Chapter 10

Repercussion Effects of Climate Change, Global Warming, and Urbanization on the Biological Diversity in the Riparian Zones River Noyyal

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Abstract: Global warming has disrupted the climate, but greedy urbanization and industrialization have caused turmoil in the environment. An in-depth study was conducted on the Noyyal, the oldest and most venerated river in south India. The river, which springs in the Western Ghats, has the most diverse ecosystem on Earth before it enters urbanized regions. The effluent from Tiruppur's black-colored textile industry is transported by this river when it merges with the holy Kaveri River. The little hamlet of Tiruppur is known as "Dollar City" because it receives $720 million in foreign exchange each year. The purpose of the study was to evaluate the damage that the effluent did to the biological diversity and ecotone of the river. The 35 km research zone included nine established study sites. We used recognized methodologies to survey the whole research area's flora and fauna and collect the taxonomic data. The analysis revealed the extensive harm done to the flora and wildlife as a result of the unplanned overuse of water supplies. The findings demonstrate the permanent disruption of the biological system and the rise of new species that have supplanted the indigenous species. The irreversible loss of India's extremely significant genetic wealth is apparent if action is not done to stop the river's misuse.

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1. Introduction

Existence of all organisms depends directly on the availability of water (Balasundram and Balasubramanium, 1973). Water is available in three forms on earth namely solid (ice), liquid (water), and gas (humidity). Liquid water is the most important for the survival of plants and animals. This water is available to these creatures by rainfall, rivers, lakes, ponds, oceans, etc. Swanson et al. (1988) stated that the rainfall in a place is governed by the topography, i.e., the mountain formation and relative humidity. Southern India receives monsoons in two periods due to southwest and northeast monsoons (Balasundram and Balasubramanium, 1973). These monsoons lead to the formation of rivers from the Western Ghats such as River Noyyal (Balasundram and Balasubramanium, 1973). This river finds its way into the dense forests of the Vellingiri ranges of the Western Ghats. This river harbors rich biodiversity, in both plants and animals before it reaches the human settlements (Nair and Henery, 1983, Henery et al., 1989).

Tiruppur is known as "Dollar City", "Knit City", "Cotton City" and “Banian City of India” The natural world has been kind enough to give Tiruppur ample water. An enormous number of industrial facilities that perform auxiliary tasks including making cartons, polythene bags, zips, buttons, tapes, and other packaging materials have also proliferated (Anand et al., 2012, Aishwarya et al., 2018). This town's pollution of its own surroundings and aquatic bodies generates an annual foreign exchange profit of $720 million. The extent of damage caused to the ecosystem due to the unending greed of human activity by lack of hosieries, and industries is irreversible in this area.

Studies by Roberts and Ludwig (1991), Simpson (1988), and Salo et al. (1986) emphasize the importance of monitoring river dynamics and riparian vegetation diversity to understand their complex relationships and inform effective conservation and management strategies. The literature survey revealed that there is no study available for this Noyyal basin (Chandrabose, 1981, Chandrabose and Nair, 1988, Senthilnathan and Azeez, 1999).

The present study was conducted to fill up this lacuna and to develop a primary baseline data of its biodiversity, which can form the basis for the protection of the speedy vanishing of native flora and fauna (Di Castri et al., 1988, McNeely et al., 1990).

2. Study area

The study area was about 35 km long, which was divided into 9 study stations (Figure 1). (i) Mangalam to Avinashi Road (ii) Mangalam (iii) Sultanpet (iv) Andipalayam CEPT (v) Nataraj Theatre Bridge (vi) Kasipalayam Bridge (vii) Orathupalayam Dam Inlet (viii) Orathupalayam Dam and (ix) Orathupalayam Dam Outlet.

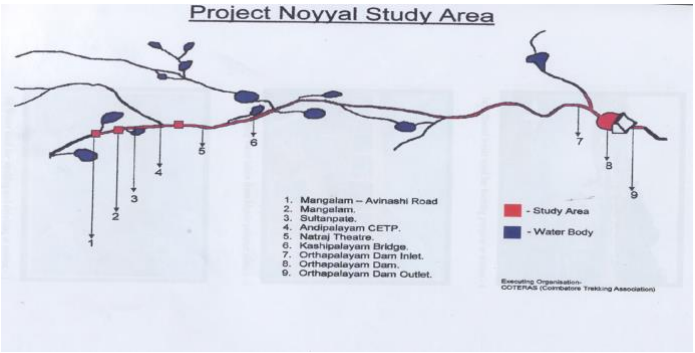

Figure 1. Project noyyal study area

3. Methods

The survey technique applied for fauna was the Belt transects method (Naiman et al., 1988) and Transect enumeration (Biligrami et al., 1992).

Angiosperms were surveyed according to their life forms as trees, shrubs, and herbs. The methods of quadrats and point quarters were used for the estimation of diversity (Gergory et al., 1991). Transect enumeration was made of the first 100 trees encountered in a belt. The same method was applied on the other side of the riverbank. This method was repeated in all eight stations and all available plants were recorded with their taxonomic details. Water samples were collected from all nine study stations and microscopically analyzed for the identification of microflora and microfauna based on the classification given by Honigber (1964) and Wright et al. (1984).

Rapid Bioassay Assessment was chosen for the speedy field survey of fauna, covering many taxa simultaneously by the multidisciplinary approach. This method was chosen based upon the guidelines of an international program of “Conservation International” (Trueman and Granston, 1997) which had dual benefits namely cost-effectiveness (New, 1998), and the results thus summarized, are easily understood by non-specialists (Resh and Jackson, 1991). Taxonomic grouping was done according to Oliver and Beatti (1996), freshwater macroinvertebrates as per Resh and Jackson (1993), protozoa by Hyman (1940), Mollusca by Hyman (1967), platyhelminthes by Hyman (1951) and insects as per New (1998).

4. Results

In some stretches of river, polluted water flow was continuous throughout the year (Krishnamoorthy et al.,

2023) Noyyal River which has been continuously exploited for the past three decades has not only deteriorated the water used for drinking and agricultural purposes but also spoiled the direct dependents like plants and animals. An alarming issue of irreversible genetic shift was revealed.

From the present survey, 90 plant species were identified from Angiosperms belonging to 77 genera and 44 families. The major classification of the group was 74 Dicotyledonous families and 11 Monocotyledon families were found (Table 1).

Table 1. Percentage of dicots and monocots in the study area

S. No.	Major Plant Groups	Representation (%)
1	Dicotyledon	87.77
2	Monocotyledon	12.22

Dicotyledon families were predominantly present than the Monocotyledon families. In the study area, the Dicotyledon families occupied a lion's share of 87.77%, whereas the Monocotyledon families represented only 12.22% of plants. On the other hand, there was no representative for Gymnosperm families in the study area.

Many of the native plant species are removed by natural selection due to habitat change (Petts, 1990) and loss of habitat (Noss, 1985). These physicochemical-hydrological changes due to the untreated effluent not only eradicated the native species but also introduced many exotic weeds and pollutants tolerable plants in the ecosystem.

The fauna study enlightened many interesting facts in biological selection and the emergence of pollutant-resistant species. The density of the individuals outnumbered the faunal diversity. In some cases, the number of individuals (e.g. amphibians) is insufficient to

pass on their genes to the next progeny. Plates show the existing fauna population and the impact of pollution on it. Table 2 depicts the taxonomic classes recorded.

Table 2. The number of fauna species found in each taxonomic division.

S.No.	Taxonomic Division (Phylum & class)	Number of faunas recorded
1.	Protozoa	7
2.	Coelenterates	1
3.	Nematodes	1
4.	Annelids	4
5.	Arthropods	14
6.	Aquatic Arthropods	19
7.	Mollusca	4
8.	Reptiles	3
9.	Amphibians	2
10.	Pisces	4
11.	Birds	44
12.	Mammals	3

5. Discussion

This study shows the serious damage that has occurred to both flora and fauna separately.

Floral survey reveals that the contaminated water spoiled the physico-chemical property of the soil which is reflected by (i) the advent of many exotic species in the riparian zone, (ii) the dominance of xerophytes (iii) the diminution of native aquatic plant species.

Faunal survey illuminated the presence of a single dominant species of organisms, which is due to the phenomenon called “survival for the fittest” and “genetic shift”. In the study area, the micro-organisms and invertebrate fauna show “genetic drift”, a vast variation within the species (e.g. crabs). The elimination of mollusks and native fish in the polluted waters of the Tiruppur had posed a threat to the existence of surviving fauna. The

amphibians, fish, and bird populations are also in serious threat. The diversity in the organism is less whereas the population of surviving species is enormous, which shows that only a few organisms have evolved to tolerate high salt concentrations and toxicity.

The majority of the species were identified and classified to the Recognizable Taxonomic Units (RTU). This study succeeded in generating significant baseline data in terms of species distribution and diversity of this riparian zone, which forms the reference for any further change in the ecotone of the river either deterioration or rejuvenation of the river in the future.

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