

The Value of Biodiversity

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Biodiversity, as defined by the Convention on Biological Diversity, “means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems”. In its simplest form, biodiversity includes all species on the planet, from single cellular organisms (bacteria and viruses) to complex organisms such as plants and animals. At the cellular level, biodiversity refers to genetic variations between populations of species separated by geography, as well as those among individuals within single populations. On higher levels of organisation, biodiversity also includes “variations in the biological communities in which species live, the ecosystems in which communities exist, and the interactions among these levels. All levels of biological diversity are necessary for the continued survival of species and natural communities, and all are important for the well-being of humans.”^[1]

The value of biodiversity can be separated into two categories: anthropocentric and intrinsic or ethical. Anthropocentric value is comprised of direct and indirect economic benefit to humans and ethical value is based on a respect for life, a reverence for the living world and a sense of intrinsic value in nature and a concept of divine creation.

Biodiversity provides a range of goods, from agricultural crops to medicines and fibres, to which a direct value and cost can be assigned. This direct economic value of the natural environment can be divided into those associated with consumption and production i.e. consumptive use and productive use values.

Consumptive use value is usually assigned to goods consumed locally that are neither bought nor sold and therefore do not contribute to the economy of a country. People “living off the land” obtain the goods that they need for survival from the environment. Should the environmental quality decline, for whatever reason, their standard of living would obviously deteriorate.

This consumptive use value can also be seen in the use of fuelwood for heating and cooking. It is estimated that about 2.4 billion people use fuelwood and other forms of biomass for cooking and heating^[2]. While this is not the case in Jamaica, the demand for fuelwood (charcoal) for domestic and commercial use had increased until the late 1990s^[3]. The value of this energy source can be determined based on the how much would be spent on kerosene or other fuels if people were unable to get their fuel needs from their environment. In many countries, people have exploited their local sources of fuelwood but are unable to purchase alternatives. This has been referred to as “the poor man’s energy crisis” which was “brought about by population pressure, dwindling forest, and the increased cost of alternative means of cooking and heating”^[4]. This eventually compels people to travel further away from their environment for fuelwood, thereby increasing deforestation.

Productive use values are assigned to those goods harvested from the environment, which are bought and sold locally, nationally or internationally. Major products include construction timber, fuelwood, fish and shellfish, fruits and vegetables and seaweed, to name a few. The value of these products is determined not by the final retail cost of the product but by the amount paid at the first point of sale less the expenses to that point. This value may, therefore, be misleading as what appears to be an insignificant natural product may be starting points for very important manufactured products.

In some cases, wild populations of species act as the blue print for the synthesis of medicine. As in the case of aspirin, one of the most valuable and widely used medicines, once the chemical structure had been identified from nature, it was found to be cheaper to synthesise than to grow. Other examples of medicines whose chemical structures were derived from nature are morphine, modified from the poppy plant (opium), and novocaine, a synthetic form of cocaine derived from the coca plant. The 20 pharmaceuticals most used in the United States are all based on chemicals first identified in natural products; these drugs have a combined sales value of \$6 billion per year^[5]. One such example of this is the rose periwinkle from which drugs have increased the survival rate of childhood leukaemia from 10% to 90%. Peruvian Indians treated malaria with an extract from the bark of the *Cinchona* tree. Study of this extract led to discovery and use of quinine, the first effective treatment for malaria.

Biological diversity also provides economic benefits without being consumed i.e. *indirect economic value*. These benefits include, but are not limited to the following environmental processes and ecosystem services:

- Water resources protection

Buffering ecosystems against extremes of flood and drought, protection watersheds and maintaining water quality. Biological communities are an integral part in the protection of water resources. Natural vegetative cover in watersheds protects ecosystems from extreme events such as flood and drought, and regulates and stabilises water runoff thereby maintaining water cycles and water quality. Vegetation removal such as with deforestation leads to siltation of reservoirs, a reduction in water yield and quality and the deterioration of aquatic habitats. It has been estimated that both the capacities of Mona and Hermitage reservoirs have been reduced by 2.2% and 19% respectively^[6]. Wetlands and forests act as water purifying systems, while mangroves trap silt, reducing impacts on marine ecosystems.

^[1], R.B. Primack *Essentials of Conservation Biological Diversity*, p.22

^[2] http://www.cifor.cgiar.org/docs/_ref/publications/areports/english2003/fuelwood.htm

^[3] State of the Environment Report, 1997 – Natural Resources Conservation Authority

^[4] <http://www.fao.org/docrep/l2680e/l2680e06.htm>

^[5], R.B. Primack *Essentials of Conservation Biological Diversity*, p. 211

^[6] State of the Environment Report, 1997 – Natural Resources Conservation Authority



Plate 1 Natural vegetative cover, Blue Mountains

- Soil formation and protection

Biodiversity plays an important role in the formation of soil and the maintenance of soil structure and the retention of moisture and nutrient levels. Biological activity, from bacteria and algae to millipedes and worms, conditions soils, breaks down organic matter, and releases essential nutrients to plants. Clearing of vegetation, and thus biodiversity loss, has been a factor in the salinisation of soils, soil erosion and a decrease in soil productivity. By maintaining biodiversity, the productivity of the soil can be maintained, landslides and the degradation of aquatic environments can be prevented and coastlines and riverbanks can be protected.

- Pollution breakdown and absorption

Ecosystems and ecological processes play an important role in the breakdown and absorption of many pollutants created by humans and their activities. Some such pollutants are garbage, sewage and oil spills.

- Regulation of Climate

On the macro level, it has been suggested that undisturbed forests maintain the rainfall in their immediate environment by contributing to the hydrological cycle. On the micro level, vegetation may create the specific micro climates that some organisms require for their existence.

- Recreation and ecotourism

The natural environment is used for recreation through activities such as hiking, bird watching, nature walks and SCUBA diving (see Plate 2 and 3). Jamaica is the home of over 200 species of birds, with approximately 25 of these native to the island. Ecotourism, as an industry, is

growing rapidly in many developing countries, earning approximately \$12 billion per year worldwide. An ecotourist will visit a country to experience its biological diversity and to view particular flagship species^[1] thereby contributing to the economy of the country.

^[1] A species chosen to represent an environmental cause, such as an ecosystem in need of conservation. These species are chosen for their vulnerability, attractiveness or distinctiveness in order to best engender support and acknowledgement from the public at large. [http:// en.wikipedia.org/wiki/Flagship_species](http://en.wikipedia.org/wiki/Flagship_species)



Plate 2 SCUBA Dive, Negril



Plate 3 SCUBA Dive, Montego Bay

- Education and scientific value

The natural environment has been the basis for many books, television programmes and movies produced for entertainment and educational purposes, as well as in scientific ecological observations (see Plate 4). These activities have great nonconsumptive value but the true benefit is the enhancement of environmental awareness through education.

^[1] A species chosen to represent an environmental cause, such as an ecosystem in need of conservation. These species are chosen for their vulnerability, attractiveness or distinctiveness in order to best engender support and acknowledgement from the public at large. [http:// en.wikipedia.org/wiki/Flagship_species](http://en.wikipedia.org/wiki/Flagship_species)



Plate 4 D. Buddo showing school children the JA-CHM website

Indirect economic values are difficult to measure because we have never had to cost them. In 1997, it was estimated that these services would cost between \$16 trillion and \$54 trillion a year^[1] – greater than the global GNP.

There are strong ethical arguments for the preservation of biodiversity. These arguments can be readily accepted by the general public because of their foundations in the value systems of most religions, philosophies, and cultures. As such, they provide the rationale for protecting species of no obvious economic value. These are as follows:

- Each species has a right to exist
- All species are interdependent
- Humans must live within the same ecological limitations as other species do
- People must take responsibility for their actions
- People have a responsibility to future generations
- Resources should not be wasted
- A respect for human life and human diversity is compatible with a respect for biological diversity
- Nature has spiritual and aesthetic values that transcend economic value
- Biological diversity is needed to determine the origin of life.

This concept is best described by Aldo Leopold (1949), “A thing is right when it tends to preserve the integrity, stability and beauty of biotic community. It is wrong when it tends otherwise”.

Conclusion

Protecting biological diversity can be justified from an economical standpoint as well as from an ethical standpoint. Generally, decision-makers respond best to economic benefits derived from the use of natural environment. An important focus is that evidence has shown that the improvement in health services has been heavily dependent on the world’s rich biodiversity. Although this has economic benefit, there is greater value in human health. The challenge

therefore lies in the question – “how many valuable species will go extinct before they are discovered?”.

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^[1] <http://www.enviroliteracy.org/article.php/99.html>