2.073	1.83	3.251706	6 423	3.1327
16	Sulphate (mg/L)	13.428	15.218	11.63	4.35	8.979	7 074
17	Nitrates (mg/L)	-	-	-	Nil	Nil	0 2115
18	Phosphate (mg/L)	0 009	0 016	0 0095	0 009	0 093	0 01
19	Iron (mg/L)	<0.3	<0.3	<0 3	<0 3	<0.3	<0.3
20	Ammonia (mg/L)	1.0-3 0	1.0-3 0	1.0-3.0	1.0-3 0	1 0-3 0	1 0-3 0
21	Residual Chlorine (mg/L)	<0 2	<0 2	<0.2	<0 2	<0 2	<0 2
	BIOLOGICAL PARAMETERS						
22	Coliforms	Present	Present	Present	Present	Present	ND

Sustainability of wetlands :

The sustainability of these wetlands is largely linked with the activities taking place in and around the catchment. In order to identify the threats to these wetlands, local people around these wetlands were interviewed. Out of the 13 identified threat parameters (Table 4), the Kaspadi and Nagara tanks are facing 7 threats individually, Ulluru 9 and Govaturu 11 threats. It can be stated that the number of threats is inversely proportional to sustainability. In other words, Govaturu tank is under severe stress. As the number of threats increases, the complexity associated with restoring and managing these tanks also increases, Until the magnitudes of all the threats are relatively equal, the theory of classifying the wetlands based upon the number of threats holds good.

Table 4. Threat documentation to the sampled tanks

Sl. No.	Threat Parameter	Ulluru Tank	Kaspadi Tank	Govaturu Tank	Nagara Tank
1.	Sewage	Yes	Yes	Yes	Yes
2.	Industrial Waste	No	No	Yes	No
3.	Agricultural Wastes	Yes	Yes	Yes	No
4.	Siltation	Yes	Yes	Yes	Yes
5.	Cloth washing	Yes	Yes	Yes	Yes
6	Cattle bathing	Yes	Yes	Yes	Yes
7	Vehicle servicing	No	No	No	Yes
8	Encroachment	Yes	No	Yes	No
9.	Cattle Grazing	Yes	Yes	Yes	Yes
10.	Mud Lifting	No	No	Yes	Yes
11.	Poaching of Wildlife	No	No	No	No
12.	Solid Waste Dumping	Yes	No	Yes	No
13.	Weed choking	Yes	Yes	Yes	No

Economic Valuation :

Quantification of direct and indirect use benefits of selected tanks was done. Table 5 lists the most familiar uses under direct uses. In the present case, the direct values include fish and agriculture. Both the values are being estimated to the fullest potential, invariable to the present practice. The potential for fishery activity in Govaturu tank is feeble due to drying up during summer season. However, proper desilting of the tank may provide sufficient space for water storage and can open ways to fishery practices. Agricultural practices in the command areas of the tanks are more or less dominated by commercially valuable areca crops. Due to this the economic value is quite high.

Table 5. Economic valuation of the sampled tanks

Tanks	Ulluru	Kaspadi	Govaturu	Nagara
Direct uses				
Fish Rs/fishing day/ha)	136.4	76 47	0	98 29
Agriculture (Rs./ha/year)	122000	122000	8000	122000
Indirect uses				
Nutrient retention	High – More agricultural activities in the catchment	High – More agricultural activities in the catchment	High – More agricultural activities in the catchment	Less
Flood control	Moderate – small catchment area	Moderate – small catchment area	Moderate – small catchment area	Moderate – small catchment area
Groundwater recharge	High	Moderate	Low	High
Option and Quasi- Option Value				
Potential future (as per direct and indirect uses)	Present	-	Present	-
Non-use values				
Biodiversity	Water birds	Water birds	Water birds	Less birds
Culture heritage	Pooja during Ganesha	Pooja during Ganesha Festival	Nil	Pooja during Ganesha Festival

Financially unrewarding uses are categorised under indirect uses of wetlands. The nutrient retention values are quite high in most of the cases. This is because the catchment areas near the tanks comprise extensive paddy cultivation, wherein farmers use enormous amounts of fertilisers. The leached products are retained by the tanks and lead to rapid growth of hydrophytes. Thus, presently the catchment area of Nagara tank does not have any agricultural activity. Flood control value is quite low in many of these tanks. As the catchment area is very low to cause huge floods, the flood control value remains to be moderate in any circumstances.

Groundwater recharge potential is high in many of the cases unless otherwise there is huge silt deposition. Nagara tank is comparatively more pervious than other tanks. Kaspadi and Ulluru tanks seem to be highly deposited with silt and thus reduce the pervious nature of the soil.

Quasi-option value is the expected value of the information derived from delaying exploitation and conversion of the wetland today. By slightly modifying the concept so as to adjust to the local conditions, it may be further justified that encroachment of the tank area in the form of converting into agricultural fields reduces the value of the wetland as a whole. Thus it is highly necessary to prevent encroachment problems in the case of Ulluru and Govaturu tanks.

Non-use values are extremely difficult to measure. Biodiversity, culture, heritage, and bequest values are classified under non-use values. However, the present study lacks the detailed understanding of the biodiversity issues of these tanks. But overall observation made during field visits showed that the tanks are the habitats for a number water birds such as Little Cormorant, Little Grebe, Egrets, Purple Moorhen, Whitebreasted Water hen, Red Wattled Lapwing, Whitebreasted Kingfisher, Large Pied Wagtail, etc, only Govaturu and Nagara tanks recorded no birds other than White breasted Kingfisher and Little Cormorant. Thus, overall valuation of these tanks shows that they are a part and parcel of the ecosystem. The rich commercial value in terms of fishery and irrigation justifies their necessity to be preserved. Apart from this, other indirect uses include groundwater recharge, flood control and biodiversity values.

Economic valuation of the wetlands illustrates that they are a part and parcel of the ecosystem. The rich commercial value in terms of fishery and irrigation justifies their preservation. Apart from this, other indirect uses like groundwater recharge, flood control and biodiversity values further enrich the worth of these wetlands. To a large extent, these wetlands are the sources of cloth washing, drinking water for hundreds of cattle, vehicle servicing, and many more needs.

Comparison between the presence and absence of wetlands : TOP

When the wetland is converted into an agricultural area, it assumes purely the shape of a paddy field and definitely there will be decrease in productivity due to lack of water availability. The command area gets dried up. Assuming the conversion, the annual revenue decreases to 8000/ ha/year. Thus, there will be a sharp decline in annual revenue in the command area as well as converted wetland area. Further, the indirect values, option and quasi-option values also diminish in the absence of the wetland. The overall observations clearly highlight the need for preservation of the wetlands.

In general, it can be stated that the wetlands of Sharavathi River Basin are in a pathetic condition due to a number of threats. Waterfowl census of these four tanks shows that most of the tanks (three out of the four sampled tanks) are suffering from increased weed coverage and siltation. Thus, it is of prime importance to restore the wetlands immediately.

Overall observation of the wetlands in Sharavathi River Basin indicates that encroachment is the major problem. As per the Revenue Department, landless farmers are targeting the tankbed and forestlands and converting them into agricultural areas. Even the studies carried out in Keladi Lake of Sagara Taluk (Sreekantha et at, 2002) and Anekere of Karkala Taluk (Bhat, 2001) pointed out that encroachment is the major threat to the sustainability of the wetlands.

Restoration of wetlands :

These wetlands in the dry region can support the drinking water requirement of the village if managed properly. When there is scarcity of sufficient groundwater for both drinking and irrigation, these wetlands can be highly advantageous if they are restored. With the groundwater table alarmingly dropping down in recent times, they can act as water sinks to enhance the water table. Consideiing the health of the various hydroelectric power projects in Shaiavathi River Basin, these wetlands can inhibit the silt flow to the reservoir. Properly managed wetlands can be commercially used for fishing activities. The fisheries department can get new opportunities to extend the fishing activities in these wetlands. The aesthetic value of properly managed wetlands is very high.

The restoration and management measures of these wetlands should be the responsibility of various organisations either directly or indirectly associated with them. The role of local people is a major factor that needs attention. The local people are closely associated with the wetlands. So they can actively take part in restoration activities of the wetlands. For this purpose, the village committee should be formed and the responsibilities of monitoring and management should be handed over to them. Strategy followed in JFPM scheme can also be extended to the present case. The Gram Panchayath and the Revenue Department should take prime responsibility in supervising the restoration and maintenance after restoration of these wetlands. The Project authorities of the Sharavathi River Valley Projects should be actively involved in the restoration considering the watershed management and direct and indirect benefits to the projects after restoration. The Forest Department should take necessary action against deforestation in the catchment area and catchment area treatment.

Conservation and Management Strategy for these wetlands :

The tank boundaries are susceptible to encroachment. These sensitive areas should be properly monitored. Cattle grazing in the marshy areas of the tanks can contribute significant amount of nutrients to the lake/tank thereby leading to eutrophication. Anthropogenic activities like cloth washing, vehicle servicing and cattle bathing in the tanks should be prevented considering the quality to be maintained for future use as drinking water. Instead, for such activities, water extraction should be allowed by taking utmost care to avoid release of the wastewater into the tanks again. Properly maintained database on ecological conditions, regular water quality and catchment area monitoring is essential for any management options. Healthy catchments are required to maintain the wetlands in healthy conditions. The degraded areas of the catchments should be brought under afforestation programmes associating the local people.

ACKNOWLEDGEMENT

We are grateful to the Ministry of Environment and Forests, Government of India and Karnataka Power Corporation Limited, Government of Karnataka for the financial support. We thank the Karnataka Forest Department for providing necessary permission and cooperation during the field data collection.

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