TROPICAL BIOLOGY AND NATURAL RESOURCES: HISTORICAL PATHWAYS AND PERSPECTIVES

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Summary

Since the first explorers arrived in the tropical lands, the general aspects of nature, its natural resources, medicines and the culture of native populations called attention initially of European countries and, with the passage of time, of all the world. The richness and diversity of unknown forms of life fascinated the European naturalists that produced though time lot of documents, drawings and collections about tropical nature that, in some cases, remains conserved in great museums, universities and botanical gardens. Here, we present a brief description of this history, a description of the initial and main papers, the foundations of Tropical Biology and its settlement as a science in the modern world. The importance of colonial governs, priests and explorers in the 16th and 17th centuries; the great collections of animals and plants, followed by the initial texts in tropical biology, botany and ecology during the 18th and 19th centuries produced by the firsts real naturalists to set feet on tropical lands will be discussed. Additionally we will present the new insights in Tropical Biology, and discuss the importance of appearance of scientific organizations dedicated to the study of tropical biomes and their efforts to answer questions like: How to explain the extraordinary biological diversity of tropical regions? How many species really are there in the tropics? How to understand the origin and maintenance of tropical diversity? How to increase life quality, production and economy of people in tropical countries and at the same time to maintain preserved the tropical ecosystems? This chapter will take the reader from an

understanding of the importance of Tropical Biology today to the preservation of viable natural communities conserved, while introducing the Tropical Biology Theme in the Encyclopedia of Life Systems Support (EOLSS).

1. Introduction

"*I think that by crossing the equinoctial line to reach it, there is the earthly paradise*"
Christopher Columbus

The Italian explorer, Christopher Columbus, was one of the first men to describe the tropics. On a third expedition crossing the Atlantic Ocean (May 30, 1498-October 1500), Columbus sailed farther south, to Trinidad and Venezuela. Columbus was the first European since the Viking Leif Ericsson (sometime during 980-1020) to set feet on the mainland of America. Since Columbus arrived at the "earthly paradise", humankind has been overwhelmed by the extreme richness of beauty and natural resources of tropics (Figure 1). However, after five hundred years of inconsequent exploration by the colonial governs, wars and social conflicts, bad use of soil, predominant poverty and low education of major part of people living in the tropics, nowadays we have these "paradises" in a severe endangered situation. As in regions of the New as in that of the Old World, the tropics need all of our attention as it has been shown through the last two centuries by the tropical biologists.

Figure 1a. The Atlantic Coast of Southeastern Brazil, in a view very similar to that observed by the first explorers. (Photo by Kleber Del-Claro).

Perhaps it is easier to define tropical biologists than to define tropical biology and its

importance. In this sense, tropical biology is what scientists, mainly biologists, decided to study in the tropics: water, soil, microorganisms, fungus, plants, worms, arthropods, reptiles, birds, mammals, species' interactions, ecology of populations, communities and/or ecosystems. Tropical biology is about the nature, its physical and biological aspects, of the tropical regions. It includes the historical pathways that enable us to understand the evolutionary and ecological processes that generate the rich diversity of life in the tropics. This knowledge is absolutely necessary, to conserve viable natural communities and, consequently, the life on Earth.

Figure1b. Inside the Tropical Forest: The interior of a preserved forest in the Atlantic Coast of Brazil. (Photo by Kleber Del-Claro).

2. The Foundations of Tropical Biology

Explorers with a soul full of curiosity, open eyes and mind, having inside their crew missionaries, collectors, cartographers, chroniclers and painters can be regarded as the pioneering tropical biologists. These people had, as main duties in the tropics of New and Old Worlds, to document and to report to the colonial governs about the biological riches of the new lands. Hundreds of documents were produced in the first century of colonization, in great part letters and reports, some of them illustrated with drawings. Unfortunately for the biological sciences, the major number of these documents presented superficial description of plants, animals and biomes, concentrating details on the indigenous people and natural resources, mainly wood, food and minerals that could be obtained by direct extractive action. Perhaps, the poverty of documental information of this period, compared with the following centuries, has been a result of the enormous difficulties that Europeans had to settle themselves in the new lands, mainly in tropical Americas. However, there are some documents of this period that are precious in terms of natural history details, some of them are most known than others. A good example is the "*Sumario de la natural história de las Indias*" written in 1526 by Gonzalo

Fernández de Oviedo y Valdés who spent 34 years in the New World serving King Ferdinand of Spain. This report presents the first elaborate description, with examples and specific details of fauna and flora of Spanish America, mainly of Mexico region. Other famous documents were small reports and letters of several Jesuit priests and chroniclers who stayed for five or more years in different parts of the coast of Africa, South Asia, Caribbean Isles, Central and South America. Together, these fragments of history can provide us the first impressions about the tropical world. Nevertheless, the letter of Pero Vaz de Caminha written in 1507 to the King of Portugal, is possibly the first document describing the exuberance of the Brazilian tropical forest, detailing animals and plants, the soil quality, and also the aspect of the indigenous people of the tropics in South America. Despite some romantic accent, common in official documents of the early times of the colonial period, Caminha did a very good description of Atlantic forest. In some aspects this letter could be regarded as one of the first documents testifying plant-animal relationships in the tropical rain forest.

By the end of the 15th century, a very interesting literary work called attention of West Europe; it was the book "*Historia natural y moral de las Indias*" published in 1590 by José de Acosta. Like other Jesuit priests, Acosta was sent to Spanish Americas to catechesize and to spread the fundamental principles of Christian faith, in his case in Peru where he could observe and do annotations during years on aspects of the culture and life of the indigenous people. He included in his annotations data about typical diseases and some natural medicines, aspects of tropical animals and plants used as food or to obtain specific products, and also about general characteristics of the natural environments that he visited. Again in Europe his book had a phenomenal success, because common people and the nobles alike were interested to know a bit about the new continent and new opportunities. Thus, details of the medical flora, diseases, description of adventures and the native life of the New World received great attention. Other documents followed in the steps of Acosta, describing other parts of the tropical world to Europeans, in way similar to our novelists nowadays.

In the seventeenth century political and economical contests between colonial empires produced some good natural narratives, and novelties in documentations; this occurred mainly because in some parts the contests brought to the tropics members of the dominant elite. As an example, the Dutch prince Joan Mauritz von Nassau-Siesgen was sent to Brazil by the Dutch East India Company and begun a contest against Portugal by the northeast part of Brazil and other colonies in the west coast of Africa. Nassau settled in Recife for almost six years (1638-1644) and with fellow European naturalists collected many botanical and zoological treasures, surpassing anything done early in the Americas. In the following years, these collections were studied by Georg Marcgrave and Willem Piso, probably the first well prepared European scientists that studied the flora and fauna of Brazil. Their indirect observations, transformed into papers and reports represent one of the earliest real looks of scientists at the tropical life.

Similar to what occurred in Americas, the expansion of the British East India Company in South Asia also produced an enormous amount of specimen collections, stories and surveys of the tropical Asia. The ornithologist Francis Willughby published in 1628 a first compendious bird book, written in English, presenting the life of birds and other animals mainly in Tropical India. Another work that received attention in this century

was that produced in 1678 by the famous botanist John Ray. He compiled a book describing the new species of unknown parts of the world, in the major part and obviously, tropical areas. These first naturalists had enormous importance registering the initial impressions of tropical life. They created the basic conditions, experienced the initial difficulties and showed to the colonial governs the enormous importance of a well done naturalist work in the new tropical lands of New and Old Worlds. However, the literature produced in the seventeenth century related to tropical biology was very small and superficial when compared with the development of tropical biology in the following centuries. It is not a demerit of the studies of the first two centuries of colonial period, but a simple result of great advances in the manner of thinking, new devices and political changes that surged after 1700.

2.1. Linnaeus, Humboldt and the Illuminists

After more than three hundred years of European colonization in the tropics of New and Old Worlds, the commerce between the colonies and Europe increased immensely, followed by the number of regular trips and the establishment of new cities. The colonies were now vital to Europe as font of food, minerals and wood. The colonial needs exerted an enormous pressure on native communities; civilizations were dominated and destroyed in proportion to colonizers who went to the interior of countries searching for more and new natural resources. Thus , more and more naturalists and adventurers visited regularly the tropics. On the other hand, the advances of Illuminism, or the Enlightenment, during the eighteenth century brought profound political, economical and cultural changes in the human way of life, mainly in Europe and North America. The naturalists and first biologists found in the age of "reason" an open door needed to advance in all fields of science. In the mid-eighteenth century Carl von Linnaeus created a new system of species identification and classification bringing certain stability and a general pattern in the study of natural sciences. Indeed, it created a new horizon of research and development to the biological sciences, the classification system called "Linnean nomenclature". As relevant examples we may mention the advances in tropical biology due to Linnaeus and illuminist influences; we have to comment and to single out the works of Mutis, Banks and Solander.

The Spaniard José Celestino Mutis traveled to Colombia in 1760, followed by a pupil of Linnaeus, Pehr Löfling. Mutis, influenced by the ideas of Linneaus, that were transmitted to him by Löfling before his premature death, performed successful botanical expedition that resulted in eighteen volumes, the "*Mutis Flora*", reviewed in 1988. What is significant in the Mutis' work, is that it was not only just a simpler description of new botanical material, but it also included aspects of the new Linnean classification, full data on localization and geography of plants occurrence. Due to this detailed and more organized scientific way to work on natural collections, we have nowadays conditions to study and understand the original tropical flora present in the early times of colonization in South America, specially in the Amazonian vegetation. Rumors are that over a hundred boxes of botanical material, more than 6,500 drawings of plants, and four thousand pages of Mutis' manuscripts, still reside in the Spanish national archives, in very good condition, waiting for proper attention.

The Linnaeus' influence spread quickly also to the Asia and Oceania mainly when in 1768, Captain James Cook navigated to Tahiti having on board two naturalists, Joseph Banks and Douglas Solander, the latter a student of Linnaeus. This two enthusiastic tropical-adventurer-scientists, helped to produce enormous improvements in the natural sciences when they returned to Europe after their long trips. For example, Banks helped to found the famous Royal Botanical Garden at Kew, England. Kew is until now a reference place where one can find one of world's most important and representative collections of tropical plants. Solander and others, as Alexander von Humboldt, created in 1788 the "African Association", an entity used to promote exploration and provide funds to a future series of British expeditions mainly to Africa, Americas and Oceania. After numerous unsuccessful attempts to visit the tropics by himself, Alexander von Humboldt (1769-1859) joined to the amateur botanist Aimé Goujaud Bonpland. Together they finally convinced the Spanish ministers to support and carry out a new scientific expedition to Spanish America (1799-1804). These two young explorers traveled ten thousand kilometers of unknown areas of the tropical world on foot and by canoe, collecting around twelve thousand plant specimens. With their well documented tropical collection, these young men doubled the number of plant species known in the Western Hemisphere. Their "*Voyage aux Régions équinoxiales*" consumed almost all of Humboldt's fortune, and this masterpiece was translated to English between 1814 and 1829, in five volumes under the title of "*Personal Narrative of Travels to the Equinoctial Regions of the New Continent during the years of 1799-1804*". "Humboldt's narratives" was for more than a century a reference book and an example to other adventurer-scientists, that followed Humboldt's steps, producing similar literature. In another book, "*Essai sur la geographie des plants*" (Humboldt, 1805), he firmly established plant geography as a scientific discipline. Humboldt has probably exerted more influence than any other tropical naturalist in the scientists of his time. In this team of new explorer-naturalists from the early nineteenth century, strongly influenced by Humboldt books, we can include among others, the eminent Karl von Martius, Charles Robert Darwin and Alfred Russel Wallace. This new generation of explorers was also known as "Victorian Naturalists".

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Biographical Sketch

Kleber Del-Claro is a biologist with doctorate in Ecology by State University of Campinas (Unicamp) in Brazil. Since 1992 is a teacher at Federal University of Uberlândia (UFU), where between 2003 and 2007 was the coordinator of the graduate program in Ecology. Kleber is the coordinator of the international cooperation agreement between UFU and the University of Missouri, St. Louis (UMSL), USA. He is a researcher from the Brazilian Council of Research, Science and Technology (CNPq) since 1996. At UFU and other Brazilian universities he was instructor of several master and doctoral thesis in ecology and animal behavior developed in the tropics. His scientific history, books and publications are available in: www.leci.ib.ufu.br. In 2005 he was the president of the "Frontiers in Tropical Biology and Conservation" meeting, settled in Brazil (Uberlândia), the annual meeting of Association for Tropical Biology and Conservation (ATBC) and supported by the Brazilian Society of Ethology (SBEt, now President for the second time).