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SUCCESSION OF WATERBODIES DUE TO CIVILIZATION: A GLOBAL ISSUE

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Absract:
Fresh waterbodies is used mainly for irrigation purpose and fish culture and water is polluted due to anthropogenic activities, events like Gauri - Ganesh, Durga idol immersion, surface run-off and inflow of city sewage water. The faunal components are poorly represented and shallow littoral fauna exhibits monotony, playing hosts to a wide range of indicator organisms that unequivocally qualify as pollution tolerant species i.e. Chironomus sp. and Eristallis sp. (Rat tailed maggot)]. The bottom of the lake shows black mud due to the decaying organic matter. The marginal area of most of the lake is covered by vegetations like Ipomoea sp., Typha grasses and Eichornia while surface of water containing mostly free floating plants. The lake maintains a permanent bloom of phytoplankton and diatoms. The lake or pond and its community are converted into land community is known as hydrarch succession. Water bodies located in cities are likely to receive more phosphorus from domestic effluents containing detergents. However, urban water bodies also receive major quantities of phosphorus from fertilizers and other agriculture-related activities. Eutrophication of water bodies alters the physicochemical properties of water, the diversity of aquatic flora and fauna. The main cause of eutrophication process is overloading and cycling of nutrients like phosphorus. The overall outcome of eutrophication in terms of reduction in size and depth of water bodies leads into succession.

Introduction:

In freshwater ecosystems, the production, community composition and life-history traits of macrophytes are governed by the availability of carbon, nitrogen and phosphorous. Free-floating and tall species with floating leaves are the most competitive for light, and usually dominate macrophyte communities when nutrient levels in the water are sufficiently high. Several activities of human interest, including navigation and power generation, are hampered. A large number of water bodies in the United States, Europe, and Asia have recently been found to be in highly eutrophic condition. Most of the water bodies of world are surrounded with densely populated human settlement areas and agricultural fields. The size of smaller water bodies in human settlement areas is on the decrease with rise in population. Several environmental factors have also been found to add to the problem of eutrophication in addition to nutrients. The limiting factors like CO_2, temperature, pH, light, and dissolved oxygen are also affects on eutrophication of water bodies.

Oligotrophic lakes are very deep with well marked thermal stratification. Organic matter on bottom and in suspension is very less. Electrolytes low; calcium, phosphorus, and nitrogen are relatively poor; humic materials very low or absent. Generally, dissolved oxygen content is high at all depth through out the year. Plankton is restricted but contains many species, water blooms rare, chlorophyceaen members are dominant. Larger aquatic plants are comparatively less in number and are on the margin. The bottom fauna is quite good.

Eutrophic lakes are relatively shallow water bodies with much organic matter in either suspension or on the bottom. Electrolyte concentrations are more but variable depending upon influx. Amount of calcium, phosphorus and nitrates is abundant. Large aquatic plants are abundantly seen around the margin. Plankton is abundant; variable in quality. Algal blooms are very common; myxophyceae and diatoms are very common. Bottom fauna is poor in species.

Dystrophic lakes are shallow water bodies with high organic material. Electrolytes concentration varies to greater extent, calcium, phosphorus and nitrates are scanty. Plankton is more variable and bottom fauna may be very poor.

Eutrophication, or the promotion of the growth of plants, animals, and microorganisms in ponds and lakes has been a very slow and natural process. Succession is the process by which a waterbody becomes a marsh, then a bog, and finally a drier terrestrial body. Human activities around the aquatic bodies have enhanced the nutrient input. Phosphorus and many nutrients have key role in eutrophication and finally in succession. Succession is a dynamic and continuous process, often occurring gradually in due course and leads to change in species composition, age and size, ecosystem structure and their function.

In the initial stage, phytoplankton i.e. blue green algae, green algae, diatoms and bacteria are the pioneer colonizers. They are consumed by zooplankton, variety of fishes and other organisms. Gradually these organisms die and increased the content of dead organic matter in ponds or lakes. This is utilized by bacteria and fungi, and minerals are released after the decomposition. The nutrient rich mud then supports the growth of rooted hydrophytes in shallow water zone. The macrophytes like rooted or nonrooted inhabited by many organisms. After the death of these aquatic macrophytes decomposition started and again released the nutrients. In addition to this due to silting, the water depth of ponds or lakes gets reduced and marginal area is completely occupied by marginal plants. Gradually the water depth in the water bodies decreases due to evaporation and the deposition of organic matter and over loading of nutrients. After some period the aquatic water body converts into swampy ecosystem and gradually reduced water depth atlast converted in to land ecosystem where the large quantity of shrubs and trees grow.

Ecological indicators or bioindicators provide the information of the ecosystem condition. They may be used to observe the functioning and cause-and-effect relationships within an ecosystem. The biological indicator of eutrophication may be a single species or an assemblage of several species. The diversity and distribution of species in an ecosystem depends upon the ecological amplitude of species and the existing environment of the ecosystem. Some of the biological parameters are given below. Algae are commonly used for biological assessment of water quality and indicators of eutrophication (Garg et al., 2003; Patrick, 1950). Growth and continuous blooms of *Microcystis* and presence of *Stigeoclonium* leads to organic pollution in Banjara Lake, in India (Swaranlatha and Rao, 1998). Adoni and Yadav (1985) also focused on chemical and productional characteristics of *Potamogelon pectinutusn* and *Hydrilla verticillata* in a eutrophication of lake. Some aquatic macrophytes are known as bioindicators of eutrophication. *Vallisnaria* is reported as the efficient biomonitor of organic contamination and stressed aquatic ecosystems. Some important bioindicators of eutrophication are *Wolffia* sps., *Lemna* sps., *Typha* sps., *Spirodela polyrrhiza, Ceratophylum* sps, *Elodea* sps. and *Phragmites* sps. These are the best indicators of eutrophication of water bodies caused by organic effluents and nutrients (Stojanovic et al., 1998). The growth of *Spirodela polyrrhiza* was found to be directly related to the nutrient concentration of water (Ansari and Khan, 2002). The population and growth of *Lemna and Spirodela* were studied as a measure of eutrophication caused by household detergents (Ansari, 2005). The diatom assemblage in water bodies indicates eutrophication by nitrogen and phosphorus concentrations (Denys, 2003; Winter and Duthie, 2000). The changes in geochemistry and diatom assemblages are probably linked to increases in nutrient supply, increases the primary production (Gibson et al., 2003).

The changes in an ecosystem that follow a disturbance are collectively called succession; it is a dynamic and continuous process, often occurring gradually and there is a change in species composition, age, size, and ecosystem structure and function in due course. Primary succession occurs in environments that lack organic matter and which have not yet been altered in any way by living organisms. Primary succession includes the development over time of the original substrate into a soil, and occurs over centuries while secondary succession occurs in an environment that has supported mature vegetation in the past, and where, after the disturbance in soil remains relatively intact.

Phosphorus has been identified as the "limiting nutrient" in fresh water ecosystems. This nutrient is mainly brought to aquatic environment from the weathering of rocks, the leaching of soil, and rain. The major part of phosphorus is unloaded into aquatic bodies from agricultural runoff and domestic sewage. The phosphate is a relatively immobile element and may be carried to streams through soil erosion and storm runoffs from over fertilized or excessively fertilized agricultural fields, nurseries, lawns, and orchards. Certain synthetic chemicals, such as pesticides, construction materials, flame retardants, and plasticizers, are the other sources of phosphate discharges. Garg et al. (2002) studied three lakes of Bhopal i.e. Upper Lake, Lower Lake, and Mansarovar Lake in India and assessed the potential fertility of the lentic water and its aquatic flora and observed highest eutrophication in Mansarovar Lake. These observations indicated that different species of phytoplankton could subsist up to a certain nutrient level, beyond which competition between cyanophytes and other algae enhanced and eliminated the sensitive plankton flora.

Lakes and ponds undergo physical aging finally and become filled with sediment and particulate matter causing it to become shallower. The two main factors that control the succession are the mean depth of the waterbodies and the addition of nutrients from the surrounding drainage basin. The waterbodies will filled with sediments and particulates deposited from various processes and gradually waterbody can change into a wetland or even to a dry land environment. Succession is the process by which a water body becomes a marsh, then a bog, and finally a drier terrestrial body. Human activities around the aquatic bodies have enhanced the nutrient input rate and accelerated the natural aging process known as "eutrophication." This aging process brought down the water body under a faster cycle of succession (Reutter, 1989).

Conclusion:

Civilization and rapid eutrophication has leads to significant changes in water quality as well as results in physical, chemical, biological, and ecological changes in water bodies. The studies on eutrophication have revealed that the nutrient inputs into shallower and warmer parts of lakes are more severely altered (Reutter, 1989). Enrichment of nutrients in a water body accelerates its aging process and leads to faster succession Water bodies located near large cities are likely to receive more phosphorus from domestic effluents containing detergents. However, urban water bodies also receive major quantities of phosphorus from fertilizers, other agriculture-related activities and surface runoff. Due to civilization and anthropogenic activities, water bodies alters the physicochemical properties of water, the diversity of aquatic flora and fauna. The overall outcome of eutrophication in terms of reduction in size and depth of water bodies leads into succession.

Some effective control measures, including awareness programs pertaining to the present threat to water resources on the blue planet need to be implemented. The garbage and other city wastes should not be released in to or near the shoreline of waterbodies. The phosphorus input from anthropogenic sources such as detergents and fertilizers needs to be checked. The depletion of the water resource may be checked by local government bodies like municipal corporation.

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