VISION ON BIODIVERSITY: EXAMPLE OF ECOSYSTEM SERVICES IN BANGLADESH

Bashar, M. A.

Environmental Biology & Biodiversity Laboratory (EBBL), Department of Zoology, University of Dhaka, Dhaka-1000, Bangladesh

There are many definitions of ecology and there are many studies to form the term ecology (Egerton 1977). The subject of ecology covers a wide range of topics. It starts from the molecular properties such as enzyme systems adapted to function well under certain environmental conditions, to organismal, population, community, and ecosystem structure and function (Price 1984). Ecosystem is a system of interaction between abiotic and biotic factors of a certain area of the biosphere (Bashar 2004). Compound communities are composed of merging and interacting component communities which are assemblages of species associated with some microenvironment or resource, such as a food plant, a tree hole, or leaf litter (Root 1973). The component community may be formed of several guilds of species, being groups of species that exploit the same resource in a similar manner (Root 1967, Jaksic 1981). The interactive system produces optimum ecological conditions for maintaining species assemblage and species richness if the system remains functional for doing the same. The created ecological conditions in such an area provides proper niche for an animal so that the animal remains sound in its habitat; and continue there in tranquility. In such ecological conditions an animal can produce its progeny with least disturbances.

Ecosystem services derive from the interacting facts between abiotic and biotic sources in a certain area of our biosphere. The services are the product of interactive dynamism between living organisms and their surroundings (Bashar 2004, 2015). The surroundings cannot produce and give services to the environment equally in every parts of the world. Some specific areas are more suitable for providing services to the animals as well as to the environment. Bangladesh provides maximum services as that type of the ecological places provide. Some examples of the services are focused in the present article.

In Bangladesh, ecosystem services maintain a vital functional pattern and we are benefited by the services. Our responsibilities are to protect and enrich the ecosystem services systematically and scientifically. We are to do it by providing and conserving suitable areas of genetic resources. Worldwide biotic resource-distribution deserves to be safeguarded for maintaining the such other ecosystems existing elsewhere in the planet.

One of the problems of ecology is the failure to arrive at some basic principles. Because the ecological world is by its very nature a rather messy place and because nature has so many exceptions to its "rules" ecology may never have any precise principles. But on the other hand, ecosystem has got much more specified principles and interactive functions that can characterize the nature's structure in some places of our biosphere.

Ecosystem is the major functional ecological unit. It contains biotic and abiotic components through which nutrients are cycled and energy-flow maintains its regulation in synchronizing way. To permit these cycles and flows the ecosystem must possess a number of structured interrelationships among its

components (soil, water, nutrients, producers, consumers and decomposers). The function of ecosystem is related to the flow of energy and the cycling of materials through the structural components of the ecosystem (Lindeman 1942, O'Neill *et al.* 1986). The total number of energy that flows through a natural system depends upon the amounts fixed by plants or producers (Kormondy 2004). As energy is transferred from one feeding level to another, a considerable portion is lost for further transfer. This limits the number and mass of organisms that can be maintained at each feeding level. When maintenance of this feeding level (a species) as a part of ecosystem gives services to the nature then an ecosystem tends toward maturity. In so doing it passes from a less complex to more complex state. This change is called succession. The major functional unit of the ecosystem is the population. It occupies a niche system, that is, it plays a particular role in energy flow and cycling of nutrients (Brooks *et al.* 1987, Cary *et al.* 1988). A niche within a given ecosystem cannot be simultaneously and indefinitely occupied by a self-maintaining population of more than one species. Both the environment and the amount of energy fixation in any given ecosystem are limited. When a population reaches the limits imposed by the ecosystem, its number must stabilize or, failing this, decline (often sharply) from disease, strife, starvation, low reproduction, and so on. Changes and fluctuations in the environment (exploitation and competition, among others) represent selective pressures upon the population. Species diversity is related to the physical environment in an ecosystem (Bowden and Bormann 1986).

Changement of coincidences between physical factors and the biological factors in an ecosystem (a place of nature) if created even for some months, arrivals of new (non resident) species may happen. If this creation of coincidence provides successive feeding levels useful for the species, the arrival of the species stands distinct and remarkable. Because the species needs to use the said coincidence as its depending niche is available here in the ecosystem even for few months only. When the abiotic-biotic coincidence is over or hampered in the ecosystem the arrived species remains no more there. Here is an example. An agricultural wetland ecosystem is situated at **Salna** about 40 Km away from Dhaka city in Bangladesh. Grey-headed lapwing (*Vanellus coronatus*) locally known as langoila tity winters in northern Southeast Asia as well as in Bangladesh. The lapwing utilizes its eco-trophical resources available in the Salna agro-wetland ecosystem for a short duration of time (from the mid-January to the end of the March). Male and female individuals almost always live in pair; and they search their nutritional sources plus suitable ecological conditions in groups. A group generally varies with 2 to 22 individuals as it has been recorded in our experiment. During their stay in the Salna ecosystem, they are found to feed on insect larvae (Mainly chironomids and scrabaeids), annelids, small mollucs (gastropods mainly), small fishes, tadpoles and field grasshoppers. During the period of January to March, the above small animals (or their developmental stages) show their peak population abundance. Physical factors at that time remain very favorable to the bird. It is remarkable that during the short period, the bird (*V. coronatus)* finds suitable ecological and nutritional supply (resources); and stay in the wetland ecosystem in tranquility. But when agricultural practices like use of chemicals and insecticides together with anthropogenic disturbances start in the area, the nutritional source-populations are found to decline abruptly and unusually. The bird gets away from the wetland ecosystem suddenly. So far the ecosystem can provide the required services to the bird in sound environmental conditions, it stays here though the place (Salna) is situated near the most populous city (Dhaka) of the world.

If suitable ecosystem can be created by assembling species richness of different interacting factors (both biotic and abiotic), created ecosystem services would be utilized for enrichment of animals at all trophic levels. Example could be cited here from Bangladesh.

Butterflies are different creatures with different features and activities (Bashar 2015). Life cycle of the butterflies is with four different stages: Egg-Larva-Pupa-Adult. In these stages they are vitally active in performing various activities for maintaining species richness in an ecosystem (Berenbaum 1983, Feeny *et al.* 1983, Richard and Guedes 1983, Thompson 1988a, b). The activities are: foraging behaviours, resting behaviours, heat regulations, puddling activities, busking behaviours, territorialities, gene-flow activities, predator fighting, pre-mating and mating behaviours, larval activities, pupating strategies, adult-emerging behaviours, relation with other animals symbiotically. All the activities are highly delicate; and sophisticatedly utilized naturally for keeping an environment sound in an ecosystem where the butterflies live in tranquility (Akand *et al.* 2015, Akand *et al.* 2015). Because butterfly activities require balanced combination of optimum interactive conditions between physical and biological factors in an ecosystem especially in a forest ecosystem.

Butterflies need three categories of plants physiologically and ecologically for their colonizing mechanism in an ecosystem. They are the host plants, the nectar plants, and the shelter/shade plants. The plant categories comprise plants at the soil surface layer, undergrowth layer, and the canopy layer of vegetation in the forest(s), especially in tropical rain forests. Assemblage of the three layers of vegetation in a forest gives a sound status of the forest(s). This stands as an ideal natural ecosystem for all other trophic levels. The butterflies have equal access to the plants of all the three layers of vegetation; they are very much actively related with gene-flow and diversification of plant populations in the forest. No other animals, even not the other insects are so equally important to the plants at all layers of vegetation in this respect. Butterfly colonization is a vital factor for maintenance of healthiness of three layers of vegetation in the forests; and that healthiness ensures the natural processes for conservation of wildlife and also for other trophic levels in nature.

Ecosystems seldom have more than five trophic levels. This is because there is no enough food or energy in the top trophic level to feed another level (Weins 1976). First, not all the food available at one trophic level is actually eaten by animals at the next level. At each level, the biomass, the total mass of all organisms present, is only partly consumed (Harmon *et al.* 1986). Second, most of energy an animal eats does not go to make us fatter it is used in respiration; for the maintenance and repair of body tissues; and for locomotion, circulation and feeding. As we will expect from the laws of thermodynamics, none of these processes is very efficient. Some useful energy is lost as heat and as entropy each time energy is converted from one form to another. Because of these energy losses from one trophic level to the next, there is not enough energy left to support higher trophic levels (Moore 1984). Energy from the sun enters an ecosystem during photosynthesis. Then it passes from one trophic level to the other trophic level (lower to higher trophic level) chronologically in the ecosystem's food web (Paul *et al.* 1979, Briand and Cohen 1984).

Now question comes 'whether conservation of wildlife is the mere conservation of plantation or not'. In the energy-flow system, plant is the basic structural form and first trophic level. This first trophic level is characterized by three characters at a time, whereas the other trophic levels (the animals/

different consumers) are the successive ones and having with only two characters in an ecosystem. Among the three characters, the plant can convert abiotic energy into biotic molecules and can manufacture its own food (first character); the plant can store the energy in the biotic form (second character); and the plant can transfer the energy (in organic form) to the higher trophic levels (to the consumers) (third character). This is occurred by the process of "being eaten". In an ecosystem, all other trophic levels (the consumers) are only having with the second and third characters of the first trophic level. It is evidenced that no animals can exist and multiply in an ecosystem if the first trophic level is absent. Directly or indirectly an animal has to depend on the plant in an ecosystem. If plants are available, animals get nutrition first and then can take shelter, can mate, can prepare for nesting, can produce off-springs, can perform other activities (where necessary and essential), can get towards speciation, can enrich the species richness, and can assist the sustenance of species richness. This sustenance is the conservation of living organisms in an area; and then the conservation of wildlife in nature.

The plants are not only used as the nutritional sources for animals, but they are also used as ecological sources and as the ecological niche-sources. The bird 'seven-sisters' is found to take characteristic rest in the trees, but these trees are not found to supply them food materials. Without these trees they cannot take their characteristic rest in the forest. If they cannot pass in such resting time they cannot survive in the forest. So needs of the trees (in collective form) is multidimensional, many of the needs have yet not been identified and discovered. Another interesting example of the plant association of birdwing butterfly (*Troides* spp.) with the specific plant (the Indian birthwort, *Aristolochia* spp.) could be cited as the related happening of the ecosystem services. Birdwings are the largest butterflies in the world. Some of the species of the butterfly are available in Bangladesh. They do not found to copulate without the *Aristolochia* plant. When the mating behaviour is studied it is found that their characteristic mating takes place with the *Aristolochia* plant in hanging condition. If the specific plant is not found, the butterfly cannot go for successful mating activities. For progeny-maintenance in this species such association with the plant is absolutely necessary (Bashar 2014). This peculiar mating behaviour is the simple example of an interaction of the biotic-biotic factors in an ecosystem (Alam *et al.* 2014).

Now the question is why plants and plantations are the major events to go for wildlife conservation. Because if plant is there initiation of bio-conservation mechanism is there, if plant is not there no initiation of bio-conservation existed. Plantation is the stimulation of the fact-initiation. If there is no stimulation, there is no response. If there is no response there is no fact of happenings, if there is no happening (specially among the living beings) there will be no behavioural aspects and then there will be no appearance of bio-conservation mechanism in nature (Bashar and Khan 2015).

The EBBL lab of Dhaka University has established a hypothesis that butterfly-colonization and colonizing centres are the tools that can determine and assess proper soundness of a healthy forest. Steadiness of the healthy forest could ensure wildlife conservation. The laboratory has discovered hundred host-plant species for Bangladeshi butterflies on which they lay eggs, develop larval stages, go for pupation and use the host-plant hedges as adult emergence supports. As the butterflies of different families have access to plants at different height levels in a forest, they can cause gene-flow in plants at

different height levels also. And that is the "fact of happening" '*how butterflies maintain healthiness of a forest'*. This healthiness contains natural assemblage of not only the plant populations but also the population of all trophic levels. Here wildlife conservation means the conservation of all trophic levels (autotrophs - consumers - decomposers) in an ecosystem without allowing any hamper to the nature. The butterfly-colonization and the release of butterflies to the forests can maintain the status of forest for harbouring wildlife sustenance and then the term conservation stands valid (Bashar *et al.* 2015). The EBBL has established the technique for maintaining the assemblage of maximum number of trophic levels and also sustenance of interactions among the trophic levels; and that is required for keeping dynamic mechanism in conserving the wildlife. By establishing the process in nature genetic resources could be conserved very effectively in the areas of ecological importance like Bangladesh.

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