ECOSYSTEM HEALTH-APPROACH TO RESTORATION OF WETLAND RESOURCES OF LAKSHMITAL LAKE

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Wetlands: A Glance

6.4% wetlands

India:

- 67,429 in India covering about 4.1 million ha,
- 2,175 natural (1.5 million ha)
- 65,254 man-made (2.6 million ha)
Objectives: Present Study

- Identification of most appropriate indicators for ecosystem health for wetland-system components.
- Assessment of physico-chemical characteristics of Lakshmital in different seasons.
- Assessment of metals concentration in lake water, sediments and in macrophytes.
- Identification and assessment of macrophytes in Lakshmital.
- Assessment of socio-economic pressures on the lake ecosystem.
- Development of specific planning and restoration strategy for sustainable and cost-effective management of Lake Lakshmital.
Study site: Description
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- situated outside the city wall in the direction of Kaimasan Hill,
- covers an area of 32.52 hectares with an average depth of 2.5 meter.
- It lies between longitude of 780 371 E and 250 571 N of latitude and has a catchment area of 2370 hectares having a storm water intensity of nearly 0.75 per hour/acre of flood rain.
- It is a rain fed water body.
Study sites
Methodology

- Basis of relative proportion of inflow, outflow and storage, quality of inflowing water and human activities within or near the wetland six sampling sites were selected for physico-chemical and metal analysis.
- Samples were collected in three different seasons viz. winter, pre-monsoon and post-monsoon during a period of one year.
- Sediment sampling was carried out from one location during a period of five days randomly.
- Macrophyte sampling was done once in a year.
Results & Discussion
Physico-chemical Analysis

**Temp.**: No significant spatial variation, max. in *summer* may be attributed to clear atmosphere

**pH**: Max. on SIS, due to constant input of sewage. Max. in pre-monsoon due to increased prim. production that raise pH
**Results & Discussion**

**Physico-chemical Analysis**

**Turbidity:** max. SIS, Seasonally; Max. in post-monsoon might be due to increase in sedimentation with influx of monsoon runoff.

**EC:** Max. RABW, shallow and low mixing caused accumulation of ions, DS & nutrients. Seasonally; max. in pre-monsoon, due to high temp. gradient that increased evapo-transp. Rate leading to low level with constant sewage inflow.
Results & Discussion
Physico-chemical Analysis

**TH:** No significant variation within the sampling sites of lake. Seasonally; Max. hardness was in pre-monsoon followed by winter & post-monsoon season because hardness remains minimum in high flow seasons and max. in lean seas.

**TA:** MLR, highest TA, can be judged by an interaction between Na, Cl, CaCO₃ & water stagnate over a long period of time in MLR. Seasonally; post-monsoon seas. showed max. TA, due to input of no. of bases with surface runoff.
**Results & Discussion**

**Physico-chemical Analysis**

**Phosphate**: SIS, max. conc. Seasonally; max. conc. In pre-monsoon due to death & decay of vegetation and aquatic life and constant sewage input.

**Nitrate**: Max. conc. at site adjacent to vegetable farms may be due to leaching of nutrients & continuous input of plant residues. Seasonally; max. nitrate was in post-monsoon seas. probably by transport of nutrients from watershed areas with runoff.
**Results & Discussion**

**Physico-chemical Analysis**

<table>
<thead>
<tr>
<th>Sampling sites</th>
<th>Sampling sites</th>
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<tbody>
<tr>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Winter</td>
<td>Pre-monsoon</td>
</tr>
<tr>
<td>Dissolved Oxygen (in mg/l)</td>
<td>Biochemical Oxygen Demand (in mg/l)</td>
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</tbody>
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**DO:** Seasonally; higher conc. in winter while min. in pre-monsoon seas. that can be correlated with temp. which influences the oxygen solubility in water

**BOD:** Max. at SIS and outflow site might be attributed to presence of excessive nutrients commonly originate in domestic fertilizers, waste matter from animal feed lots etc. Seasonally; in summer, high BOD value due to high temp., pH & presence of microorganisms which easily degrade the organic matter in presence of oxygen.
Results & Discussion
Metal Analysis

Mn was in highest conc. followed by Zn & Cu while Pb and Cd were lowest and Ni was absent.

Mn: Max. conc. at SIS & watershed site as it strongly depends on pH.

Zn: household sewage and agricultural runoff from surrounding areas.

Cu: alkalinity & pH influence the Cu conc.
Results & Discussion

Metal Analysis - Plants

![Graph showing metal concentration in plants](image)

- **Phalaris root**: 0.005
- **Phalaris leaf**: 0.006
- **Eicchornia root**: 0.007
- **Eicchornia leaf**: 0.008
- **Potamogeton root**: 0.003
- **Potamogeton leaf**: 0.0035
- **Elatine root**: 0.004
- **Elatine leaf**: 0.0045

Total metal concentration in milligrams per liter (mg/l): 0.0005 to 0.0045

**Roots and leaves of plants**

**Plant species**
Growth of *Phalaris arundinacea* in Lakshmital Lake
Growth of *Potamogeton zosteriformis* in Lakshmital Lake
Growth of *Eichhornia crassipes* in Lakshmital Lake
Growth of *Elatine triandra* in Lakshmital Lake
Results & Discussion
Socio-economic Analysis

- 10,000-50,000 Rs. (9%)
- 51,000-1,00,000 Rs. (13%)
- 1,10,000-2,50,000 Rs. (27%)
- Above 2,60,000 Rs. (37%)

- 100-200 l/d (20%)
- 210-300 l/d (24%)
- 310-400 l/d (37%)
- 410-500 l/d (3%)
Results & Discussion
Socio-economic Analysis

Biodegradable waste: 40%
Non-biodegradable waste: 60%

1-3 years: 3%
4-6 years: 7%
7-9 years: 53%
10-12 years: 37%
Conclusions & Recommendations

Due to increasing anthropogenic interferences and tremendous population growth in periphery of lake, subjected it a number of problems like water quality deterioration, inadequate water holding capacity due to siltation. Eutrophication by invasion of aquatic weeds and a number of socio-economic pressures.

An integrated approach is required to rehabilitate the lake including practicable management techniques:

**Structural Techniques:**
1. Lake Mang. (Pollution obstruction, weed control, Desilting, Cleaning of lake water,
2. Watershed Mang. (Fencing, Plantations in Buffer Zone, waste mang.)

**Non-structural Techniques:** Future Management & Maintenance of Lake
THANK YOU