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The Concept of Biodiversity and its Relevance to Mankind: A Short Review

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Abstract

Biodiversity plays significant roles in the lives of humans. Unfortunately, global statistics indicate a speedy decline in the numbers of flora and fauna diversities, with extinction threats for many of them. This short review paper explains the scope of biodiversity while highlighting its tremendous aid to mankind as well as its intrinsic and anthropogenic values that justifies the need for their conservation and sustainable use. The paper relied on extensive review and interpretative analysis of existing secondary literature on the subject and provides synthesizing interactions between biodiversity and their ecosystems. The paper unveils the direct and indirect benefits of biodiversity which are pertinent to life sustenance. It cautions governments to support bodies and institutions that are tasked with the responsibility of conserving biodiversity. This support in the form of logistics and funding would aid them in carrying out the education and sensitization programs on the need to conserve biodiversity for the perpetual sustenance of the lives of the current and future generations.

Keywords: biodiversity, nature conservation, environmental sustainability, flora, fauna

1. Introduction to the Concept of Biodiversity

Biodiversity is one of the words in the area of ecological and environmental sciences that does not lend itself to a particularly unique meaning. Chadwick (1993) concurs that there is no agreed definition of the word. Owing to this, the word 'biodiversity', according to Science for Environment Policy (2015), is assigned different meanings in line with the context of its usage in ecosystem assessments and ecological services. Many conservationists and biological scientists normally adopt a working definition to suit their interests and the idea regarding the word they want to propagate. For instance, this researcher has adopted a simple working definition for biodiversity in this thesis. In his view, biodiversity refers to the different species of flora (plants) and fauna (animals) in different kinds of habitats.

Historically, the word 'biodiversity' was first referred to as 'biological diversity' by the wildlife scientist and conservationist called Dasmann (1968) in a book he authored titled 'A different kind of country' which campaigned for the conservation of nature's resources. The term 'biodiversity' was first used by Rosen (1985) while he was planning the 1986 National Forum on biological diversity organized by the National Research Council (NRC) as noted by Dasmann (1968). Although, the framing and coining of the two words 'biological' and 'diversity' into 'biodiversity' are credited to Rosen by Dasmann (1968) though Science for Environment Policy (2015) assigns it to Wilson. Despite the contradiction regarding the creditor of the word, what is worth knowing is that there is a consensus with the year 1985 when the word came into existence. Cho (2011) defines biodiversity as 'the variety of all living organisms including ecosystems, plants, animals, their habitats, and genes.' Takacs (1996), on the other hand, defines biodiversity as 'the full variety of life on earth'. The term concerns itself with the variety of individual species within populations and communities and the range of ecological roles within ecosystems (Science for Environment Policy 2015). A generally loose

definition for biodiversity implemented by biologists is the whole number of genes, species and of ecosystems of a region.

All these definitions share one thing in common regarding biodiversity. It refers to the different kinds of all living organisms on earth and the different dwelling places. However, the most widely used explanation of the word 'biodiversity' is what the Convention of Biological Diversity gave. It defined biodiversity as 'the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystem' (CBD 1992). The International Union for the Conservation Nature (IUCN) also uses the term biological diversity to describe the variety of life on earth, including the number, variety and variability of living organisms like animals, plants, fungi, microbes etc. and the genetic differences among them and the ecosystems in which they occur.

1.1 Components of Biodiversity

Yucel (2015) divides biodiversity into three main components namely genetic diversity, species diversity and ecosystem diversity.

1.1.1 Species Diversity

A species is a group of living organisms that can interbreed with each other. Species diversity refers to the different kinds of species within a particular Region. For instance, in a small river, there can be plants, frogs, fishes, snakes and so forth constituting diversity in species. Species diversity is also referred to as 'species richness' thus the extent of the biodiversity resources of a site (Naughton-Treves et al. 2005). This richness or species diversity of a site is dependent on climatic conditions.

1.1.2 Genetic Diversity

Gene is the distinct sequence of DNA (Deoxyribonucleic Acid) forming part of a chromosome which offspring inherit from their parents. Genetic diversity refers to the different types of genes in chromosomes of species and their variations (Whittaker 1967).

McGrath (1999) cites a simple scenario of dogs in explaining genetic diversity. A certain group of dogs may belong to one species but their genetic codes are different. This explains why there are bull dogs, Chihuahua dogs, Great Lane dogs, etc. Even with the genes, there exist other variations in terms of colours, sizes, shapes etc. The numbers of genes increase when the size as well as the environmental boundaries in individual species also increases.

1.1.3 Ecosystem Diversity

Ecosystem is a biological community of animals and plants that interact with each other as well as their environment in a particular Region. Ecosystem diversity refers to a particular assemblage and interaction of species living together and their physical environment in the given area (Whittaker 1967; McGrath 1999). For instance, there may be two different forests in an area, the species in each of the ecosystems, natural communities and habitats will certainly be different from each other. This is termed as ecosystem diversity. All these three components of biodiversity show that bio-spheres' richness is maintained when they are in their original regions, what ecologists term as 'in-situ conservation'. Dasmann (1968) mentions other factors that contribute to diversity of a system such as evolutionary changes, geological changes, and random population fluctuations. This means that conservation of bio-resources must be of chief concern to all humans. There must be strict measures in place to check the abuse of these resources that are pivotal to the sustenance of man.

1.2 The Relevance of Biodiversity

Biodiversity is very beneficial to the existence of man. Land use change, alterations in river flow, freshwater contamination, and misuse of marine resources are presently the greatest significant drivers of biodiversity variation and becomes projected to continue throughout this century (Leadley et al. 2010). As part of nature, these bio-resources very abundant because without them life would be very unbearable (Bradley et al. 2012). Tackacs (1996) categorizes the valuable nature of biodiversity into two. They are intrinsic

value and anthropocentric value. The intrinsic value of biodiversity refers to the innate value of bio-resources to exist concurrently with humans as planned by the creator. On the other hand, the anthropocentric value refers to the conservation of biodiversity resources due to their economic values.

1.2.1 The Intrinsic Values of Biodiversity

The intrinsic values of biodiversity advocate that biodiversity is worth protecting because of the importance humans can glean from them. Ehrenfeld (1972) bases his arguments on Noah's principle that the existence and presence of nature's biodiversity in the long history of life evolution are enough reason for their conservation. The future progeny must have to know of these bio-resources. It is the duty of humans to leave it to future generations in their original form as was handed down to the current generation by their forebears. Their long presence in nature is like a history book to educate the future progeny. Intrinsically, this must motivate humans in this present generation to conserve them. It is not just the economic incentives that can be obtained from the biodiversity in nature that should be the driving agent for their conservation but also, their admirability. This sentiment is expressed in the words of nature writer Henry David Thoreau (Meltzer 2007): 'This curious world which we inhabit is more wonderful than it is convenient; more beautiful than it is useful; it is more to be admired and enjoyed than it is to be used.'

The intrinsic value also involves the emotional, spiritual and religious reasons why the bio-resources in nature have to be conserved. Human beings are naturally part of nature because it has always been like that since the beginning of creation (Ingold 1992). For instance, Huber et al. (2002) talk of the spiritual gifts accrued from the bio-resources in the environment. Local communities benefit greatly from these spiritually protecting plants and animals that surround them. It is interesting to note that the stories of the forebears of indigenous people skillfully painted detailed imageries of the flora and fauna species in their environment. This, to May (2000), has contributed to the great variations in the folk art, folk dances, myths as well as maxims which contribute to the richness of

the world's art and literature which were creatively propounded as a result of their interaction and experience with nature's biodiversity.

Still, highlighting the intrinsic value of biodiversity, the National Park Service (2010) pointed out the emotional satisfaction humans enjoy from the aesthetic value of nature. The organization mentions that biodiversity has rejuvenating powers that are silently meditating on the awe in nature. That is, psychologically, nature assists man to overcome the stress and strains of life. This chiefly accounts for the mass interest in ecotourism today such as travelling to a reserve or any interesting site pregnant with bio-resources with the aim of viewing, sustaining and supporting ecosystems and local culture (Grant et al. 1992).

1.2.2 The Anthropogenic Values of Biodiversity

The anthropogenic value of biodiversity refers to the economic value humans obtain from the bio-resources in nature justifying the essence of conserving them. The economic benefits of biodiversity can be direct benefits as well as indirect benefits.

1.2.2.1 Direct Benefits of Biodiversity

The direct benefits humans derive from biodiversity include the food, clothing, shelter, fuel, medicine, raw materials for industries and so forth. For instance, Attuquafio and Fobil (2005) noted that some biodiversity species have the potential of providing new as well as proactive medicines for the management or possible cure of such intractable diseases such as HIV AIDS or cancer. Cho (2011), writing on medicines obtained from plants and animals on the earth planet for the cure of man's ailments today, had to mention aspirin, tamoxifen, quinine, digitalis and others to emphasize the need for the conservation of biodiversity. Tracing the roots of some medicines to some of the bio-resources in nature, May (2000) mentions that the Opiate pain relievers were derived from poppies, aspirin from willows, and quinine from the *Chinchona* tree. Also, the same source adds that the rosy periwinkle (*Vinca rosea*) and Pacific yew (*Taxa brevifolia*), which are both flora species provide substances used in chemotherapy to prevent the division

of cancerous cells to other parts of the body. This clearly underpins the reasons why the bio-resources have to be conserved. The total livelihood of humans rests on them.

In addition, there is a field of engineering called biotechnology or biomimicry. It involves the study of the bio-resources in nature, that is, the plant or animal species in the environment to provide the remedies for the problems of mankind (Huber & Hohn 2002; Biomimicry Institute 2009). Designs and structures in nature are used for studying or designing of engineering products. This explains why there are dozens of scientific and technological inventions that are replicas of nature. For instance, The People and Planet Organization (2009) reports that the model or concept used for the production of the hydrodynamic swimming suits was developed from the skins of sharks. Tiny organisms that are seemingly irrelevant even provide powerful lessons for technocrats and scientists. The People and Planet organization again reports that the Sandcastle worm (*Phragmatopoma californica*) produces a certain kind of glue for bonding their broken sand particle shells. Today, Surgeons have picked a lesson from that type of glue to produce a kind of glue that can mend fractured bones in the aqueous internal environment of the body. This is just but a few of the marvels of nature. These valuable lessons and tutorials picked from the bio-resources in nature to remedy human needs and problems would not have been possible if human forebears wantonly destroyed them. This justifies the need for humans to conserve these valuable assets even the invisible ones noticed only through a microscopic test!

1.2.2.2 Indirect Benefits of Biodiversity

The indirect benefits which living organisms gain from bio-resources in nature are not as easily recognized as the direct benefits are acknowledged. These indirect benefits are numerous but difficult to quantify (Takacs 1996). Some biodiversity and conservation experts refer to these indirect benefits as 'Ecological services'. Other scholars have further broken them down into provisional services, regulatory services, cultural services, supporting services and so forth. These services are critical to human survival. For

instance, Bradley et al. (2012) pointed out that the bio-resources and their natural communities' aid in the proper maintenance and regulation of the gaseous concentration in the atmosphere that bars the rapid changes in climatic conditions. Also, the reduction and cessation of natural disasters such as volcanic eruptions, hurricanes, floods, earthquakes, tsunamis, tornados etc. are as a result of the abundance of the bio-resources in nature (Leakey & Lewin 1996). What marvels the researcher is the waste management and recycling services rendered by these biodiversity resources. Ehrlich and Ehrlich (1992) reveal that the natural ecosystems absorb the human waste and render them non-toxic. They argue that the wetlands serve as large filters that purify freshwater while working on it by removing the hard metals and contaminants from it. The numerous rivers break down the liquid wastes or effluents and sewage by factories and industries that would have been hazardous to life on the planet. Science for Environment Policy (2015) actually lists some of the supporting services of biodiversity as decomposition of the soil as well as its formation and retention, nutrient recycling, pollination, atmospheric oxygen production and others that this thesis will not be able to discuss. Also, there are special indigenous flora species and fauna species that portray the cultural origins of people. These species give society members a sense of satisfaction and belongingness which result from biodiversity conservation (Adom, 2018). Others include spiritual enrichment, cognitive development, recreational and aesthetic experiences etc.

Yucel (2015) estimates from the ecology point of view that a replacement of these indirect services rendered by the bio-resources in nature would cost the world over three trillion dollars! It is therefore not surprising to know that Ghana as a country loses a huge amount of four hundred and twenty million Cedis annually as a result of poor sanitation leading to biodiversity loss (Ghana News Agency 2012). If humans fail to conserve these bio-resources, there is no way the direct and indirect services provided by them can be atoned or replaced. It is, therefore, the responsibility of humans to conserve the bio-resources in nature at all cost and at any means.

2. Conclusion

Biodiversity changes towards adaptations of ecosystems ranges from transformation of forests into pastures and croplands, climate-induced invasion and reductions in the abundance of predators affecting the ecosystems. The survival of the planet and its services relies solely on biodiversity. Therefore, mass public education and sensitization of the worth of biodiversity and the eventual repercussions of its reduction and eradication must be intensified by conservation ministries, agencies and NGOs set up with the ultimate goal of protecting biodiversity. Governments must support these conservation ministries and agencies with the required logistics and funding to aid in their activities. These efforts will in the long term save these rich biological diversities that hinges life on earth. Interventions to tide over the gaps in the socio-economic, climate and global bio-geochemical can possibly accelerate the biodiversity transformations over the coming years thereby can mitigate and adapt measures that can have significant impacts on the biodiversity.

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