

# **STUDENT GROUP STUDY PROJECT REPORT ON**

## **A study on the ecological succession state of few surface water bodies (Lakes and Ponds) in Hyderabad**

*Submitted to the Collegiate Education for Jignasa – Student Study Projects in  
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**CERTIFICATE**

This is to certify that the following students of Department of Zoology, Government Degree College, Khairatabad, Hyderabad, have submitted group study project "A STUDY ON THE ECOLOGICAL SUCCESSION STATE OF FEW SURFACE WATER BODIES (LAKES AND PONDS) IN HYDERABAD" to Commissioner of Collegiate Education for Jignasa – student study projects in Degree Colleges for the academic year 2021-22. And it is original in its contents and was not published anywhere else.

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## 1. Abstract:

Hyderabad, the capital of erstwhile Andhra Pradesh, now the capital of Telangana was found by Mohammed Quli Qutub Shah in 1591. Initially the water needs of Hyderabad city were fulfilled by Osman sagar and Himayath sagar built in 1920 and 1927 respectively. As the inflows to reservoirs like Himayat Sagar and Osman Sagar decreased, water could not be drawn from them for the use of people of Hyderabad. Consequently in the year 1958 a scheme was undertaken to draw water from Manjira River which is 58 to 81 kilometers away. As the demand for water increased due to more urbanization, projects were undertaken to draw water from Krishna River (Akkampally project) which is 116 kilometers away and Godavari River (Yellampally Project) which is 186 kilometers away. Except Himayat Sagar and Osman Sagar, all other projects need pumping to bring water to Hyderabad. Pumping is very expensive both in terms of establishment and maintenance.

As an alternative, ground water can be used to cater to the needs of urban population and also agriculture. Ground water is being lost due to diminishing or vanishing of surface water bodies in Hyderabad. Surface water bodies are the ones which naturally recharge the ground water.

Ecological succession of aquatic habitat (Hydrosere) is a natural process which converts the former into a terrestrial habitat. A careful physical observation of ponds/lakes like Gopi cheruvu, Manikonda Cheruvu, Malcam Cheruvu and Hakimpeta Kunta in Hyderabad revealed that they are at different stages of ecological succession.

In this context it would be wise to save and protect the surface water bodies like lakes and ponds from which water can be drawn with less expenditure and with less difficulty. Hence this study proposes to save lakes and ponds from hydrosere, a process which converts a water body (lake or pond) into terrestrial habitat over the years.

Lakes and reservoirs, because of their resources, play a significant role in shaping the socio-economic conditions of the people inhabiting the area around these aquatic bodies. Moreover, the lakes in and around urban systems are known for lowering the ambient temperature.

## 2. Statement of the problem or hypothesis:

Hyderabad, the capital of erstwhile Andhra Pradesh, now the capital of Telangana was found by Mohammed Quli Qutub Shah in 1591. Initially the water needs of Hyderabad city were fulfilled by Osman sagar and Himayath sagar built in 1920 and 1927 respectively. As the inflows to reservoirs like Himayat Sagar and Osman Sagar decreased, water could not be drawn from them for the use of people of Hyderabad. Consequently in the year 1958 a scheme was undertaken to draw water from Manjira River which is 58 to 81 kilometers away. As the demand for water increased due to more urbanization, projects were undertaken to draw water from Krishna River (Akkampally project) which is 116 kilometers away and Godavari River (Yellampally Project) which is 186 kilometers away. Except Himayat Sagar and Osman Sagar, all other projects need pumping to bring water to Hyderabad. Pumping is very expensive both in terms of establishment and maintenance (1,2,3).

Table-1

	Osman Sagar	Himayat Sagar	Manjira (Phase 1 & 2)	Manjira (Phase 1 & 3)	Krishna	Godavari
Year	1920	1927	1956-1981	1991-1993	2004	2015
Distance from city (in km)	15	9.6	58	80	116	186

As an alternative, ground water can be used to cater to the needs of urban population and also agriculture. Ground water is being lost due to diminishing or vanishing of surface water bodies in Hyderabad. Surface water bodies are the ones which naturally recharge the ground water.

## 3. Aims and Objectives:

7.1. The aim of this study is to assess the ecological succession state of surface water bodies in Hyderabad because the ecological succession of surface water body converts it into a terrestrial community.

7.2. This study also proposes necessary measures to protect them from ecological succession so that they will be used as water resource for the population of Hyderabad.

7.3. The objective of this study is to highlight the importance ground water and the surface water bodies which recharge the ground water.

#### 4. Research Methodology:

For this study the methodology followed by Sushil Kumar Upadhyay et al. (4) was adopted.

**Study Area:** The city of Hyderabad has a history that goes back to 400 years. It was founded on the banks of the river Musi in 1591-92 by Muhammad Quli Qutb Shah and remained a capital of the Quli Shahi rulers. It was an independent province under the Nizams during the British period. When India got independence in 1947, the State of Hyderabad was merged with the Union of India and later became the capital of the present state of Andhra Pradesh. From April 2007 onwards it became Greater Hyderabad Municipal Corporation (GHMC) based on a notification released on 16th April 2007 by the Government of Andhra Pradesh. Since June 2014, GHMC is part of Telangana State.

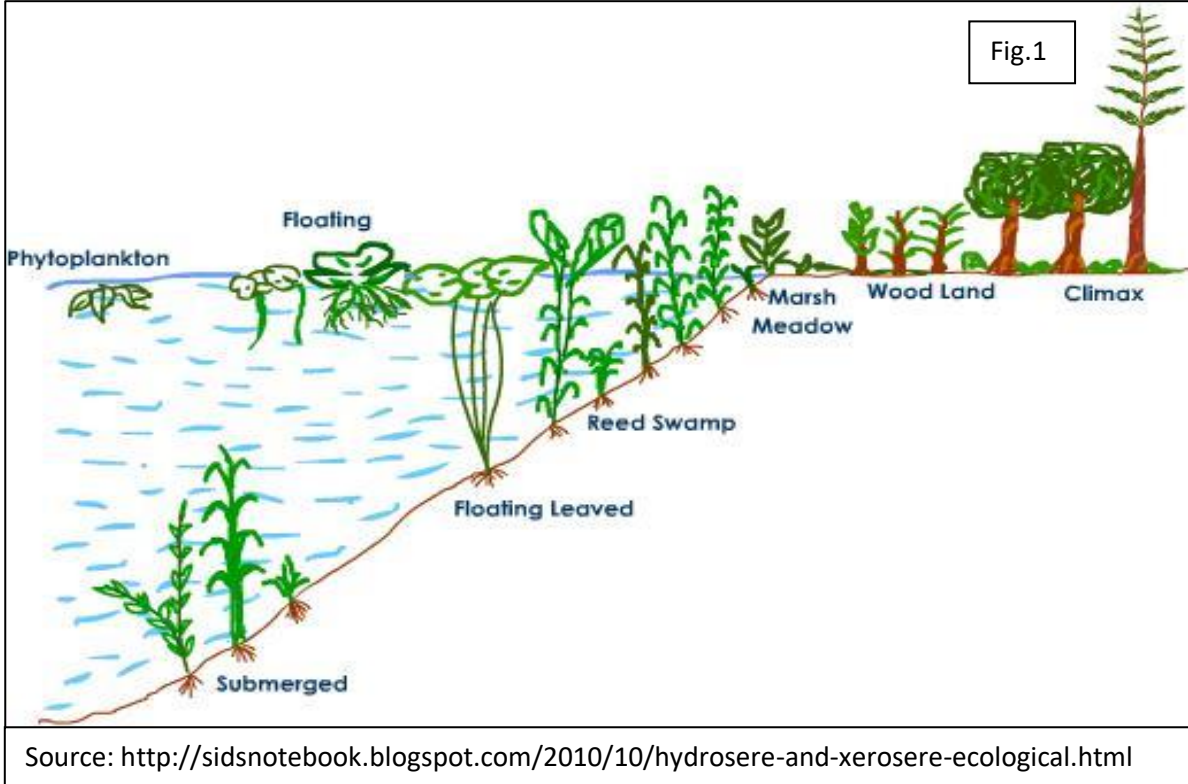
**Survey:** Authors used smart phones with good quality cameras, motorbikes, city buses, MMTS trains, Metro trains, field stick and google maps etc. for the survey. The findings are based upon the work conducted in November to December 2021. Survey was conducted on every Sunday in the two months. Physical observation of the ponds/lakes was made while moving around and walking along the banks of them.

#### 5. Findings and Analysis:

An ecological succession is a characteristic temporal order in which plant and animal species replace each other in an ecosystem. It is a natural process (5). There are two types of ecological successions based on type of habitat i.e. if succession takes place in aquatic habitat it is called hydrosere and if it happens in terrestrial habitat it is called xerosere (6).

Hydrosere of a pond ecosystem consists of different stages like Pioneer community, Seral community and Climax Community. Pioneer community is the starting community and consists of phytoplankton stage which include blue-green algae, green algae, diatoms, bacteria etc.; seral communities include rooted submerged stage which consists of Myriophyllum, Elodea, Hydrilla, Potamogeton, Vallisnaris etc., floating stage consists of duck weed etc., rooted floating stage, Nelumbo, Nymphaea, Limnathemum, Trapa, Eichornia etc., reed swamp stage include species

like *Scirpus*, *Typha*, *Sagittaria* etc., sedge-meadow stage include *Carex*, *Juncus*, *Cyperus* etc. and woodland stage include terrestrial shrubs like *Salix*, *Cornus* and trees like *Populus* and *Alnus*; forest stage becomes the climax community which include plants like *Alnus*, *Acer* and *Quercus*

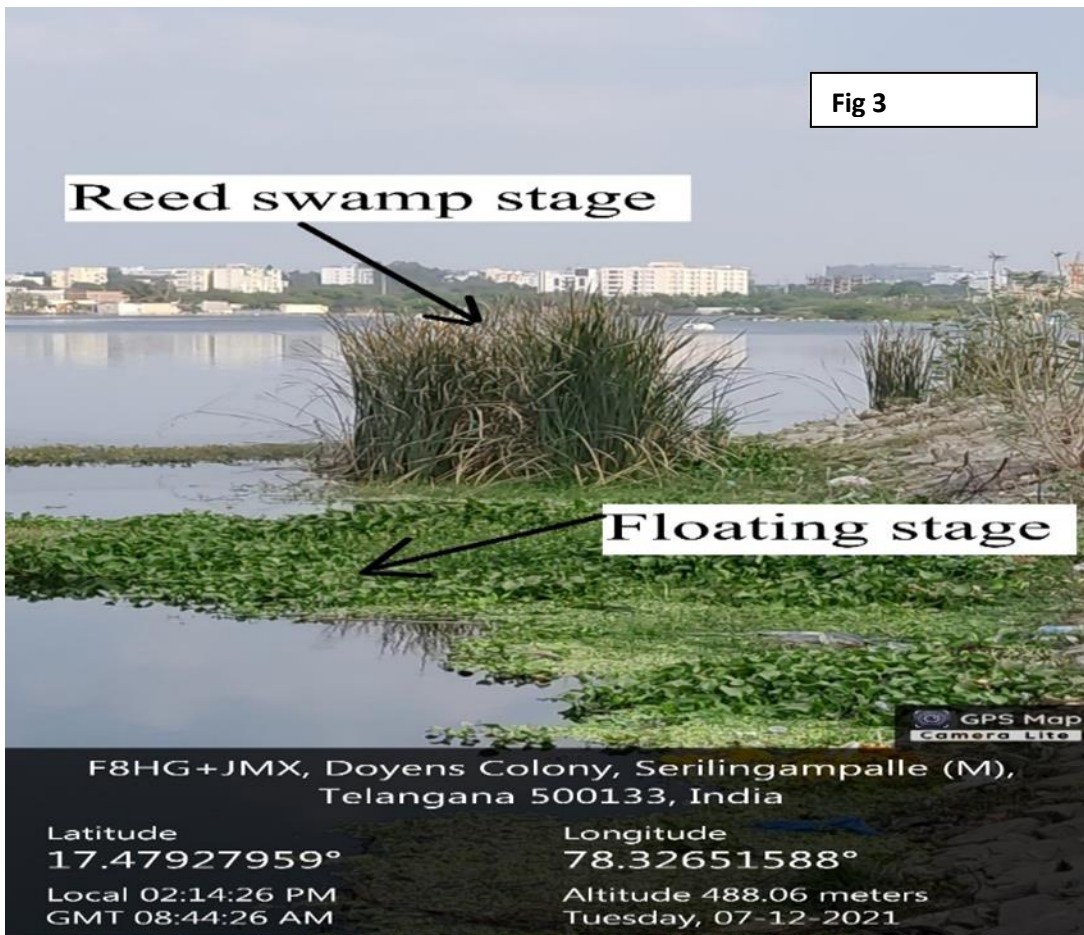


(Fig.1) (7,8).

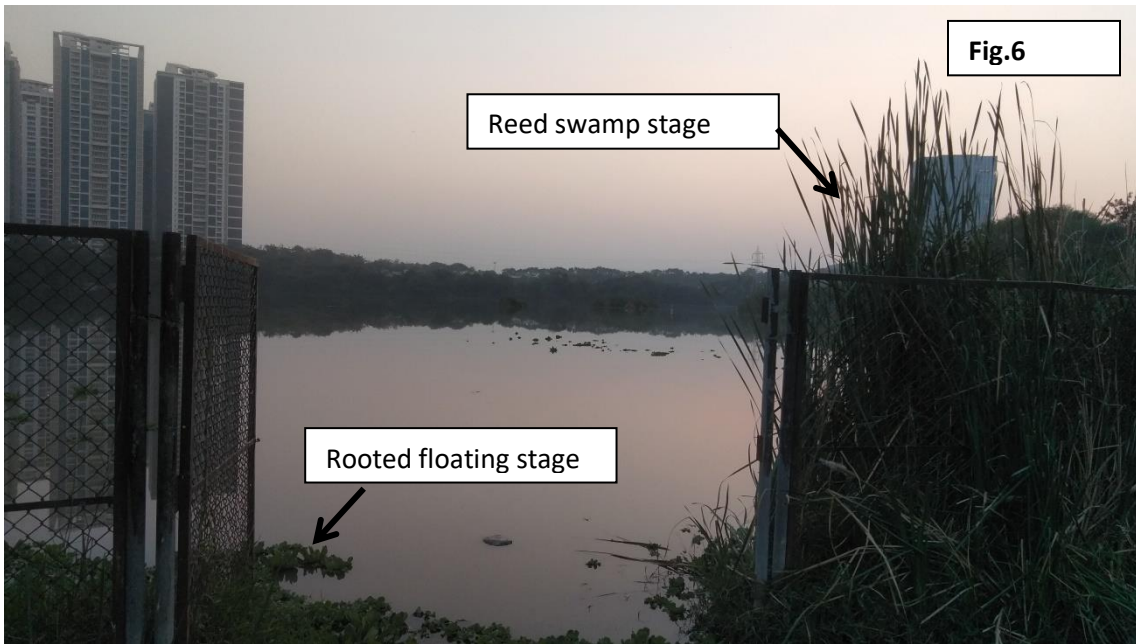
A careful physical observation of ponds/lakes like Gopi cheruvu, Manikonda Cheruvu, Malcam Cheruvu and Hakimpeta Kunta in Hyderabad revealed that they are at different stages of ecological succession.

Malka Cheruvu situated in Raidurgam appeared to be at pioneer stage containing mostly green algae (Fig.2). Gopi cheruvu situated in Serlingampally appeared to have two stage of hydrosere viz., rooted floating stage and reed swamp stage (Figs. 3, 4, 5). Although Manikonda Cheruvu appear to be clean, the periphery of the lake is marked by rooted floating stage and reed swamp stage (Fig.6). In both Gopi cheruvu and Manikonda cheruvu, the rooted floating stage is dominated by *Eichornia* species and the reed swamp stage mostly consists of *Typha* species.









## .Conclusions and Suggestions:

The Indian Sub-Continent is one of the most densely populated regions of the world, hosting ~23% of the global population within only ~3% of the world's land area. Although India has rivers like Brahmaputra, Ganges, Krishna, Godavari and Indus Basins, lot of people depend on ground water for their daily needs and agriculture (9). India, home to 17% of the world's population, is facing water scarcity. Ranked highest in groundwater use globally, its groundwater use is 250 billion m<sup>3</sup> per year (10).

Since 1920 the drinking water source has been moving away from Hyderabad city which makes it difficult and financially more expensive to get water to city (Table.1).

As per the records of Hyderabad Metropolitan Water Supply and Sewerage Board and as on 21.12.18, the source of water to Hyderabad city is given in Table 2 (11).

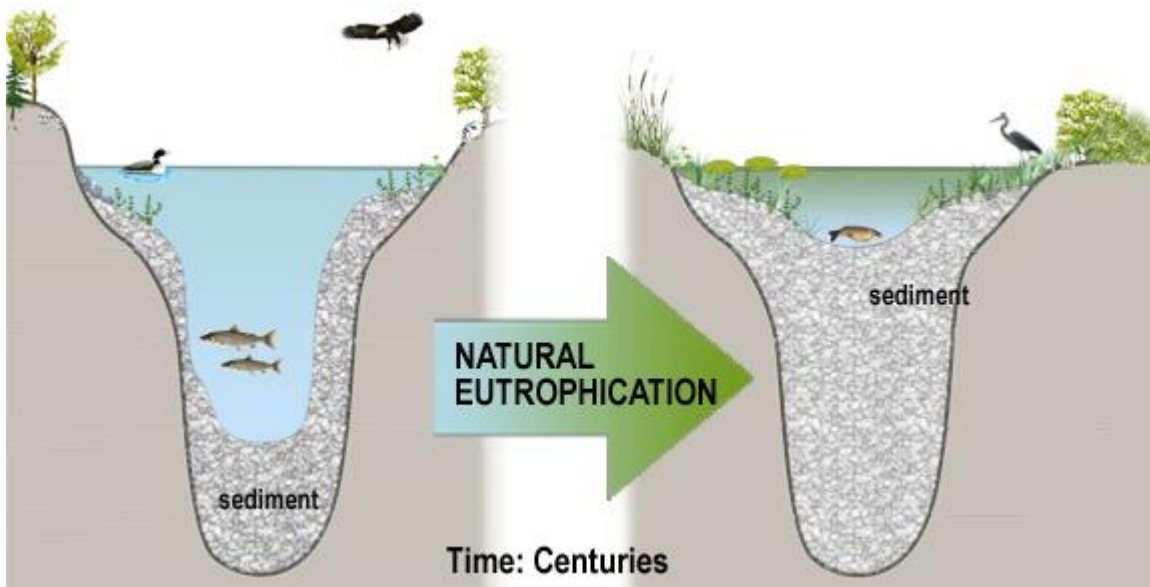
Table-2

Source	Normal Drawls (in MGD)	Present Drawls (in MGD)	System mode
Osman Sagar	25	0.00	Gravity
Himayath Sagar	15	0.00	Gravity
Singanoor	75	75	Gravity/Pumping
Manjira	45	30	Gravity/Pumping
Akkampally (Krishna Ph-1,2,3)	270	226	3 stage Pumping
SriPadaYellampally	86	56	Pumping
Total	516	387	

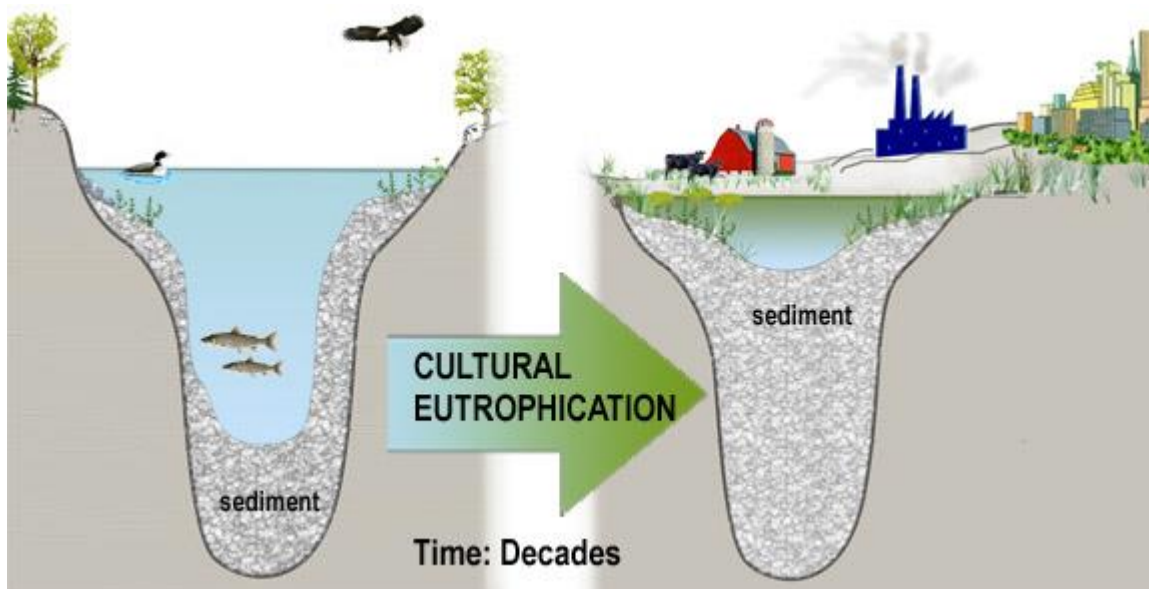
From the table it is evident that two reservoirs i.e. the Osman sagar and Himayath sagar which can supply water to the city through gravity are no more in a position to supply water. So we are getting water from other sources which are far away from the city and that too by pumping which is expensive in terms of money and man power.

The hydrosere occurs due to eutrophication of lakes. Eutrophication is a process where in excessive growth of algae takes place in lakes and ponds due to the availability of sunlight and nutrients like carbon, nitrogen, phosphorous etc. (12). Eutrophication occurs naturally over centuries as lakes

age and are filled in with sediments (13) brought in by runoff water from the catchment area. Naturally, in a pond ecosystem the hydrosere reaches to climax community after around 100 years (6). However, human activities have accelerated the rate and extent of eutrophication through discharge of nutrients such as nitrogen and phosphorus, into aquatic ecosystems, a phenomenon known as cultural eutrophication. This dramatic consequences for drinking water sources, fisheries, and recreational water bodies (14).



Source: <https://www.rmbel.info/primer/lake-eutrophication/>



Source: <https://www.rmbel.info/primer/lake-eutrophication/>

In this context it would be wise to save and protect the surface water bodies like lakes and ponds from which water can be drawn with less expensive and with less difficulty. Ponds are common property resources that allow users to obtain water on-demand because of their capacity to store rainwater and other surplus water close to users. Effective management of these ponds is crucial, especially with increasing water scarcity and decreasing water deliveries for agriculture that are taking place in many irrigation systems (15).

Using London as a case study, Bricher et al., highlighted the importance of groundwater for cities (16). Effective conservation and management of these ponds and lakes systems relies on our ability to fulfill the growing human demand for freshwater while maintaining system integrity (17). There is evidence that the pond waters increase the levels of ground water (18).

Hence this study proposes to save lakes and ponds from hydrosere, a process which converts a water body (lake or pond) into terrestrial habitat over the years.

Phytoplanktons from a pond can be removed by using chemicals or alum but have side effects. 'CLEAN-FLO International' a custom engineering/manufacturing company has developed a CLEAN-FLO system which is an effective and long term approach to naturally reducing and controlling algae. CLEAN-FLO systems have been installed: United States, Puerto Rico, Canada, Mexico, Peru, England, France, Italy, South Africa, Korea, Taiwan, China, Singapore, Malaysia, Philippines, Japan, New Zealand, and India (19).

There a wide range of aquatic plant management techniques which fall under the heading of physical control. On a worldwide basis, physical control methods remain the most widespread means of managing aquatic weed problems. Manual and mechanical cutting and clearance are the commonest approaches, using tools ranging from simple scythes and similar implements, to large complex aquatic weed harvester machines (20,21).

Eutrophication can be prevented by preventing the sewage, drainage etc. to enter the lakes. Water resource managers also can be employed to understand how to minimize the intensity and frequency of algal and cyanobacterial blooms. In general, this strategy have proven to be ineffective, costly, and/or impractical, especially for large, complex ecosystems (22). Water quality can often be improved by reducing nitrogen and/or phosphorus inputs into aquatic systems. However, nutrient reduction can be difficult (and expensive) to control, especially in agricultural areas where the algal nutrients come from nonpoint sources. Furthermore, in lakes where external loading of nutrients has been reduced, internal loading of nutrients from sediments may prevent



improvements in water quality (23). The use of algaecides, such as copper sulfate, is also effective at reducing Harmful Algal Blooms temporarily (24). However, algaecides are expensive to apply and pose risks to humans, livestock, and wildlife, in addition to harming a variety of non-target aquatic organisms. Another alternative for improving water quality in nutrient-rich lakes has been biomanipulation - the alteration of a food web to restore ecosystem health (25).

Despite all these approaches, control and management of cultural eutrophication is a complex issue and will require the collective efforts of scientists, policy makers, and citizens to reduce nutrient inputs, to develop effective, long-term biomanipulation techniques, and to eventually restore aquatic communities (26).

Telangana state government had undertaken a scheme called Mission Kakatiya under which the surface water bodies (lakes and ponds) in the state are cleaned and well maintained (27). Despite this many of the lakes in the city remain unattended and in deteriorating condition due to hydrosere and pollution. So it is very much needed to pay attention to the lakes in the city.

The erstwhile Andhra Pradesh government had issued GO 111 to protect Osman sagar and Himayath sagar by prohibiting development of lands around (catchment area of) the lakes (28). The order was issued when there was dependence on Osmansagar and Himayatsagar for catering to the drinking water needs Hyderabad city. Recently, the Telengana state government has announced its intention to withdraw the G.O. The government is of the opinion that since the drinking water needs of the city are being fulfilled through Mallannasagar project and other sources, the GO had become redundant (29). Revoking of the GO may lead to severe pollution or gradually disappearance of the lakes. We don't know and we cannot predict how long the rivers Krishna and Godavari can cater to the drinking water needs of the city, although at a cost. Construction in the catchment area of the lakes may lead to flooding during rains. Lakes also contribute to sustainable societies. Apart from the traditional environmental and recreational contributions to society, lakes also provide aesthetics, education, economic opportunity and spirituality (30). The recreations benefits that humans get from lakes increase the well-being of human (31). In view of the advantages that the humans get from lakes, we request the government to refrain from repealing the GO 111 and protect the lakes. Also, repealing of GO 111 is in contrary to the Mission Kakatiya, a scheme intended to clean and maintain lakes and ponds in Telengana state.

Although this study is made in Hyderabad and suggests to protect lakes, it is a universal issue. This can be applied to all places in Telangana, India or anywhere in the world. So we request the government to protect the lakes in the Telangana regularly so that they can store good amount of water which plays a significant role in sustainable development of mankind and also all living organisms.

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