Short Communication

Some thoughts on Biodiversity and Sustainability

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Received: 01 July 2021; **Accepted:** 12 July 2021; **Published:** 22 July 2021

Citation: Graeme P Berlyn. Some thoughts on Biodiversity and Sustainability. Journal of Environmental Science and Public Health 5 (2021): 371-373.

1. Introduction

Life began on this planet some four billion years ago. Since that time the planet has experienced many changes in climate and biodiversity. In the view of Vladimir Vernadsky [1] we live in a thin film of biologically processed matter on the surface of the planet. At the present time our planet is changing more rapidly than in any of the previous cycles and this rapidity is primarily due to human activities. Of course in the past there have been many extreme events like meteorite impacts, but in general the natural changes are slow. With the beginning of agriculture after the last ice age the pace of change accelerated. Although organisms have come and gone in the history of our planet our biodiversity is now under a threat of decline that is unprecedented.

2. Explanation

According to J.B.S Haldane [2] chemical diversity preceded biological diversity in the warmer waters of the planet whose composition he likened to “hot dilute soup”. Charles Darwin [3] postulated that all the organisms that have ever lived on this earth are descended from a single life form. As life systems evolved they eventually reached the status of the last universal common ancestor (“Luca”). As Darwin said, “there is a grandeur in this view of life”. For one thing it means we are all related. As the ultimate time binder sensu Alfred Korzybski [4] our capacity to alter habitats (roads, houses, factories, forest removal, agriculture clearings, etc) it now falls upon humans to protect the remaining biodiversity of life on earth as far as possible. The Biden administration has a target of preserving 30 % of our land area. Whether this goal is achievable remains to be seen. But ecosystems are dynamic and exchange energy, matter, and organisms with the environment. As Heraclitus, the ancient Greek philosopher noted, “no man ever steps in the same river twice because the river is not the same and the man is not the same" [5]. Every thing flows.

Thus, there is a conflict between protection, conservation, preservation, and sustainability. In practice preservation management often opts for a few charismatic species over other less favored communities. Whole lakes have been poisoned with rotenone in order to restock with favored species like certain trout. There is no doubt that hard choices will have to be made about what to preserve.

From an energetics point of view life is characterized by the following six requirements:

I. Free Energy Source- The Sun, negentropy (sensu Schrodinger).

II. Cellular Structure- The basic unit of life, a manifestation of chemical bond energy

III. Growth and Metabolism- the systematic transfer, transformation, and utilization of energy

IV. Reproduction

V. Response to environment

VI. Death = recycling as the flow of energy through the biosphere required for sustainability of life. Everything flows sensu Korzybski [1].

Organisms come in a variety of shapes and sizes that comprises the diversity of life. For most organisms there is an optimal size for them to function in their range of habitats. However, the habitat may change due to environmental changes large and small. Organisms may adapt to these changes because of a variety of mechanisms such as natural selection, hybridization, mutation, epigenetics, and random genetic drift. Changes in an organism's size, shape and physiology can affect the ecosystems they inhabit in many ways including survival of themselves and the other organisms in the community. Organisms can communicate in various ways and even cooperate as keystone species in various communities. Nitrogen fixation and mycorrhizae are also examples of cooperation in plants.

The development and diversification of leaves, although often over looked, was a big factor in the amplification of life on the terrestrial biosphere. Leaves enabled plants to increase photosynthesis and store vast amounts of structural and non-structural carbohydrates. This increase in carbohydrates allowed the herbivores and the carnivores that preyed on the herbivores to "live long and prosper". Gradually the complex webs of life that we know today emerged. As organisms get larger or smaller because of habitat changes and natural selection their organs may increase or decrease disproportionally if the organ growth rate is larger or smaller than the growth rate of the whole body. This change in relative growth can happen in both phylogeny (allomorphosis) or ontogeny (heterauxesis) sensu Julian Huxley in *Evolution*: *The Modern Synthesis* [6].

Many organisms do increase in size over evolutionary time. Cope's Rule is that in the phyletic line organisms increase in size until they become extinct. There are many examples of this rule, but there are also limits to size. Large size has many advantages in defense, competition for food and mates, survival under low temperature stress due to the decrease in area to volume in colder climates, etc. J.B.S Haldane [2] noted that a small animal may function efficiently with an uncoiled intestine and it suffices. However, if the animal increases in size the intestine must become coiled in order to absorb the additional food required by the larger size.

The environment can also cause reduction in size. The red deer of Scotland (*Cervus elaphus scoticus*) seldom exceeds 125 kg with antlers of 12 points. There are cave sketches in Scotland that depict a much larger animal and these were thought to be a separate species. However, when the Scottish red deer was introduced in New Zealand the "extinct species" reappeared. In New Zealand the red deer can attain 250 kg with antlers of 25 points. Adaptation can proceed in various ways. Redwoods grow fast, tall, and live long while bristlecone pines grow slow, short, but also live long. There is obviously a genetic component as well as an environmental component to variation in size and longevity. Habitat diversity promotes biological diversity.

3. Conclusion

The diversity of life is our heritage and it enriches our lives and the livability of our planet. It is our history and we need to maintain as much as we can of this marvelous beauty of life for ourselves and the generations to come. How to achieve this goal is our problem. Each case may require a different solution and management dilemmas may not be resolved in a way that satisfies all the stakeholders involved. The answer to the old question is from the sun we come and with the environment we go.

Acknowledgements

The author would like to thank Professor Emeritus Chadwick D. Oliver for his comments.

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