Historical Perspectives of Environmental Science

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**Historical Ecology**

Historical ecology encompasses all of the data, techniques, and perspectives from paleoecology; land-use history from archival and documentary research; and long-term ecological research and monitoring extended over decades. Multiple, comparative histories from many locations can help evaluate both cultural and natural causes of variability and characterize the overall dynamic properties of ecosystems (Swetnam et al. 1999).

Ecology is the study of earth's living systems and how they interact. It is not environmentalism, a social and political movement. Ecology is one of the most complex sciences and is very new. As such we are only at the beginning of our understanding of how environmental systems react and how a change in one element might affect a whole system or one organisms in that system.

**1941** - **Aldo Leopold** - Took a scientific approach looking at data related to the health of the environment and the organisms in that environment.

**1700's** -  **Antoine Lavoisier**was a chemist who discovered and named oxygen in 1778 and carbon in 1783.  He also identified these elements as necessary for life. He was the first to identify that oxygen was indeed a reactant in combustion reactions. This notion was again contradictory to the prevailing theory of the time, “phlogiston theory”.        The phlogiston theory is an archaic scientific theory that a mysterious "fire-like element",  called phlogiston, was released from substances during combustion.

​**1852** - **Robert  Angus Smith**(called the “father of acid rain” ) was a chemist who linked acid rain to the pollution that arose from the industrial revolution. Smith was active during the middle of the nineteenth century, when the consequences of the Industrial Revolution and urbanization on public health and the environment was just beginning to be understood. He made the link between the low pH (acidity) of rain water here and sulphates derived from the combustion of coal.  The acid rain of the time caused erosion of buildings made of stone, bricks and mortar, and damage to agriculture.

**1869** - **Ernst Haeckel** was a German biologist, naturalist, philosopher, physician, professor, and artist who discovered, cataloged and classified literally thousands of new species in his lifetime. In 1869 Ernst Haeckel coined the term ecology. He created the phylogenic or genealogical tree that postulated heritage of genetic traits back to a common ancestor for species sharing similar phenotypes. He coined many terms in biology, including anthropogeny, ecology, phylum, phylogeny, stem cells, and Protista.
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**1875** - **Eduard Seuss** defines the biosphere and plate tectonic theory. Eduard Suess was the first to suggest the idea of a supercontinent that had since separated due to continental drift. This theory followed his discovery that some species were found on separate continents. This gave explanation for the discovery of on his work studying fossils in the Alps and his knowledge of the fossils of Glossopteris ferns that were found on several different continents. There is even a crater on the moon and one on mars that are named after him.
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**1877** -  **Albert Bernhard** defines symbiosis (translated as "living together" from the Greek words for "living" and "together".  He used the word "symbiosis" to describe inter-species interactions that are  closely tied to one another and are persistence over time.

.       **Example 1) Clownfish and Sea Anemones**
                                - In a symbiotic mutualistic relationship, between the clownfish and the sea anemone, the clownfish feeds on small invertebrates  that are dangerous to the sea anemone, and the sea anemone feasts on the yummy fecal matter of the clownfish! The clownfish enjoy the protection gained by using the sea anemone's stinging cells as a shield against predators. The clownfish are immune to the stinging cells of the sea anemone. The clownfish even ward off butterfly fish (that would potentially eat the sea anemone)by emitting a high-pitch sound that the butterfly fish avoid.

       **Example 2) Lichen**
                                  -  A lichen is an organism that is a composite of algae growing on filaments of fungus. Lichen has properties that are distinct from the properties of the algae or fungus growing alone. Lichen is formed from a mutualistic symbiosis between the fungus and algae. The fungus eat the photosynthesizing algae, and the algae benefit from the fungus's ability to provide nutrients and moisture for the algae.
​        The definition of symbiosis has evolved to apply to commensalistic and parasitic relationships between different species in addition to mutualistic behavior.
​        Symbiosis, in modern science, is defined as a close, persistent relationship between species that may come in three different forms (mutualism, commensalism and parasitism. In mutualism, the relationship between the different species is beneficial to both species. Examples of this type of interaction was mentioned previously. Commensalism is a symbiotic relationship between different species that benefits only one of the species, but does not help or harm the other species involved in the interaction. An example of a commensalistic relationship between species is the interaction between cattle and the cattle egret. When cattle go about their day foraging on food, insects hidden beneath the soil come to the soil's surface, The cattle egret then eats the insects that have been revealed. in this way, the cattle egret benefits by being provided with a valuable food resource, and the cattle are not helped or harmed in any way. They have a one-sided relationship. In other examples of commensalistic relationships, we see the benefit to one of the species being protection or transportation.  In a symbiotic parasitic interaction, one species benefits while the other is harmed. For example, tapeworms will attach themselves to the intestines of a host organism. The tapeworms feed off the partially digested food traveling through the intestines of its host. This interaction deprives the host of valuable nutrients and results in malnutrition or death.
​     All three forms of symbiosis can exist either as an endosymbiosis in which one species lives inside another species or an  ectosymbiosis in which one species lives outside the other species. Symbiotic relation ships can be either obligatory or facultative. In an **obligate** symbiotic relationship the organisms depend on each other for their survival, whereas in a facultative symbiotic relationship the species could survive separately.

**1859**  - **Charles Darwin**​created the theory of natural selection after observing many species that displayed specializations suited to their environments that gave them enhanced abilities to survive and thrive in that environment.  Many of his observation were written in his book, "The Origin of the Species".

​**1890** - **Edward Bagnali Poulton** was an English zoologist that took a special interest in camouflage and write the book, "The Colours of Animals".

**1900** - **Henry Chandler Cowles** ​formulated the idea of **ecological succession** after observing that beach grasses grown in a dune ecosystem assisted the growth of subsequent cottonwood trees, which in turn assisted the future growth of pine trees. . The beach grasses grow near the water front in a dune ecosystem. This growth helped to stabilize the soil enabling the growth of cottonwood trees. The cottonwood trees in turn enrich the soil allowing for the growth of future pine trees. Plant succession described the naturally-occurring phenomenon of one plant species within an ecosystem creating optimal conditions for subsequent plant life of another species to flourish in its place after it is gone.

**1915** **Ecological Society of America** ​was founded on December 28, 1915.

**1927** **Charles Elton** described and characterized **​**​the processes energy transfer from species to species within an ecosystem as the "food chain" or in more complex examples, the "food web".

**1933**  - **Aldo Leopold** writes Game Management, beginning the discipline of wildlife management.

**1935 -**  **The Dust Bowl crisis** raised ecological awareness after unregulated farming through the west left severe drought and barren land as a result. Ecology was used to define practical land usage practices that would help to prevent repeats of the crisis in future generations.

**1935 -**  **Arthur Tinsley** defines the ecosystem as both living and non-living components of a geographical area that are interconnected either directly or indirectly.
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**1951 -**  **Nature Conservancy is founded.**

**1953 -**  **Eugene Odum** wrote the first ecology textbook. Ecology begins to be taught as a discipline.

**1978** - **Conservation Biology** established as a discipline focusing on environmental management

**1980 -**  A hole in the ozone layer over Antarctica was discovered by scientists in 980.  On the other hand, new sewage treatment technology and the use of catalytic converters in automobiles resulted in a reduction of water and air pollution, respectively.

**TODAY** - While all of the eco-friendly modern advances are too numerous to list here, here is a list of just a few advances that modern science and technology, along with political legislation and social activism, have made possible.  New desalination plants are working in developing countries to provide clean water to populations that have suffered from a long-standing water shortage. The U.S. government approved a plan to release genetically-modifies mosquitos that exist in areas prone to certain illnesses and diseases, such as the Zika virus. The result of the genetic mutation is to reduce the fertility in the mosquito population to decrease the spread of the disease by them. Cleaner emissions, recycled products, electric and hybrid cars, and biodiesel fuels, are helping to change the pollution that has plagued our planet.

   These advances give the current and future generations hope that we can use our intelligence and our diligence to work together collectively for the common goal of health for our world, and, in turn, its inhabitants.