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Harvesting Monsoon Rain in Educational Institution and Enriching the Water Table at Microlevel - A Case Study

S. Karpagam[1], B. Umamaheswari[2]

[1]Associate Professor and Head of Botany, Queen Mary's College, Chennai 600004
Email: *s.karpagam98[at]gmail.com*

[2]Principal, Queen Mary's College, Chennai 600004
Email: *principal[at]queenmaryscollege.edu.in*

Abstract: ***Ponds are among the most biodiverse and ecologically important freshwater habitats. They are the water harvesting units at microlevel and checks run off of the valuable soil nutrients. In addition, it serves as a recreational venue with supporting greenery. Climate change, adverse environmental challenges, increase in average global temperature are the problems that are interrelated and a global concern. The contributions at microlevel to the natural environment is more advantageous than the steps taken by the government and non governmental organisations (NGO) in largescale. This paper is aimed at the changes introduced in Queen Mary's College campus in the last 3 years which contribute significantly to the natural conservation and biodiversity at microlevel. The ecopond constructed in 2022 as a salvage for water stagnation has increased the ground water level and nurtures the bird population during the monsoon, and also adds to the aesthetic beauty of the college campus. It serves as a model for freshwater ecosystem for environmental studies for the benefit of the students with theoretical knowledge and practical experience.***

Keywords: Ecopond, Green campus, rainwater harvesting, ground water, sustainability

1. Introduction

Freshwater is a rare commodity when compared to the vast available salty sea water. Human civilization and terrestrial biodiversity depends on the fresh water availability. A century of industrialization and urbanization has led to pollution, carbon emission and the resultant unprecedented climate change. Carbon emission and underground water depletion are the challenges faced not only by the developing countries, but also by the entire world. Climate change and *La nina* effect are directly related with the carbon emission and denudation of the ground cover along with the depletion in ground water table.

Biodiversity is declining worldwide with significant reduction particularly in freshwater fauna and flora (Grooten and Almond, 2018). In recent decades, there has been a growing interest among scientific and non - scientific communities in pond biodiversity, their conservation and contribution to ecosystem services (Biggs *et al*.2017). Despite this growing recognition of the ecological and societal importance of ponds, freshwater scientific research, policy, and conservation remains disproportionately focused on rivers and larger lakes (Biggs *et al*.2021).

In 2001, Ubl and Anderson forewarned that the Earth is in decline, graduates leave college to begin lives, generally contribute to growing array of environmental and social problems. When todays graduates (2001) are middle - aged, the Earth's human population would have expanded by one - third and resource use as well as waste production doubled; all this on a planet that is already groaning under the weight of the human enterprise. After 24 years of warning by scientists and environmental activists we face the adverse effects of changing climate and global warming. Acute water shortage in summer months and wastage of rainwater during the monsoon months has been the norm for many decades. This motivated and lead to the construction of a small pond named as ecopond with the sponsorship from Indian Oil Corporation Limited (IOCL), ExNoRa and Coir board.

The ecopond constructed in the college campus with the collaboration of the sponsors stores large portion of the runaway rainwater in the ponds, otherwise the water would have reached the Bay of Bengal. Slow percolation of the rain water through the sandy soil enriches the ground water table. The flora and fauna flourishes with the increased water storage. The amount of flora grown in the enriched soil sequesters carbon adding to the environmental advantages. These changes can be accelerated through changes in land use and planting with fast growing plants. Establishment of protected natural vegetation as the best practice of restoration programs that yields a high carbon sequestration potential with multiple benefits for biodiversity conservation, livelihood support, and climate change mitigation. Pond ecosystems are hotspots of biodiversity, often containing many rare and protected species that are not commonly found elsewhere. The amount of green cover in the area contributes directly to the ratio of carbon sequestration. Such smaller projects at microlevel contributes to the larger scenario in the resurrection and environmental reclamation.

The location of the college (Karpagam, 2024) is in the coromandel coast, and is among one of the educational campus located along the sandy coast of second longest beaches of the world. The sandy nature of the soil along the coast line faces a serious threat of sea water inundation due to excessive pumping of ground water.

Acute shortage of water during the months of May in 2021 and 2022 and the rainwater runoff during the monsoon

triggered this project. Eco pond is a freshwater ecosystem and is a complete biosystem and it has three purposes educative, recreational, natural water harvesting that increases the underground water table, attracting the various life forms like algae, fishes and birds in equal numbers. The students of the undergraduate discipline has an environmental studies in their curriculum and a visit to this ecopond and the study of flora and fauna is more educative then the classroom teaching. The pond serves an ambient atmosphere for recreational purposes and small meetings in an informal setting. The ecopond is an additional asset to the Queen Mary's College. In the environmental point, it serves the dual purpose of recharging the water table by rainwater harvesting and a favourable habitat for flora and fauna.

2. Methodology

The area of the ecopond was measured from Google maps (6). The Google satellite imagery was used to measure the area of the pond and a schematic map of the ecopond was derived with dimensions. The amount of rainwater collected in the ecopond region was calculated approximately using the annual rainfall data from weatherspark (7). The area of the location where the ecopond was situated was measured using Google satellite imagery. Using the measure distance option a rectangle was drawn and the area of the north east part of the College campus where the ecopond was located was derived. This restricted area serves as the catchment zone for the ecopond. The rainfall data in inches was converted to litres, gallons and cubic meters and tabulated.

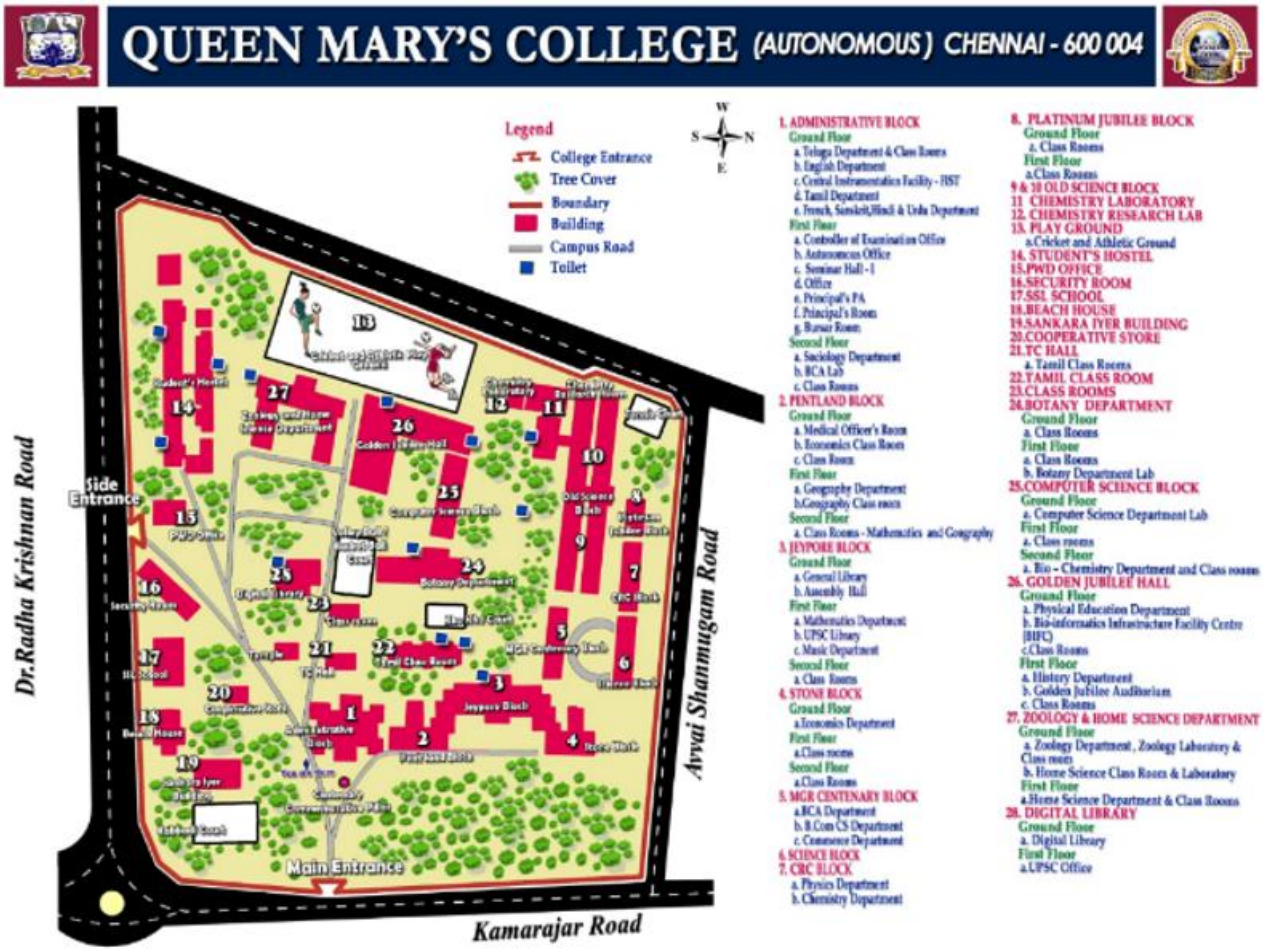

Figure 1: Shows the schematic map of Queen Mary's College campus

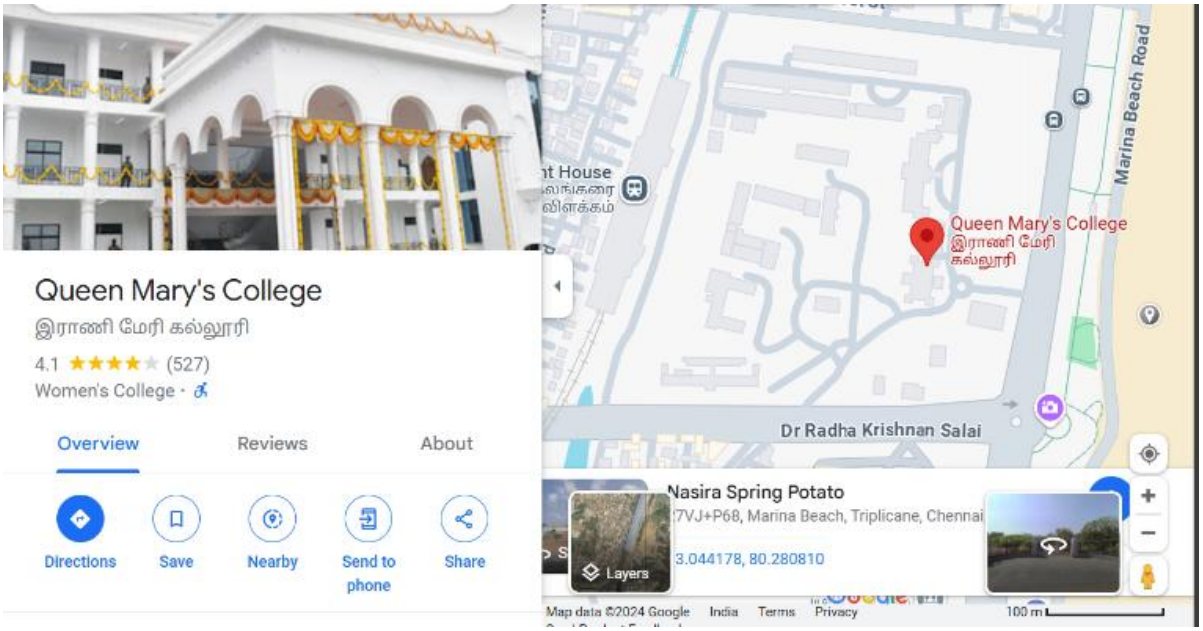

Figure 2: Shows the satellite map of Queen Marys's college campus.

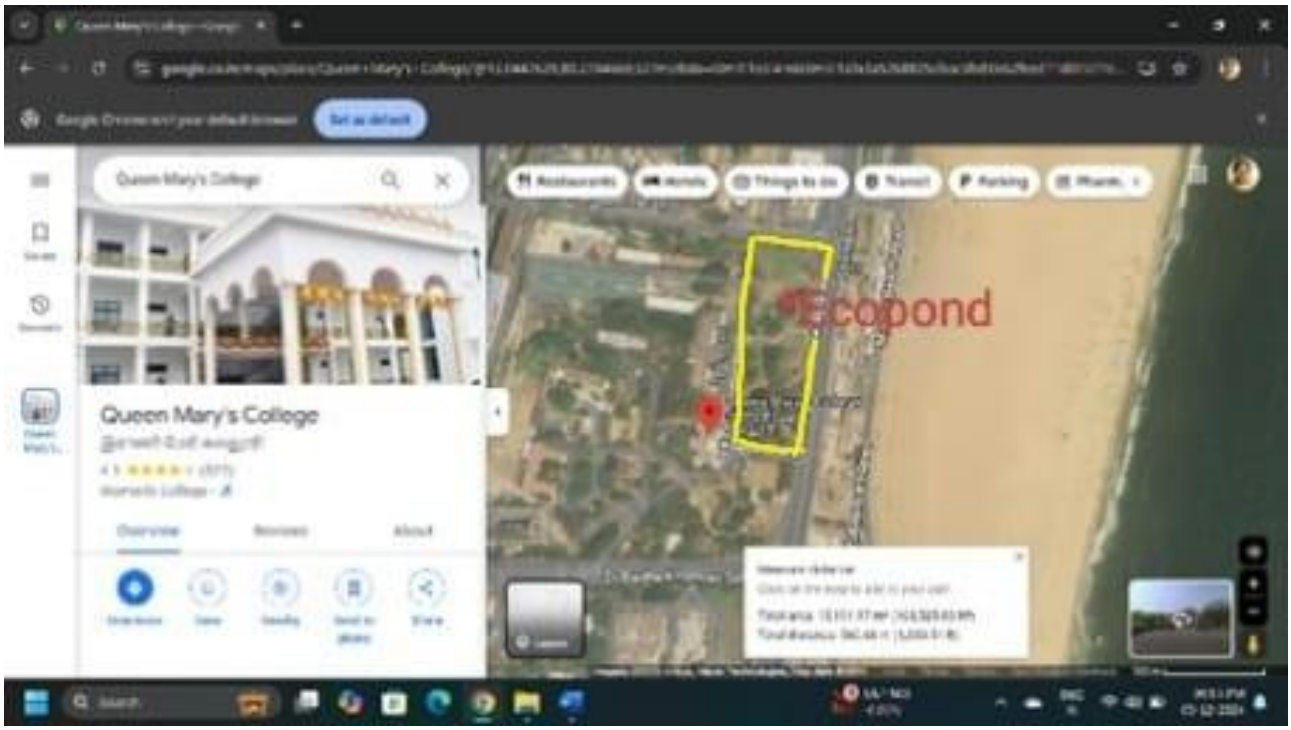

Figure 3: Shows the enlarged satellite imagery of Queen Mary's college with the ecopond region.

Figure 4: Shows the enlarged satellite imagery of the ecopond region.

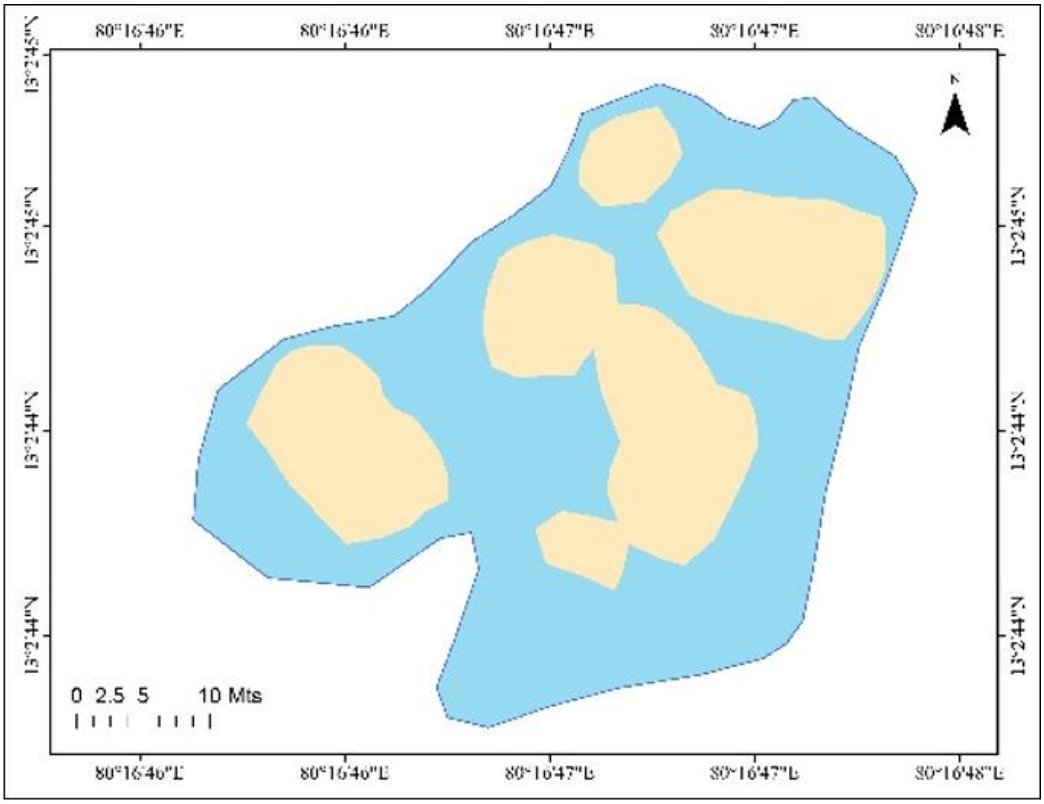

Figure 5: Shows tha schematic representation of the ecopond.

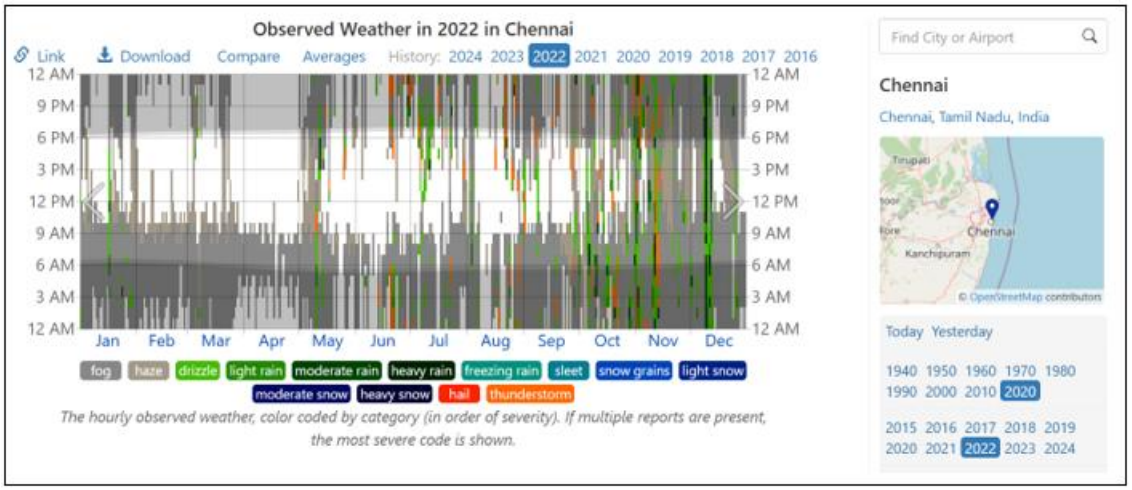

Figure 6: Shows the rainfall data for 2022 in Chennai.

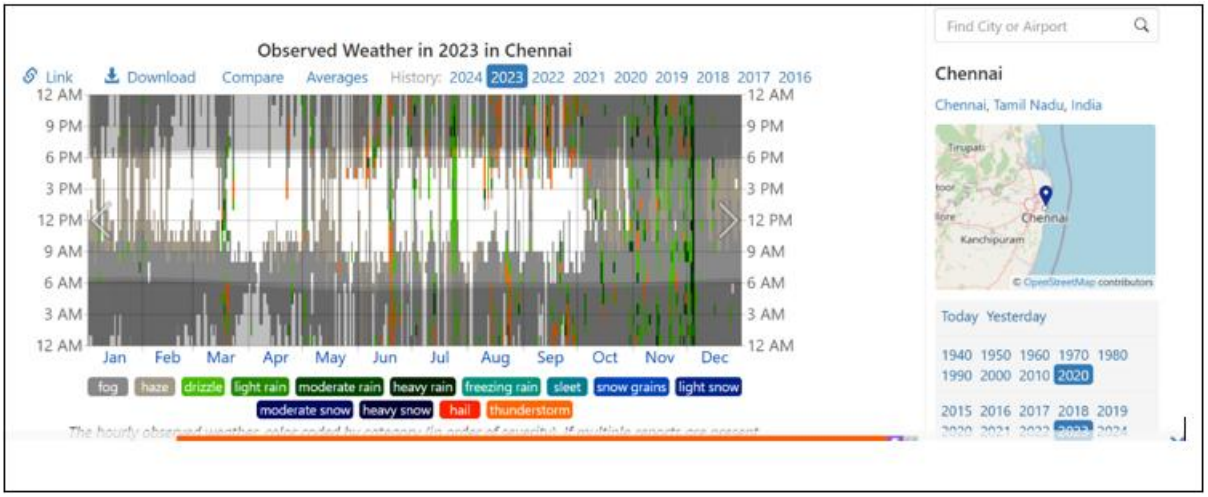

Figure 7: Shows the rainfall data for 2023 in Chennai

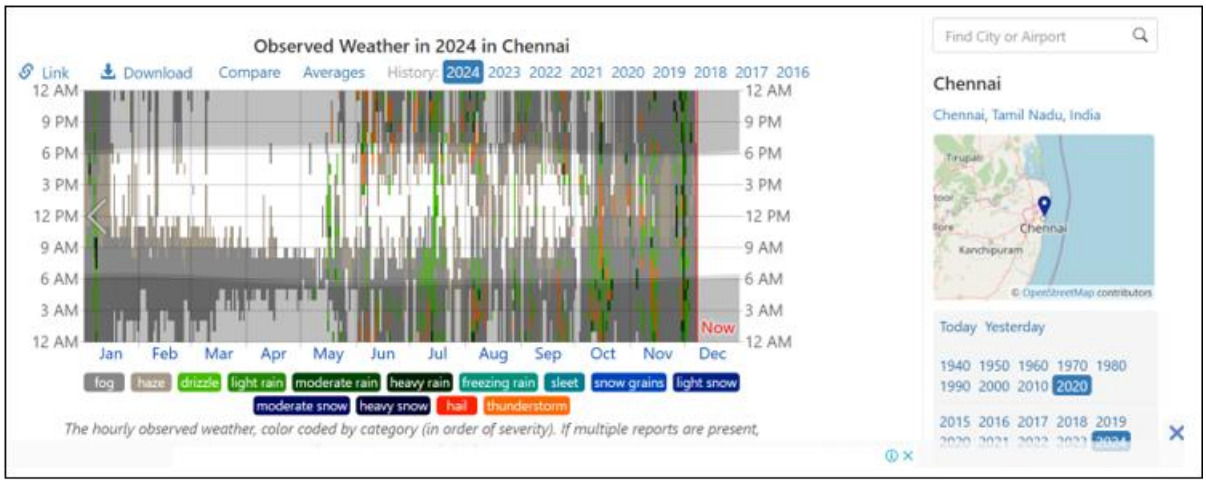

Figure 8: Shows the rainfall data for 2024 in Chennai

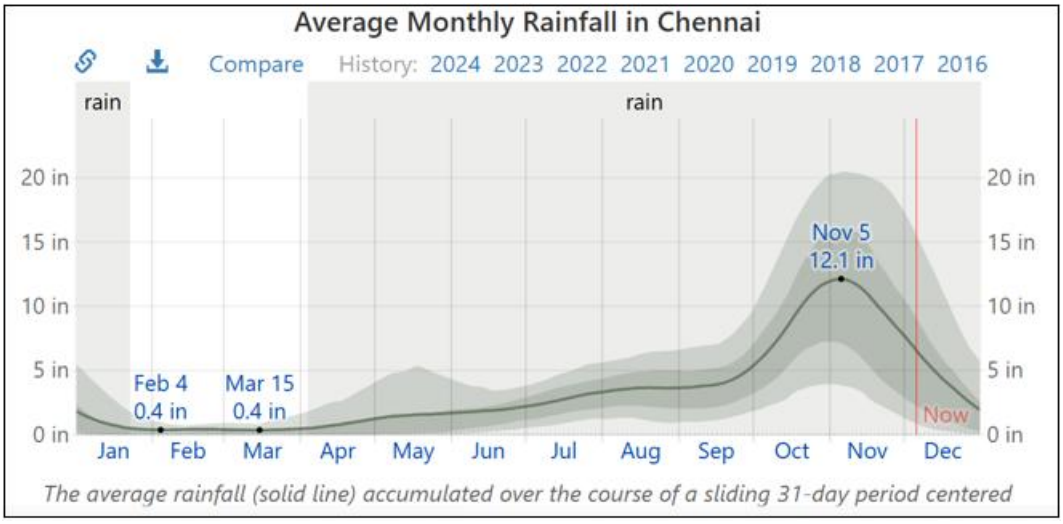

Figure 9: Shows the average annual rainfall data for Chennai.

Table 1: Shows the average water received as rainfall throughout the year in the ecopond region

S. No.	Month	Average rainfall in inches	Average rainfall in mm	Area of the Ecopond region m^2	Volume of rainfall received Litres
1	January	0.4	10.1	15, 190	153419
2	February	0.4	10.1	15, 190	153419
3	March	1	25.4	15, 190	385826
4	April	1	25.4	15, 190	385826
5	May	1	25.4	15, 190	385826
6	June	3	76.2	15, 190	1157478
7	July	4	101.6	15, 190	1543304
8	August	5	127	15, 190	1929130
9	September	5	127	15, 190	1929130
10	October	6	152.4	15, 190	2314956
11	November	12	304.8	15, 190	4629912
12	December	5	127.0	15, 190	1929130
	Total rainwater received by the ecopond area				16897356

3. Results and Discussion

In the year 2022, during the monsoon season the rainwater was overflowing and let in to the channel that reaches the bay of Bengal. In the stagnant rainwater, there were a lot of birds nestling around the area. At the time, the idea of creating an ecopond was triggered, developed, formulated and the funding was provided by the IOCL. The volunteers from ExNoRa provided the manpower and necessary expertise. The schematic map of the Queen Mary's College campus and the location of the buildings are given in Fig.1. The ecopond was dug using mechanised instruments namely JCB excavators in the north east corner of the college campus. Two large ponds were excavated, without disturbing the large trees, therefore, the shape of the pond was irregular. Both the ponds were interconnected with large pipes for the easy movement of water between them. Since the soil nature is sandier with coarse particle size, there was continuous collapse of the pond bunds. To restrict and prevent the collapse of the bunds, vegetation was planted along the slopes of the pond. Planting was difficult due to coarse sand and

therein coir board's help was sought after. The Coir Board provided coir mats and also the human resource to establish the coir mats on the slopes of the ponds. Once the coir mats were fixed, vetiver (Chrysopogon zizanioides) a monocot herbaceous plants were planted. The plant has a greater capacity of binding the soil particles and prevents soil erosion.

The total area of the ecopond region and the surrounding restricted region was calculated from the Google maps satellite imagery and derived as 15, 190 m^2. From the Google maps (Figure 2 to 5) the satellite imagery was taken and the surface area of the ecopond was calculated as 555 sqft (169 m^2) which approximately worked up to 0.17 Km^2 with a depth of 1.457 m. Ponds have been defined based on their size as water bodies between 1 m^2 and 2 ha (Williams *et al*.2010 a, b). The measurement of the ecopond clearly shows that they can be classified as pond of sufficient surface area.

The rainfall data was obtained (Fig 6 to 9) from weatherspark. From, the annual average rainfall data obtained from weatherspark, the rain fall received in the ecopond region was calculated (Table 1) which was approximately 16897356 litres (4470200 gallons) or 16897 cubic metres of water. The water received as rainfall annually by the ecopond region percolates into the ground since it is a sandy soil. Even if 10 % (153 cubic metres) of rainwater considered as evaporated, the remaining 16744 cubic metres of rain water is stored as ground water by the soil.

After an acute water shortage in the summer months of 2020 and 2021, the ground water level increased considerably. In 2023, there was no water shortage for the college and was able to provide water to the student community without depending on the external water source like buying in tankers.
Many natural and anthropogenic ponds in urban landscapes are designed and managed to hold stormwater runoff and are thus intended to be polluted as a means to protect water quality in the catchment downstream (Gold *et al*.2017). In addition, ponds are threatened by anthropogenic activities but remain a low priority of national and international conservation and environmental legislation in most countries (Hill *et al*, 2018). International collaboration and commitment is urgently needed to increase fundamental understanding of pond ecology, develop more effective practical conservation and management strategies, and for the implementation of detailed national and international conservation policies (Hill *et al*, 2018).

Humans face a challenge in learning to live in a manner that does not endanger the Earth. We contend that universities are in a unique position to address this challenge. Because their mission is education and not social action, some may seek to excuse colleges and universities from the call to embrace policies grounded in solutions to the ecological and social challenges of our times. But what is education for, if not to play a fundamental role in how our society moves forward in meeting its many challenges? (David Orr, 1994).

Not only educational institutions should educate students with interdisciplinary knowledge, but they are large, prestigious, influential institutions, and are capable of having large impacts on the environment as well as some influence on students at local communities. The challenge faced by humankind will require rethinking of our values and reeducation of our students in many aspects of our society's way of life, namely sustainability. To be precise, fulfilling the present needs without compromising the opportunities of future generations. Living within limits. Sustainability involves an awareness that natural resources are finite endowments to be used with care and provide necessary time for regeneration. Sustainability to preserve, restorate, and use of local knowledge; and to create strong, selfreliant individuals. Problems can be solved if each individual assumes a share of the responsibility.

Ponds also have significant amenity and educational value (Bastien *et al*.2012) and can be used to raise awareness of biodiversity and nature conservation as well as providing space for physical activity and relaxation (Higgins *et al*.2019). Ponds can benefit society and wildlife by providing habitats that support significant freshwater and terrestrial biodiversity. Educating the young minds on the importance of nature, environment, sustainable development, social awareness is the responsibility of the educational sector.

4. Conclusion

Apart from storing the rainwater from the monsoon downpour, the ecopond also acts as a habitat for water birds and small animals. The nutrients are also retained with in the pond otherwise the runoff storm water would have leached the nutrients from the soil. The nutrients and fine humus are deposited in the ponds which makes the deposited silt in ponds a valuable organic fertilizer. Many trees and plants grown in the vicinity of the pond would provide habitat for the birds, butterflies and smaller animals. The students were involved in volunteering work like planting saplings, keeping the place clean, trimming the overgrown shrubs, feeding the birds by refilling the bird feeders and so on. The aim of this project was to create awareness for the student community and also to the public, therefore, the ecopond and its advantages were highlighted in a television channel show "Nammal mudiyum" (Pudhiya thalaimurai, 2023). This paper highlighted the construction of an ecopond and the resultant impact on the surroundings for a span of three years, in the long run the advantages would be many fold and has to be studied continuously for a longer period of time.

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Disclosure of conflict of interest
The authors declare no conflict of interest financial or otherwise.

Compliance with ethical standards

No ethical approval needed for the study and compliance of all the persons involved in the project got approved.

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