

Ethnobiology and Biodiversity Conservation

Ulysses Paulino Albuquerque and Daniel Carvalho Pires de Sousa

Abstract To talk about biodiversity conservation today means relating biological aspects to inseparable social and cultural aspects. Ethnobiology stands out in this field of study because it offers a perspective on the relationships between people and the environments in which they live. Many ethnobiological works help understand how human populations survive, manage, and exploit the resources of an area. These works may be useful in planning conservation policies and management strategies for natural resources.

Conserving biodiversity necessarily involves, in addition to the usual biological aspects, important and inseparable social and cultural aspects. Certainly, local knowledge systems provide strong elements for the conservation of natural resources, as these systems are developed from the interrelation between nature and culture. Therefore, efforts to understand how different human groups exploit, handle, and perceive the environment in which they live are critical to understand how these cultures can be sustained over different generations (see Pardo-de-Santayana and Marcia 2015). Thus, there is a great interest from the scientific community to understand how the practices of local communities can assist in public health policies and biodiversity conservation (King and Furgal 2014). Ethnobiology has emerged as the science that seeks to understand the importance of local knowledge to overcome various social challenges, among them the conservation of biodiversity (Vandebroek et al. 2011; Silvano et al. 2007).

Data from ethnobiological research can be used in planning decisions, which could (and should) include local communities as an interested party, as they can actively participate in various initiatives for the conservation of their own environment, maintaining, for example, plants and animals that are important to them (Aymoz et al. 2013).

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U.P. Albuquerque (✉) • D.C.P. de Sousa
Laboratory of Applied and Theoretical Ethnobiology (LEA), Department of Biology,
Federal Rural University of Pernambuco, Av. Dom Manoel de Medeiros, s/n, Dois Irmãos,
Recife 52171-900, Pernambuco, Brazil
e-mail: upa677@hotmail.com; danielcarvalho099@gmail.com

In addition to seeking to include the will of people in policy development for the conservation of their areas, ethnobiology also identifies cultural traits that indirectly converge to the maintenance of biodiversity. Conservation principles can be found, for example, in myths and food taboos¹ (Chernella 1987), thus rationalizing the use of natural resources. Some people declare that natural resources will be exhausted if not used properly. Quiroz and van Andel (2015), in a study involving two African communities, found that endangered plants present in the official IUCN list were protected by supporters and religious leaders. They were likewise perceived by the population as scarce, therefore demonstrating the existence of a strong relationship between taboos associated with restrictions on the use of these species and the intention to preserve them.

Knowledge of biological cycles allows many cultures to exploit resources according to the capacity of nature by observing the behaviors and habits of each animal or plant species. It is possible to mention, as an example, a case study in northern Brazil with fishermen regarding the eating habits of fish in the Rio Negro (Amazonas) (Silvano et al. 2007). The study found that fishermen knew how to differentiate various ecological patterns of aquatic habitats, some known by scientists, by applying this knowledge in their practices so as not to degrade or overexploit the environment. Another example is from the Tukano Indians of northern Brazil, studied by Chernella (1987) and also mentioned by Primack (1993), who have a diet based on roots and fish that involves strict observation of the life cycles of the fish in that environment.

The techniques and management practices used by some local populations may be ecologically sustainable while respecting the complexities and sensitivities of ecosystems. A classic and well-documented case is that of the Kayapó Indians of Northern Brazil (Posey 1979; Overal and Posey 1990). The Kayapó control pests by properly managing the environment, using species of ants to protect farms and medicinal and fruit plants against *atta* ants and other insects. Posey (1979) notes that among the Kayapó, crops are also protected from pests by utilizing the land at regular intervals and changing the positions of fields. Local practices and techniques can also indirectly help sustainability. In a study conducted in New Mexico (United States), it was found that local irrigation in agriculture brought several benefits to the maintenance of riparian vegetation biodiversity of nearby rivers, recharging groundwater in the hydrological system of the region (Fernald et al. 2015).

Data obtained from different indigenous groups can have serious implications for conservation policies. Prance et al. (1987), in an ethnobotany study with four Amazonian indigenous groups, the Kayapó, the Brazilian Amazon Tembé, the Panare (Venezuela), and the Chacabo (Bolivia), quantified the percentage of useful species for each of these groups. Through a forest inventory, together with an ethnobotanical study, they found the following percentages of useful species: Kayapó (76.8 %), Tembé (61.3 %), Panare (48.6 %), and Chacabo (78.7 %). These data, combined with that obtained by other researchers, show that tropical forests possess

¹ It is often claimed that traditional communities do not overexploit their resources. Some of these claims are made without collecting biological and ecological data to support them.

a large number of useful species, and this fact, for some, already makes a strong case for conservation (see Gavin 2009). The study by Prance et al. (1987) indicated that, due to the intense use of species and high endemism, there is a need to create many conservation areas in the Amazon. However, conventional conservation projects are generally focused on natural resources, completely excluding local people and their perceptions and experiences, even though these people are responsible for the maintenance of these areas (Nastran 2015). In this regard, a recent work by Gavin et al. (2015) proposes the idea of investing in sustainability projects with biocultural approaches, which, according to the authors, provide unique approaches because they take into account all parties involved in the process. Bennett (1992) states that the preservation of tropical forests requires the preservation of indigenous communities and their knowledge.

To characterize a biocultural sustainability-based system, some authors suggest that the idea of “natural forests” should be rethought, as well as the modalities of conservation, prohibiting, with their own management systems, the use of natural resources by local people (Diegues 1993). The creation of parks and reserves without considering local populations generates greater problems with uncontrolled exploitation because locals can exploit resources that they once protected (see Diegues 1993). A study conducted in Mexico by Méndez-López et al. (2014) perfectly translates these consequences. The authors interviewed the residents of communities that have suffered under various government conservation initiatives and found that about two-thirds of those involved were not even consulted on the rules and regulations of the new protected areas. Thus, protected areas created under these circumstances project an outdated image of untouched biodiversity, creating various conflicts and contradictions with the reality of residents.

Sustainable Development in Tropical Forests

It is possible to state that present society has revealed itself to be extremely unsustainable. If nothing changes, in 2030, we will have three billion new middle-class consumers and will use approximately 40 % more water (Sircova et al. 2015). It is possible to point to four factors that may justify this statement: “(1) exponential human growth; (2) depletion of the natural resource base; (3) productive systems that use clean technologies and low energy efficiency; and (4) value systems that provide unlimited expansion of material consumption” (Rohde 1994). These factors, added to the combined results of economic, ecological, social, cultural, and ethnobiological studies, show that biodiversity conservation and sustainable development issues extend through different levels. The very idea of sustainable development appears utopian given the consumption standards of our society and the moral and ethical values we cherish. However, what usually occurs in development policies is the import of techniques and practices that are foreign to the local reality, to the detriment of models developed by local people with their resource management strategies, which are often overlooked in decision-making processes (Diegues 1993; Aymoz et al. 2013).

Ethnobiology can contribute to research on the evaluation of areas for conservation and on sustainable development in the tropics. Thus, the incorporation of local knowledge in development programs becomes interesting, especially when short-, medium-, and long-term strategies are developed (see Aymoz et al. 2013). Medellín-Morales (1990) conducted a study in a Totonac community in Veracruz, Mexico, that exemplifies this issue. The Totonac community consists of 165 families and 754 inhabitants. They have a deep knowledge of their environment and how other indigenous groups from the tropics exercise shifting cultivation systems alongside other productive activities. The Totonac farmer recognizes eight ecological units in which he performs management practices, manipulating approximately 234 species of plants, 110 species of animals, and 39 species of fungi. Based on a multiple-use ecosystem strategy, the Totonac achieve high ecological and energy productivity and an economic surplus through the sale of various products (Toledo 1995).

Local natural resource management methods can point to alternative strategies for the development and use of the environment. An important factor that must be considered is that in the tropics, farming practices and management of natural resources are not isolated activities, as the former is based on the latter (Alcorn 1984). In fact, local ecological knowledge can be the guide for further research and studies aimed at building a sustainable management model in tropical ecosystems. Gavin et al. (2015) outlined eight principles to maximize the positive results of sustainable approaches: “(1) Acknowledge that conservation can have multiple objectives and stakeholders. (2) Recognize the importance of intergenerational planning and institutions for long-term adaptive governance; (3) Recognize that culture is dynamic, and this dynamism shapes resource use and conservation; (4) Tailor interventions to the social-ecological context; (5) Devise and draw upon novel, diverse, and nested institutional frameworks; (6) Prioritize the importance of partnership and relation building for conservation outcomes; (7) Incorporate the distinct rights and responsibilities of all parties; (8) Respect and incorporate different worldviews and knowledge systems into conservation planning.”

The success of conservation and development programs relates to the necessary attention that must be given to local knowledge systems. Local knowledge documentation of methods and selection, pest control, cultivation, and use of natural resources management techniques can bring great benefits to the rational management of natural resources and the development of sustainable agriculture in the tropics, for example. When we talk about sustainable agriculture, interpretations may be different without necessarily involving commitments to the future (Matson et al. 1997). For these authors, the great challenge is to increase production by eliminating undesirable effects on local resources. Certainly, it is naive to assume that the practices of local people can meet the world's food needs and other plant products.

Ethnobiology can collaborate in the development of more environmentally friendly farming systems and help integrate aspects of local knowledge. As a result, it can reduce local impacts on natural resources. It is also important to record local ecological knowledge and make it available for future generations, as this knowledge is increasingly losing ground (King and Furgal 2014). This contribution will

help to overcome the aforementioned challenges, and it requires the participation and integration of various segments of society for its implementation (see Noble and Dirzo 1997; Matson et al. 1997; Reyes-Garcia et al. 2013).

Final Considerations

How can ethnobiology contribute to biodiversity conservation and sustainable development? By (1) identifying the sustainable use of natural resource processes, (2) identifying native biological resources, (3) assessing the economic potential of forests and promoting the marketing of non-timber products (Bennett 1992), and (4) developing projects for biodiversity conservation in situ based on the traditional knowledge of local populations. However, ethnobiology can only fulfill this role if it receives ever-increasing incentives and ample institutional support to apply the information obtained toward solving problems that threaten the stability and integrity of ecosystems and local people.

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