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RESEARCH ARTICLE

FUTURE PROSPECTS OF LIMNETIC UTILITIES - A NEW APPROACH

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ABSTRACT

A holistic approach aimed at unraveling and exploring the possible eco-sustainable utilities of limnetic ecosystems has been suggested. Practices that are in various levels of applicability cum experimentation in the developed countries are envisioned, some being highly successful in promoting the socio-economic status of the local population. India with ample potential perennial limentic ecosystems and massive demand driven dependence of its human population on natural resources can adopt such methods with suitable modulations to derive benefits from such ecosystems.

INTRODUCTION

Thehuman-aquatic ecosystem association isancient as evident from the human settlements besides rivers *viz.,* Indus valley civilization, Egyptian civilization on the banks of Nile (Butzer, 1976) and so on. Water caters to domestic and industrial requirements, navigation and recreational activities. Fresh water resources constitute 2.53% of planet earth's water (hydrosphere), approximately 1.46 X 10^9 cubic kilometer. Surface water being easily accessible, water bodies like lakes and rivershave been the most prominent sources of fresh water .With progressing time, the ever increasing population and the urbanization-industrialization impact on the fresh water ecosystems have been immense and the extent of benefits from such fragile ecosystems has significantly reduced (Ramachandra, 2001; Scott and Terry, 2004). The lakes of the city have been largely encroached for urban infrastructure (Kiran and Ramachandra, 1999; Chandrashekar *et al.,* 2003), and as a result, in the heart of the city only 17 good lakes exist as against 51 healthy lakes in 1985.Presently, the Management of Lakes is undertaken by the Lake Development Authority with a limited public–private sector participation. The Lake Development Authority an autonomous regulatory, planning and policy body for Protection, Conservation, Reclamation, Restoration, Regeneration and Integrated Development of Lakes, whether natural or man-made in the state of Karnataka was set up in 2002. Since there is an urgent need for constructive utilization of water resources and the preservation of aquatic ecosystems with ecological significance in the region, the present inter-disciplinary approach has been envisioned. The proposals were designed based on field surveys and analysis of four water lakes *viz.,* Hebballake, Nagavara lake, Rachenahalli lake and Amruthhalli lake, while intended to suit to other limentic ecosystems of similar nature.

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MATERIALS AND METHODS

Study area

Bengaluru has a salubrious climate with an annual mean temperature of 24 °C (75.2 °F) with extremes ranging from 37 °C (98.6 °F) to 15 °C (59.0 °F) and annual rainfall of 900 mm (3.0 ft) with two different rainy seasons covering nine months of the year. June to October is the rainy season accounting for 64% of the total annual rainfall in the Southwest monsoon period and 324 mm (1.1 ft)during the Northeast monsoons (November – December).

Field survey

Exploratory surveys involving field visits and literature review were undertaken of the lakes. Information regarding the status

of the ecosystems was gathered from local inhabitants in the lake environ. Necessary photographs of different views and geographic details were obtained.

RESULTS AND DISCUSSION

Bangalore is on a higher plane, the water storage is a bigger problem than compared to the sewage discharge. Hence the lakes act as large water harvesting tanks. That is why they might have been made in the first place ages ago. Now due to various factors, the numbers of such water bodies are dwindling. These factors can be broadly categorized in to 3 basic issues:

Expensive artificial treatment: Since the numbers of the water bodies have declined the remaining few are being overloaded with the dumping of sewage and other industrial waste. The water bodies do not get the required time period to rejuvenate itself. Hence artificial intervention is necessary. These means are highly cost and labor intensive. Hence such measures are not taken often leaving the lakes of the city polluted for other uses*viz.,* commercial and environmental.

Economic value not fully utilized: Due to improper management the lakes have become eutrophic. Hence the dissolved oxygen in the water reduce –further affecting the population of aquatic biota especially ichthyofauna that can be reared in the given water body. Most of these water bodies are hot spots for migrating birds and the birds too feed on fishes here.

Improper monitoring too few caretakers: The fishermen serve as true caretakers of the lake as they need it more than anyone else to earn their daily bread. It's a very mutual scenario. Since the productivity of the lakes is less, the numbers of fishermen who depend on them also reduce.

As a result of the above detailed facts, lakes are being filled for constructional purposes as they seem to give a higher economic return and also remove the hassle of maintenance. On the other hand proper planning measures (Fig.1) at local level can check the contamination of the lake, thereby facilitating an eco-friendly recreational cum income generating environs.

But more so, we must help people realize the ecological-economic -functional - aesthetical values and device a system through which more people can start depending on the water bodies and offer mutual protection to the water bodies.

The banks and islands in these lakes can be used as follows:

- Vertical farming –to receive larger amount of yield.
- Apiculture –rearing of bees drawn by the flowers
- Aquaculture –ornamental, commercial, shell fishes and shrimps. (Essential protein sources and are inexpensive compared to chicken, pork etc.)
- Horticulture –ornamental plants (nursery)
- Vermiculture –using earth worms to produce organic fertilizers
- Azolla culture –plankton when mixed with cattle feed also as excellent nitrogen fixer in the soil.

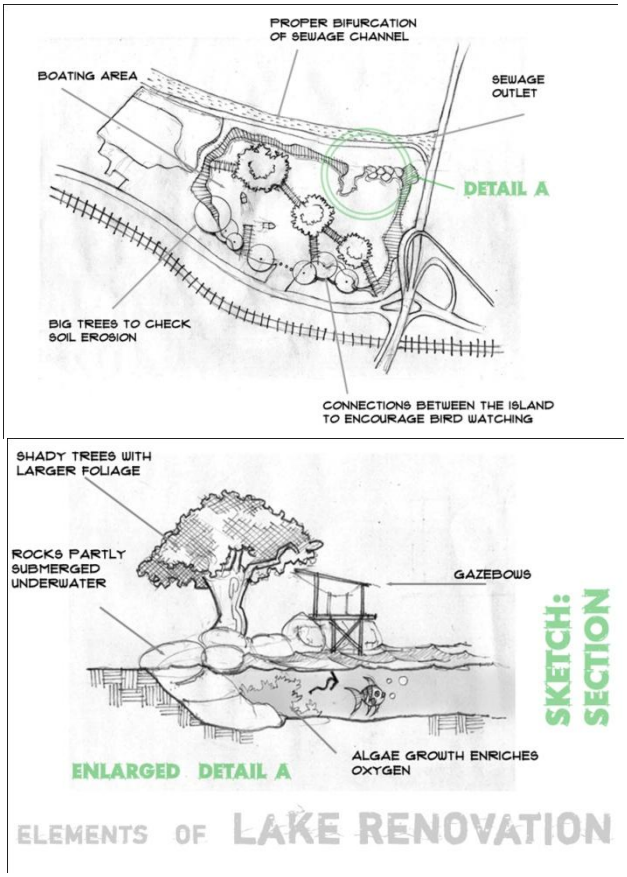

Fig. 1. Images of LakeRenovation by proper planning

Features of vegetation (Fig.2) include, native grasses and wild flowers to check soil deposition in the lake as their deep roots as compared to the exotic varieties provide tensile reinforcement to the soil. The large trees are tourist recreation points. These activities provide a wider range of livelihood options which help our above stated goal of maximizing the utility function of the spaces

Model: hybrid agriculture villages

Since such a system can be made without harming the ecology around the lakes the question arises – how can we take the vision further? We can create more lakes and develop them into settlements in the periphery of the city (Fig.3). The settlements must as independent as possible and give the people (lake dependent) a better lifestyle in their affordable budget. These settlements could share the city's problems of sanitation and heavy migration. Thus, in order to make these new settlements sustainable, we needed to attend to further necessities of energy, shelter, sustainable sanitation and education. Conceptually through our designs depicted hereon in the paper, the common attempt is to retrofit the traditional methods with modern materials and mechanisms; one of the reasons why the system is termed 'hybrid'.

The boat house (Fig.4) is designed out of expired rubber tubes of aircrafts and other heavy duty vehicles which need to carry hundreds of tones. As the tubes become harder they tend to crack without being able to carry such heavy load rendering itself useless.

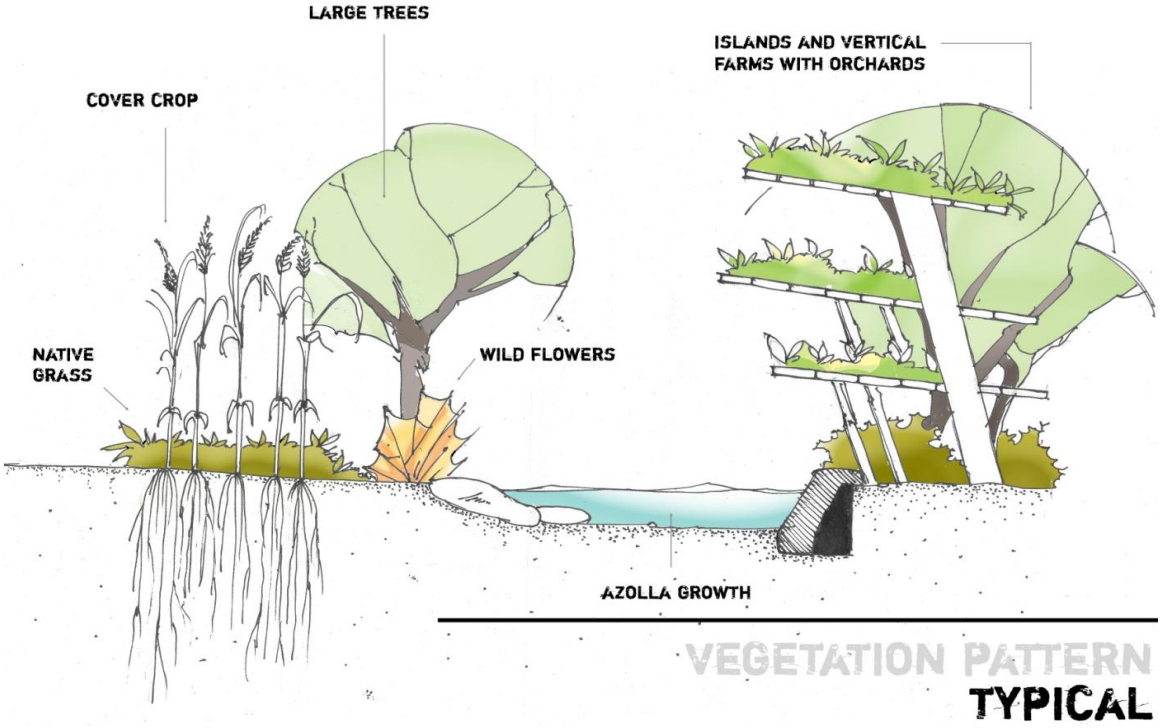

Fig. 2.Vertical farming and vegetation around water bodies

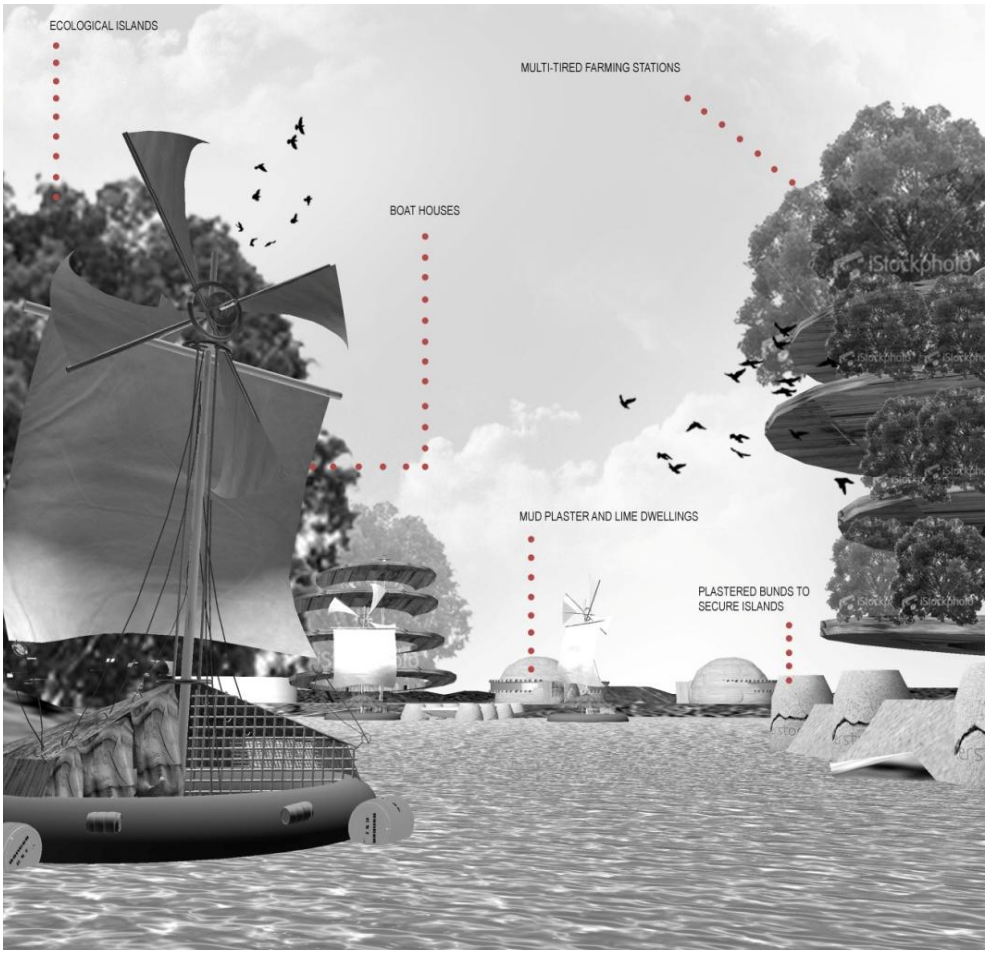

Fig. 3. Architect's visualization of the Hybrid Agriculture Village

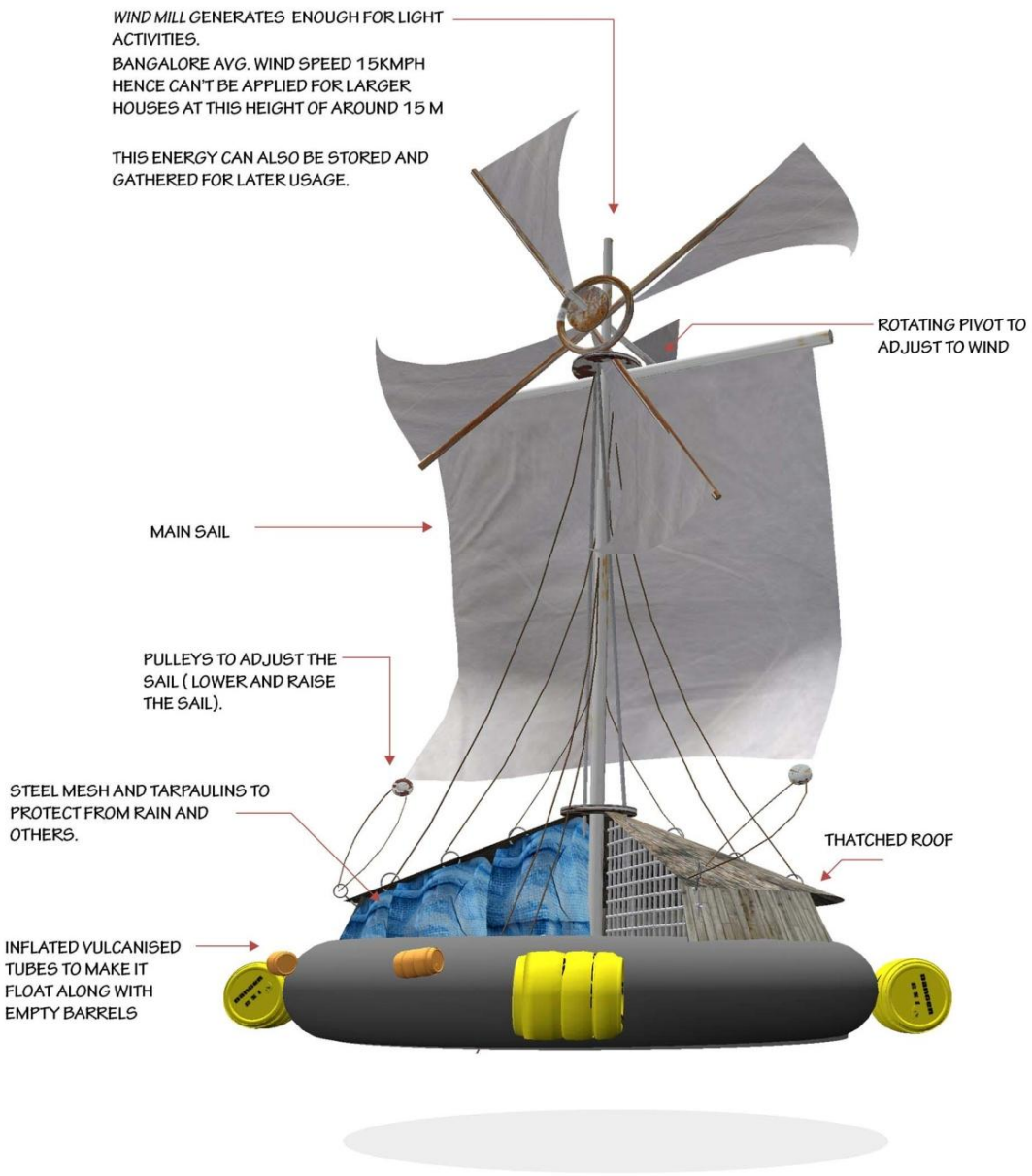

Figure 4. The boat house

Recycling is a costly and poisonous affair. Hence these can be used along with discarded barrels to help it float. Addition to these there will be dwellings in the land around for purposes such as living and storage etc, what we intend to refer as 'Hybrid Agriculture Villages' since the settlements will be partially on land and partially on water**.**

The features of such a Hybrid Agricultural Village are as follows:

Floating Boats as Housing - Transient Nature

- Boat houses that utilize the water as for housing but not harming its very existence.
- Easily dismantle-able to restore original state of lake
- Boats to contain -decks for fishing, flexible area for sleeping and living (indoor) and one toilet unit.

Sanitation

- Self contained compost toilet units for the boats and other utilities in the small settlement at the bank.
- Grey waste can be turned into compost and used for manure as its just 20 families.

Ecology

- Farming islands made are multi-tiered to use maximum space and create relief points for fishermen.

- Farming islands separated from ecological islands with buoys where birds might rest and nest during migration.

Settlement

- Requires a control centre for realizing climatic changes.
- Need banks and other financial infrastructures.
- Drinking water stations.

Economy

Agricultural products (includes things like mushrooms), pottery, orchards, dairy and poultry, fishery etc. can be developed as part of employment generating schemes around the lake environ.

Education

- Free education and can also have provision for volunteering teachers from research centers built around this place.
- The settlement will have schooling systems and hostels for their children only, broadening research and development scopes in their activities.
- Research centre set up can also assist in this programme encouraging pupils.

Tourism

Hotels offering a taste of this unique life style and ideal spot for retreat.

Social life

- The banks can have processing centre, markets and any other facilities like a common bathing house/ like an enclosed pond, a medical centre and places to watch plays etc. (One big TV as a movie screen and come to watch in a hut).
- Kitchen can be located at the bank where all the women prepare for their own families or even a common kitchen would help a sense of togetherness.
- Cultural plazas for festival and fairs along with the petty fast food stall using their own yield to add to a very interesting evening life.

Conclusion

Failure by modern societies to deal with water as a finite resource is leading to unnecessary destruction of rivers, lakes and marshes, a phenomenon which is a threat to survival and security of the biodiversity (Ramachandra, 2001). The fresh water resources of Bangalore region have been exploited and gradually getting lost. Thechange in land use due to urbanization, road construction, recreation oriented renovation etc. has led to deterioration of the quality of natural waters. The present proposals if implemented would generate income by restoring the lakes for aquaculture, eco-tourism development and livelihood improvement of the inhabitants dependent on the lake, as evident in success stories indifferent parts of the globe (Koutsouris, 2002).

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