PRIMARY PRODUCTIVITY

This is the synthesis of organic materials (nutrient and solar radiation) to manufacture organic material which is useful to the sustenance of an ecosystem. By producers, primary production set in energy into the ecosystem. It is on this production that other organisms will depend.

The producers are the chlorophyll bearing algae, macrophite, autotrophic bacteria and other phytoplankton. Although in some aquatic ecosystems that are rich in hydrogen sulphite, chemoautotrophic bacteria can be responsible for up to 25% of the primary production.

The basic steps in operation in primary productivity are as follows:

1. reception of the solar radiation by the ecosystem
2. production of the organic material by the producers
3. consumption of the organic material by the consumers
4. decomposition of the organic material by the decomposer
5. transformation of the organic material into useable nutrient (mineralization)

Example of consumers include those organism which are not capable of self food production but depend on the producers for their food. Example includes grazing herbivores (primary consumers) which are fed upon by the secondary consumers and in some food chain by the tertiary consumers and finally by the detritus feeders.

The decomposers include the organisms that are capable of breaking down the organic material into its nutrient components. They include fungi, and heterotrophic bacteria.

The role of mineralization in primary productivity is very crucial because it is the process that ensures continuous existence of the ecosystem. There are two movements in an ecosystem

1 Energy movement which is unidirection and non cyclic

2 Nutrient movement which non unidirection and cyclic

The movement of nutrient from the first trophic level continues to the last trophic level but how the last consumer will carry this energy back to the producer is the problem in ecosystems that are not self sustained by the process of mineralization.

Hence mineralization is the process by which decomposer breaks down organic materials (usually dead organic matter) into the useful forms .e.g. phosphate, nitrate, iron etc.

The process makes inorganic material available for the use of the producers. Therefore the main role of the mineralization is that it ensures continuous process of primary production and continuity of the whole ecosystem.

Biomass - this is the total weight of materials (yield or harvested) per unit space and time. The concept of biomass involves every thing like the plant, their roots and every part of the whole population. The weight of all these parts together forms the biomass of the area. Biomass can be for the plankton, fish etc. It can also be for the whole ecosystem combined.

Standing crop - is the amount of materials or resource in an area per unit space and time. It does not involves every part of the population but amount that could be harvested per weight e.g. the standing crop of plant in a pond, it is the amount of material harvested at a time in the pond which does not necessarily include the roots and every part of all the plant in the pond.

Net production- in ecosystem net production or synthesis of material occurs from the amount of energy or nutrient available to the trophic level minus energy or nutrient used for respiration and other physiological purpose. For instance, plankton synthesized inorganic material and solar radiation to manufacture organic material. Not all the organic material manufacture will be assimilated and stored by the plankton. Some of this will be used for respiration. The amount remains after removal of the quantity used for respiration is referred to as the Net production of the plankton. In a better way, this particular production is called Net Primary Production. There can be net production in each Trophic level. However the carnivore's trophic level is the most efficient because it has less quantity of material used for physiological purpose.

Rate of removal- this is the rate at which organism or organic material is been removed from an ecosystem per unit time. Emigration of animal life, predation by terrestrial animal, movement of nutrient by stream effluent, removal by secondary consumers and those remove through commercial harvesting. All these are some the ways by which organic materials are been removed from ecosystem. When the removal continued the ecosystem will not be self sustaining, hence the only way to sustain itself is through replenishment. The ratio of yield or harvest to replenishment is a measure of the productivity. This ratio determines whether or not the ecosystem is under or over-exploited. Some of the way to replenish artificially is through fertilization and stocking but ecosystem replenishes itself through recruitment.

Turbidity also prevents the fishes from finding their prey, thus reducing the feeding activities of fish and lowering productivity.

A transparency of 30-60cm is desirable for optimum productivity and an index of measuring transparency is the use of secchi disc with a calibrated string and heavy metal that will enhance sinking of the disc. The reading of both when the secchi disc becomes non-visible and when it re-appears is taken and the average of the two is measured as the correct water transparency reading.

Transparency in deep water is very dangerous because the light penetration will not get to the bottom of the water, thus primary production at that level will stop and oxygen will be depleted, decomposition of organic substances will also release ammonia and hydrogen sulphide which are poisonous to fish. Life becomes unbearable and fishes like mud fish are forced to come up to take oxygen using their accessory breathing organs. There is pollution at the bottom level and fish may stop feeding which can lead to mass kills.

Prevention and correction of Turbidity

Once there is low primary production and massive fish kills, the yield of fish will be reduced drastically. Except corrective measure are taken such as the use of Alum as a chemical mean of correcting clay turbidity and drenching gutters to prevent water run-off or erosion from getting into the water body (mechanical) and planting grass along the bank of the water (biological).

CHARACTERISTICS OF MAN MADE LAKES: METEOROLOGY AND HYDROLOGICAL PERSPECTIVES

Lakes whether natural or man-made, have varying characteristics and features which are partly due to their different geographical locations and are being modified by the environmental factors of their milieu. As such, the special and easily recognised quality

of man made lakes, which is the main focus in this discourse are not unconnected with some of these environmental factors of which meteorology and hydrological impact can not be overemphasized.

To start with hydrological characteristics of man-made lakes which are not unconnected with meteorological influences. Three major aspect of hydrological behaviour of lakes in which meteorological plays some important role are:

- changes in the volume of water in storage in lakes
- variation in rate of sedimentation and water quality
- Variation in rate of evaporation losses from surfaces.

Changes in the volume of water in storage in lakes occur seasonally and also from year to year. Variation in the volume of water storage in a lake whether seasonal or annual are primarily determined by meteorological condition which control the rate of water inflow and outflow from the lake. If we assume a water tight lake in which there is no water exchange with the substratum on which it lies, then water input will consist of two components namely river inflow to the lake and direct precipitation over the lake. These all depend on the prevailing meteorological conditions. On the other hand, water output will consist of three components namely, river outflow from the lake, evaporation losses and abstraction for human use. Again the degree of these components is largely determined by weather conditions. For instance, during the dry, hot season, human use of water is generally higher than during the cool, wet season. The meteorological conditions are firstly, the precipitation condition in the catchments of the rivers that feed the lake coupled with the direct precipitation over the lake. Moreover the duration of the sunshine

and the rate of evaporation losses are other important meteorological controlling factors affecting the volume of storage water in a lake. Variation in the volume of water during the dry, hot season can affect Hydro-electric power activities as reported from Kanji Lake.

Variation in the rate of sedimentation and water quality: The rate of soil erosion in catchments is partly determined by meteorological conditions especially rainfall, amount, duration, and intensity. Other things which affect erosion include topography, lithography and land cover. Land cover is being partly determined by climate and partly determined by human activities. The amount of eroded material transported and delivered at the control point downstream depends on the nature and frequencies of run-off which are in turn partly determined by climate conditions. The rate of flow of water through the reservoir determines the detention storage time so that the faster the rate of flow, the less the amount of sediment detained. Rate of sediment is higher in a reservoir in a relatively arid environment where little out flow is allowed than in one in relatively humid area where there is plenty of outflows.

In another perspective, meteorology can also affect some aspect of water quality often directly and sometimes indirectly. When rivers are in flood such as during the raining season, salinity tends to decrease with increase flow while turbidity and the amount of suspended solids increase. However during the raining season, at low flows the reverse occurs as suspended sediment concentration decrease while salinity increases.

The differences with rate of evaporation from a lake as one of the aspects of hydrological behaviour of lakes also owe it explanation to the influence of meteorological conditions, with important consideration of the size and depth of the lake. Evaporation from the lake,

since water is readily available at the evaporating surface is subject to atmospheric conditions. In other word, ability to vaporize water from the lake and remove it from the atmosphere could be resolved into three climatic variables namely: the amount of solar energy, the humidity of the atmosphere and wind speed. The conversion of liquid to vapour needs energy from the solar output. The relative humidity, that is the amount of water air can hold at a particular region where the lakes lies, is another factor, while the wind speed, that is the force to lift up the vapour (saturated air) from the evaporating surface and replace it with another dry air. All these climatic activities vary from season to season and from one geographical location to the other. Evaporation is higher during the dry season than during the wet season. In the dry season there is enough solar energy coupled with the general low relative humidity of the air. As such water evaporation values are higher in the northern part than in the southern part of Nigeria.

Conclusively, in this discourse on the characteristics of lakes especially man-made lakes, it could be best view, discussed and understood from their varying hydrological behaviour, all of which had been greatly influenced by the meteorological conditions of their immediate environment.

CHARACTERISTIC OF MAN-MADE LAKE: A LIMNOLOGICAL OVERVIEW

The limnological features of man-made lakes cannot be well explained without a much reference to the hydrological behaviour of the lakes, which in turn had also been greatly influenced by climatic factors of the lakes environment.

Limnologically, man-made lakes in Nigeria pass through three stages of development. The stages are: the initial period of flooding of terrestrial matter and struggle for existence by the biota; secondly, the stage in which the flood organic matter and riverine

species decompose and release nutrients; and thirdly, the period of production of organic matter as a result of released nutrients. The stages could be referred to as growth stages with other antecedent limnological features like Transparency, Thermal and Oxygen stratification, Chemical characteristics, Plankton abundance and fish catch.

Transparency: simply means clarity of the lake water and the possibility of sunlight to easily penetrate through. The low transparency of the lake water in June and October owe its explanation to the influx of flood water while in January, the mixing of the water and the re-suspension of the bottom sediment account for the low transparency. Meanwhile, highest values of transparency are recorded in September, November and December.

Water temperature, thermal and chemical stratification of the water: Lower values of water temperature are recorded between June and first half of September as a result of the low sunshine and heavy rainfall for the same period. While between October and December, the sunshine become more intense and temperature will rise. However variation of temperature has influence on the seasonal changes in the thermal and chemical stratification. The weakest stratification develop between June and September when sunshine hours are fewest; the strongest stratification as from October to the end of the dry season.

Chemical Characteristics: the acidity and alkalinity chemical characteristics of water owe its explanation to the seasonal variation and temperature differences. A write-up on Eleiyele Reservoir in Ibadan Nigeria showed that, at the bottom the water was acidic for most of the year of the deepest station but in the shallow areas, apart from the June-September period when the whole reservoir was acid, the bottom was weakly alkaline because the whole column of water was presumably within the photosynthetic zone. The

influx of flood water re-suspension of bottom sediment also account for the acidic condition. The percentage of oxygen content of surface water is also in consonance with the observed temperature.

Plankton Abundance: There is seasonal variation in plankton abundance of man-made lakes. For instance, phytoplankton abundance is high at low water level and at a time when transparency of the lake is high. The growth of algae is affected by low transparency and the immediate effect of the torrent and the high turbidity of the water. Similarly, the total zooplankton abundance followed slightly the same pattern as that of the phytoplankton abundance. It was high at low water levels but dropped sharply as the lake was being filled.

Fish Catch: the pattern of fish catch as part of limnological characteristics of man-made lake could be well explained when put the thermal and oxygen stratification into consideration. As observed by (H.A Adeniji) that the crustacean zooplankton which were distributed through a depth of 30meters during homothermy and temporary stratification periods, moved up from the de-oxygenated hypolimnion to the oxygenated epilimnion and thermocline during the period of stratification. It is believed that the zooplankton-feeding fishes in the lake will move up with the zooplankton at this time of the year. Since the hypolimnion is de-oxygenated at this time, the fishes will move away into the well oxygenated and more favourable areas of the epilimnion, thermocline and littoral regions of the lake.

In conclusion, all these limnological factors such as transparency, water temperature, thermal and chemical stratification, chemical characteristics, plankton abundance and

pattern of fish catch are among the scope through which the characteristics of man-made lakes could be explained.

CHARACTERISTICS OF MAN-MADE LAKES AND THEIR EFFECTS ON THE IMMEDIATE ENVIRONMENT

The impact of climatic factor on man-made lakes in a particular environment is in form of "Give and Take" nature. That means to say, as the climate influence the features and easily recognised quality of man-made lakes, the lakes also reciprocally affect the climate of their immediate environment. However, the magnitude of the lakes influence on the climate depends on the size of the lake and other interfering factors.

The most noticeable effects of lakes on the climate of their immediate surrounding are on temperature and humidity regimes. The diurnal range of temperature is reduced with a lowering of the maximum temperature and an increase of the minimum temperature.

The relative humidity of the air is increase owing to substantial addition of water vapour to the atmosphere from evaporation taking place over the lake. Speculatedly, this could have some effect on the amount of precipitation received downstream, though yet to be empirically proved.

In another perspective, the effect of lake on the micro-climate can be observed in the modified wind regime of the surrounding area. Depending on the size of the lake, a viable lake breeze similar to the sea breeze may be established. Because of the more humid air and the large amount of energy used to vaporize moisture, the Bowen ratio in the immediate surrounding of the lake is usually lower than in location farther off from the lake. Less energy is available for warming the air and the ground, another contributing factor to the observed modified temperature regime described earlier.