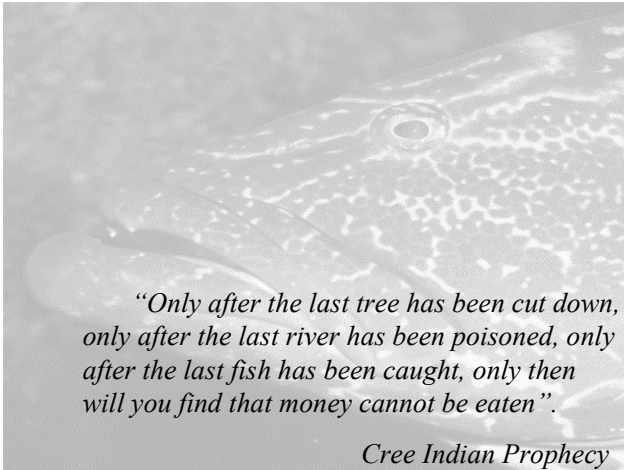


VALUES OF BIODIVERSITY



Economic Values

From the perspective of economic valuation there is an important distinction to be made between the value of biological resources and the diversity of those resources. For instance in the case of fisheries harvest, there may be no difference in the unit price of two species of fish. However, if one species is rare, and potentially useful for mariculture, or important ecologically or even aesthetically, the genetic value of that species may far outweigh its utility as a harvestable resource.

In Bermuda there has been virtually no research aimed at valuing biodiversity. However, it is clear that there is potentially great economic value to be realised through the use of our unique life forms. In addition to the financial benefit of such things as the successful extraction of pharmaceutically active compounds from marine organism, there is also remarkable intrinsic values of such endemic species

as the Cahow which could be marketed to promote tourism. Indeed given the fact that the Cahow was believed extinct for 300 years, and with 20% of all North Americans reportedly involved in bird watching, this one species alone might hold great value for ecotourism.

Non-economic Valuations of the Resources

Biological Services^{1, 2}

Nature provides many services that are essential to human life and, in many cases, are impossible to reproduce artificially. They occur as simple side effects or by-products of the normal activities of the organisms involved. There is absolutely no cost incurred by our use of these services; they are free and available to everyone. To illustrate this point, several of the more significant groups of organisms found in Bermuda and some of the services that they provide are described here.

Plants

Plants provide the most essential of services to all animal life, by using the energy of the sun to bind carbon dioxide with water to create carbohydrates and to liberate oxygen through the process of photosynthesis. In this way plants provide two essential resources for animal life, food and oxygen. Without this service virtually all animal life would

¹ Baskin, Y. 1997. *The Work of Nature: How the Diversity of Life Sustains Us*. Island Press, Washington D.C. 263 pp.

² Daily, G.C. (Ed.) 1997. *Nature's Services*. Island Press, Washington D.C. 392 pp.

cease (the only likely exceptions are the deep-ocean thermal vent communities). Plants also bind air and water-borne pollutants and affect the atmosphere, as they directly and indirectly alter the concentrations of some greenhouse gases (carbon dioxide, methane, nitrous oxide), which have been shown to cause climate change.

Plants provide humus to build, aerate and bind soil to increase production and reduce erosion and nutrient run-off. Trees create windbreaks, protecting animals and more delicate plants from severe storms. Plants create structure, providing homes of different sizes for a host of animals. Whole forests are needed for large animals whilst individual trees serve as habitats for smaller creatures. Plants influence the exchange of heat and moisture between the earth's surface and the atmosphere thereby affecting global climate or on a local scale, providing shade – an essential service for many creatures including humans, in the heat of summer!

Mangroves

At the junction between land and sea, mangroves and mangrove swamps provide some specific and critically important plant services. They absorb nutrients and trap sediments from land run-off thereby protecting adjacent seagrass and coral reef communities. Mangrove forests stabilise shorelines protecting them against severe storm damage, and creating complex 3-dimensional habitats that provide shelter to nurture aquatic organisms. The leaf litter of mangroves supports a complex web of life that is critical to a host of marine and terrestrial

organisms. Indeed the juveniles of many commercially important marine fish and crustaceans depend upon the food and shelter provided by coastal mangroves. In Bermuda, with the incredible monetary value placed on coastal property, mangroves are under threat of clearing to make way for marine access. Unfortunately, there is limited understanding of the unique biological value of Bermuda's remaining mangrove stands.

Decomposers and Soil

Soil biology is a vast and growing mystery. There is a huge diversity of microbes living in the soil, providing services that we know nothing about. Their work has been summarised as “the basis of planetary metabolism...the soil micro-organisms that turn back into nutrient flows everything that falls on or grows within the ground”³. Unfortunately we rarely treat soil as a thriving and critical ecosystem but rather view the soil as simply a growth medium containing the nutrients needed for plant growth. This ignorance leads to harmful practices, with excessive pesticides, herbicides and fertilisers used with little regard for the profound and long-lasting effect such activities can have on the health of the soil community. Indeed, anecdotal reports indicate that one established farmer actually uses diesel oil as a herbicide when growing carrots.

Insects

³ Hawkin, P., A. Lovins, L.H. Lovins. 1999. *Natural Capitalism*. Little Brown & Co., Boston. 396 pp.

Insects provide a host of important ecological services from pollination of both cultivated food crops and wild plants (bees, flies, butterflies, and moths) to degrading dead animals (flies), controlling agricultural pests (mites and ladybugs) and providing high quality Bermuda honey (bees, of course). Despite the obvious value of these services to humans, insects have received a bad reputation. Popular opinion holds an abiotic environment as the ultimate in good housekeeping and, in this regard, insects in a house represent failure. Commonly Bermudian housekeepers use excessive quantities of pesticides killing both the beneficial and “harmful” insects and disrupting the natural controls that formerly existed.



Plate 24. Ladybug, a natural pest control. (Photo courtesy of R. Ground).

Corals

Viewed in light of the extremely low nutrient environment in which they thrive, coral reef systems are amazingly productive. Capturing planktonic organisms from the water column, the coral colony efficiently recycles the nutritive value of its prey

with the help of symbiotic algae living within its tissues. Laying down a calcium skeleton, the corals build a living barrier to waves and create numerous crevices that form habitats of various sizes for a great variety of fish and marine invertebrates. With the coral colonies as the basic building block, a complex community of highly specialised creatures live together forming an extremely efficient team for recycling the scarce nutrients that occur over the reef. This vibrant community has great aesthetic and intrinsic value and produces food while protecting the land from erosion. Bermuda’s reefs are a recognised treasure that is, to date, in remarkably good health.

Aesthetic Qualities

Bermuda is beautiful. It is largely the multicoloured landscape of trees and flowers, the vast deep blue ocean, pink beaches, and vibrant coral reefs that, along with a benign climate, form the compelling draw that encourages tourists to visit Bermuda. Whilst lying on a beach in the shade of a swaying palm tree the visitor generally fails to realise that the warm sand is formed of the skeletons of numerous minute marine organisms whilst the beautiful coconut palm didn’t even originate in the Atlantic. The sounds of nature are also of great intrinsic value. The songs of birds, crickets, bees, and whistling frogs form a fantastic backdrop for the soothing sound of breezes in the trees. Biological resources both local and introduced are critical to the aesthetic charm of Bermuda and, to a great degree, it is that charm that created and sustains the Island’s remarkable quality of life.

An increasingly popular local recreational activity, is birdwatching, for example. Although Bermuda has only 20 resident bird species, over 350 migrant species have been recorded on the Island. Beginning in late August the fall migrants arrive, while late February brings the arrival of the spring migrants⁴. An increasingly popular event is the Bermuda Audubon Society annual Christmas Bird Count.



Plate 25. Whistling Frog. (Photo courtesy of R. Ground).

Although Bermuda's aesthetic qualities are critical to our economy, the nature that surrounds us is also essential for maintaining our physical and mental health, and spiritual regeneration. In fact, clinical studies have demonstrated that people surrounded by nature exhibit lower levels of stress, less violence, and heal faster from illness. Nature is also a great motivator for physical exercise and has for generations inspired our creativity through art, literature, music, and cuisine. To a very large degree the quality of our lives is so deeply entwined with biodiversity that most of us never notice. Humans

are a product of nature and, although we have the capacity to alter our surroundings, we remain dependent upon nature to sustain us. Nature has intrinsic importance, that is, an importance in and of itself, and we have a custodial responsibility to conserve it.

Scientific Value

Bermuda is one of the best-studied islands in the world. Since the shipwreck of the *Sea Venture* in 1609, people have been documenting the Island's natural history. In 1903 the Bermuda Aquarium Museum and Zoo (BAMZ) and the Bermuda Biological Station for Research Inc. (BBSR) were founded to provide accommodation, laboratory space, boats and logistic support for scientists, as well as to exhibit the Islands' marine life. Their establishment dramatically promoted the conduct of science in Bermuda, which was readily recognised to be an outstanding site from which to stage deep ocean research. Largely because of BBSR, Bermuda's marine environment has been the primary focus of study, with far less emphasis placed on terrestrial research. However, several local institutions now support marine and/or terrestrial research conducted by local and visiting scientists.

⁴ Dobson, A. 1997. Birdwatching in Bermuda. Bermuda Zoological Society, Project Nature Ecofile. 9 pp.

Throughout Bermuda's history, the Island's natural resources have been utilised and valued by locals. From the beginning, with the shipwreck of the *Sea Venture*, fish, birds, sea turtles, palmetto and cedar berries have been valued as sources of food. Many familiar plants in our landscape were once recognised for their medicinal value and were used against everything from coughs and colds (Calamint) to kidney ailments (Cape Weed)⁵. Plants also served more functional uses; the Century Plant was cut in half and used as a scrubbing brush that self-lathered, and the branches of the Allspice were tied together to make fish pots. The Bermuda Cedar has long been used in all facets of Bermudian life, including ship and house building, and in the making of furniture and souvenirs. It was recognised as a symbol of life and often planted by the bride after a wedding. Another important endemic, the Bermuda Palmetto, was used to thatch roofs, whilst the leaves were made into ladies hats and fans, and the heart of the palm was eaten.

Although the flora and fauna of Bermuda had important uses in the past, most are no longer employed today and, in many cases, their utility has been forgotten. Virtually all of the commodities traded in Bermuda are produced overseas and few Bermudians work in businesses that are directly related to the Island's biological resources. Even fishing and farming are in decline and our historically strong cultural ties to natural products are being progressively weakened with urbanisation.

⁵ Waterston, J.M. 1939. Bermuda herbs and their uses. Monthly Bulletin Department of Agriculture and Fisheries. 18 (6), 42-45.

Although the demand and appreciation for cedar products remains strong, the supply is extremely limited.

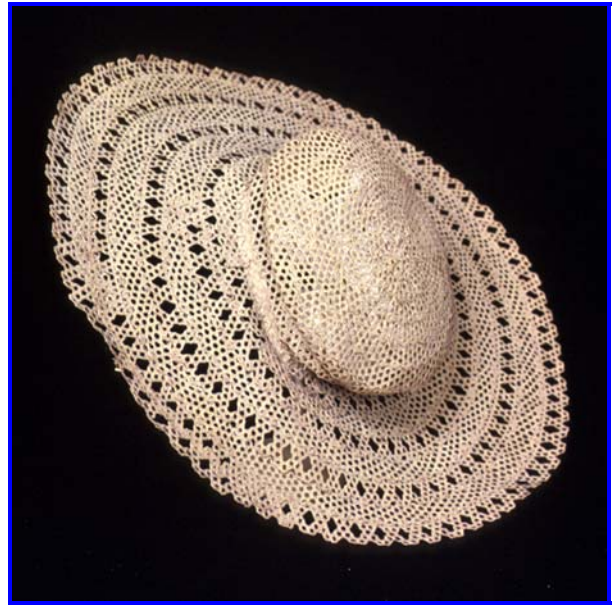


Plate 26. A Bermuda Palmetto leaf hat (Photo from BAMZ slide collection).

Our dependence upon biodiversity and biological resources for our long-term well-being is not yet fully appreciated in decision-making. Biodiversity conservation is still largely viewed as a cost to society rather than as an investment. There is a need to develop appropriate methods to evaluate the benefits of biodiversity and effect their incorporation into the Island's accounting system.

Some form of biodiversity is used by everyone everyday. Food, whether plant or animal, paper, medicines, pharmaceuticals, perfume, gum, plastic, oils, dyes, and detergents can all be derived from living organisms.