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Evolutionary ethnobiology

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ABSTRACT

Ethnobiology is a discipline that deals with understanding the relationship between human beings and biota. The strong interdisciplinary component of ethnobiology allows it to interact with different fields of knowledge. The evolutionary approach in ethnobiology is not completely absent, however it lacks systematization, which has been recently proposed. From this proposal, the evolutionary ethnobiology emerged. This approach studies the relations between human groups and biota from theoretical scenarios of ecology and evolution. Here we present the evolutionary ethnobiology, its key concepts, the theoretical scenarios with which it dialogues.

Keywords: Human ecology; Ethnoecology; Biological evolution; Cultural evolution; Evolutionary psychology.

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INTRODUCTION

After the emergence of our species in the hominid lineage, human groups have dealt with a variety of environmental conditions, whether in Africa (Trauth et al. 2010) or in other continents through migratory events (Steward and Stringer 2012). Studies show that people's responses to environmental challenges vary depending on culture and cognitive factors linked to perception (Kuruppu and Liverman 2011). This suggests that people's relationships with their environments are complex and can be influenced by different factors.

When considering the factors that may affect the human-environment relationships, there is a set of evidence, obtained from different theoretical scenarios, that stress the role of biological, cultural and environmental factors (see Albuquerque et al. 2015a). This means that a discipline dedicated to the study of such relationships must have an interdisciplinary nature. In this case, contributions from anthropology, ecology and biology have been developed to understand various aspects of these relationships, and this is also one of the central objectives of ethnobiological research. Ethnobiology represents an interdisciplinary science that studies the interactions of people with their environments, particularly with biota (Albuquerque and Alves 2016).

The definition of ethnobiology, with the focus on interactions between people and biota, also suggests an approach from an ecological perspective (see, for example, Ladio et al. 2007; Hurrell and Albuquerque 2012; Santoro et al. 2015; Hart et al. 2017; Barnes et al. 2019). Ecological scenarios allow the understanding of the current factors that modulate people's relations with their environments in space and time (Albuquerque and Ferreira Júnior 2017). For example, one can understand how people use strategies

linked to the knowledge and use of biota to respond to environmental changes (Ferreira Júnior et al. 2015). In addition, it is possible to understand how human groups affect the populations of plants and animals in the environments, due to their actions of collection and modification of the landscapes (Casas et al. 2015; Levis et al. 2017). Recent studies have shown, for example, the ability of human populations to tame entire landscapes, as in the case of the Amazonian forest, whose present configuration is largely the product of indigenous peoples' management over time (Levis et al. 2017).

The evolutionary approach, although not absent in different ethnobiological researches, only very recently had a systematization proposal for the adoption of an evolutionary look for these relations (see Albuquerque and Ferreira Júnior et al. 2017).

What is Evolutionary Ethnobiology?

In addition to ecological scenarios, evolutionary scenarios have been used to investigate people's relationships with biota (Henrich and Broesch 2011; Saslis-Lagoudakis et al. 2012; Moura et al. 2020; Silva et al. 2020; Alves et al. 2021). These scenarios allow us to understand how human behavioral diversity - in terms of its interaction with the environment - has developed throughout history and the forces that govern these behaviors (Albuquerque and Ferreira Júnior 2017).

One can imagine, then, that ecological and evolutionary scenarios are very important to understand our evolutionary trajectory. Thus, Albuquerque and Medeiros (2013) proposed a new branch of ethnobiology, called evolutionary ethnobiology (from now on EE), which *"...studies the evolutionary histories of human behavioral patterns and human understanding about biological resources and behavior), considering the historical and contemporary aspects that influence these behaviors at both the individual and societal levels"* (Albuquerque and Medeiros 2013, p.3). This branch of ethnobiology seeks to understand human-biota interactions from ecological and evolutionary scenarios, integrating many of the researches already executed and proposing guidelines for future research.

The EE encompasses both approaches related to biological evolution and cultural evolution, usually integrating both. As far as biological evolution is concerned, EE's interest lies not only on how it can shape human behavior, but also on how it can be shaped by such behaviors. Throughout evolution, human interactions with the environment have generated both selective pressures in our species (see the case of amylase and sickle-cell anemia [Albuquerque et al. 2015b]) and in other living beings (in the process of plant domestication [Casas et al. 2015]), affecting even the evolutionary history of several other species on the planet (Sullivan et al. 2017).

In the case of cultural evolution, an important focus of EE is 'change', that is, how human populations react (and provoke) environmental, socio-economic and cultural changes. Thus, studies in contexts of human migrations and environmental changes may, for example, evidence cultural adaptations in the way people interact with certain biological resources (see, for example, Medeiros et al. 2012; Cuni-Sanchez et al. 2018). Studies on migrations, for example, have shown that factors such as environmental differences between the place of origin and the new environment, as well as phytosanitary barriers to the entry of plants, give force to strategies of cultural adaptation to the flora of the new environment, causing the migrants to acquire a new repertoire of medicinal plants or enrich their repertoire with new plants (Medeiros et al. 2012).

Albuquerque and Ferreira Júnior (2017) developed theoretically and epistemologically the concept of EE punctuating a set of definitions, important theoretical scenarios and hypotheses. In this brief paper, we present the EE, its key concepts, the theoretical scenarios with which it dialogues and the main findings of the recent investigations of this approach (focused on the investigations of our research group). We also present as part of the scope of this field scientific ideas present in studies that, although they do not call themselves EE, are examples of approaches aligned with it.

Key Concepts in EE

The EE assumes that the set of human knowledge and practices directed to the environment is part of complex social-ecological systems. These emerge from people's relationships with their environments and involve the strong relationship between two systems: the sociocultural (norms, beliefs and practices present in a human group) and the ecological (the biota present in the environment and its interactions, including abiotic factors) (see Berkes et al. 2000).

Social-ecological systems are open and dynamic, and because of this, one of the major objectives of EE is to investigate the structure (how these systems are constituted), the functionality (how they currently respond to changes in the environment), and evolution (scenarios that explain the origins of these systems and how these systems have changed throughout human evolution).

An important feature of these systems is **reciprocal influence**, that is, humans co-evolve with their environments, so that they affect the environment with their decisions and are also affected at different levels (e.g., psychological, behavioral, social and

cultural). As in any system, there is information flow between the different components of this system. For example, when a person teaches someone about the use of a particular natural resource (such as a plant to treat a particular disease), they are transmitting information. This particular type of information we call a **biocultural trait** (a combination of cultural information associated with an information of biological content). These traits can be adaptive, in the case of selecting a plant that may favor the treatment of a disease, or maladaptive, when the trait does not favor survival (the plant is not effective for the treatment of the disease, for example). (see Santoro et al. 2018). The factors affecting the transmission of these traces in time and space are also the study object of EE (Santoro et al. 2018), which in this case derives from the theory of cultural evolution (see Castro et al. 2010).

The concept of a **naturalistic mind** is important in evolutionary ethnobiology. EE focuses not only on understanding human culture and behavior in time and space, but above all, how our interaction with the environment has evolved even in cognitive terms. We believe that our mind has been subjected to the process of natural selection. Additionally, cultural forces may have acted as selective pressures, influencing the human mind through evolution, and shaping the way we perceive the environment and its challenges, and how we store and retrieve contents from memory. The development of this concept is based especially on the dialogue with evolutionary psychology (see Moura et al. 2020, 2021; Silva et al. 2020). In synthesis:

- Evolutionary ethnobiology seeks the understanding of people-biota interactions from ecological and evolutionary scenarios. - Evolutionary ethnobiology deals with theoretical scenarios related to biological evolution and cultural evolution, usually seeking the association of both. - This scientific field studies not only the structure and dynamics of social-ecological systems, but the forms and biases of cultural learning related to these systems, which can favor the sharing of adaptive biocultural traits, as well as maladaptive ones in these systems. -The adaptive strategies present in human populations, whether they are genetically fixed or products of cultural evolution, are usually based on obtaining security in the use of natural resources.

Some examples of research in evolutionary ethnobiology

Recent research has used ecological and evolutionary scenarios to understand various aspects of people-biota relationships and, in this sense, may be in line with the approach of evolutionary ethnobiology. In the last 10 years, some of these studies have evaluated (1) the resilience of social-ecological systems (Díaz-Reviriego et al. 2016); (2) factors influencing plant selection in different human groups, such as environmental factors (Linstädter et al. 2013), cultural factors (Menendez-Baceta et al. 2015), factors linked to chemosensory perception (Molares and Ladio 2009) and to chemical properties involving certain groups of plants (Saslis-Lagoudakis et al. 2012); (3) the processes of transmitting plant information from the cultural evolution scenario (Henrich and Broesch 2011, Leonti et al. 2015); (4) the effect of past environmental management on the current diversity of plant species (Levis et al. 2017) and (5) the role of local knowledge to favor the survival of human groups (Reyes-García et al. 2016) - see some more examples in Albuquerque et al. (2015a) and in Table 1 (with the focus of studies carried out by our research group).

Future

Research in evolutionary ethnobiology is still taking its first steps. Some of the challenges for the future of this field are:

(1) The establishment of research groups around the world that formulate new hypotheses and test the hypotheses already proposed within the scope of this scientific field. It is necessary to investigate if the findings of the current studies are product only of the regional context or tend to be repeated in different socioenvironmental contexts. In this case, we have observed in our investigations that human groups respond strongly to regular challenges in the environment, such as having a greater knowledge of treatments for diseases perceived as more frequent (Santoro et al. 2015; Nascimento et al. 2016). We have even observed that the knowledge of treatments for diseases perceived as frequent increases significantly in a very short time, less than 10 years, suggesting rapid evolutionary changes in local medical systems (Santoro and Albuquerque 2020). Based on this and other evidence, we have proposed the *Principle of Regularity*, which can be stated as follows: in social-ecological systems, human cognitive and behavioral mechanisms respond primarily to conditions or contexts that present greater regularity in the environment, to which humans are more spatially and/or temporarily exposed. This allows social-ecological systems to be structured to meet the constant needs of human beings (see Ferreira Júnior et al. 2019). It would be interesting in the future to assess how our species respond to regular events in nature, in different contexts.

(2) The calibration of effective methods in order to give robustness to the hypothesis test in evolutionary ethnobiology. Many of the methods used come from classical ethnobiology, cultural evolution studies, evo-

lutionary psychology, and others. It is necessary to triangulate methods and repeat research designs in order to verify if the findings correspond to reality or if they present strong biases derived from the selected methods.

(3) The application of theoretical scenarios of evolutionary ethnobiology beyond the domain of medicinal plants. This domain presents high complexity and variation, which makes it especially inviting to studies in this sense. However, it is necessary to extrapolate the premises of this field to other components of social-ecological systems. Food plants and food systems, for example, may provide important insights for evolutionary ethnobiology. A key issue in this sense would be how natural selection influenced the choices of food plants and the acceptance of new components in food systems. In addition, an increase in studies on wild and/or unconventional food plants has revealed the role of several factors in explaining why plants with high caloric value, and with potential in the treatment of diseases, are restricted to a few social-ecological systems (Ferreira Júnior et al. 2021; Medeiros et al. 2021b). This may be the focus of future investigations in evolutionary ethnobiology, to address the biocultural factors involved in the consumption and popularization of these resources. Another interesting point would involve the study of the relationship between food and medicinal uses, investigating the evolution of knowledge in these domains and the main local criteria for selecting species that serve both purposes (Medeiros et al. 2021a).

(4) In the future, studies in Evolutionary Ethnobiology may contribute to strategies related to biocultural conservation. By investigating people-biota relationships from an ecological and evolutionary perspective, we can highlight the mechanisms that are modulating these complex interactions. These studies can favor, for example, the understanding of the processes that affect the importance of – and the attention given to – species and landscapes for people and the actions that our species performs in different environments, which has implications for the conservation of species and landscapes, in addition to the processes that regulate these social-ecological systems. In this sense, by understanding these foundations, we can build interdisciplinary dialogues to favor biocultural conservation (see Saslis-Lagoudakis and Clarke 2013).

Note

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CONFLICT OF INTEREST

The authors declare to be free of any commercial or financial relationships that could be construed as a potential conflict of interest.

CONTRIBUTION STATEMENT

All authors have made important contributions in the text conception and by reading and approving the final version of the manuscript.

REFERENCES

Albuquerque UP, Ferreira Júnior WS, Santoro FR, Torres-Avilez WM, Sousa Júnior JR (2015) **Niche construction theory and ethnobiology.** In: Albuquerque UP, Medeiros PM, Casas A (eds) Evolutionary Ethnobiology. Springer, New York, pp. 73-87.

Albuquerque UP, Alves AGC (2016) **What is ethnobiology?** In: Albuquerque UP, Alves RRN (eds) Introduction to ethnobiology. Springer, New York, pp. 3-7.

Albuquerque UP, Ferreira Júnior WS (2017) **What do we study in evolutionary ethnobiology? Defining the theoretical basis for a research program.** *Evolutionary Biology* 44:206-215.

Albuquerque UP, Medeiros PM (2013) **What is evolutionary ethnobiology?** *Ethnobiology and Conservation* 2:6.

Albuquerque UP, Medeiros PM, Casas A (2015a) **Evolutionary Ethnobiology**. Springer, New York.

Albuquerque UP, Ferreira Júnior WS, Santoro FR, Torres-Avilez WM, Sousa Júnior JR (2015b) **Niche construction theory and ethnobiology.** In: Albuquerque UP, Medeiros PM, Casas A (eds) Evolutionary Ethnobiology. Springer, New York, pp. 73-87.

Albuquerque UP, Medeiros PM, Ferreira Júnior WS, Silva TC, Silva RRV, Gonçalves-Souza (2019a) **Social-Ecological Theory of Maximization: basic concepts and two initial models.** *Biological Theory* 14:73-85.

Albuquerque UP, Nascimento ALB, Chaves LS, Feitosa IS, Moura JMB, Gonçalves PHS, Silva RH, Silva TC, Ferreira Júnior WS (2019b) **A brief introduction to Niche Construction Theory for**

ecologists and conservationists. *Biological Conservation* 237:50-56.

Alves RRN, Borges AKM, Barboza RRD, Souto WMS, Gonçalves-Souza T, Provete DB, Albuquerque UP (2021) **A global analysis of ecological and evolutionary drivers of the use of wild mammals in traditional medicine.** *Mammal Review* 51:293-306.

Barnes ML, Bodin O, McClanahan TR, Kittinger JN, Hoey AS, Gaoue OG, Graham NAJ (2019) **Social-ecological alignment and ecological conditions in coral reefs.** *Nature Communications* 10:2039.

Barrett B (1995) **Herbal knowledge on Nicaragua's Atlantic Coast: consensus within diversity.** *Journal of Community Health* 20:403-421.

Berkes F, Colding J, Folke C (2000) **Rediscovery of traditional ecological knowledge as adaptive management.** *Ecological Applications* 10:1251-1262.

Casas A, Parra F, Rangel-Landa S, Rodríguez SG (2015) **Evolutionary ecology and ethnobiology.** In: Albuquerque UP, Medeiros PM, Casas A (eds) Evolutionary Ethnobiology. Springer, New York, pp. 37-57.

Castro L, Toro MA (2010) **Cultural Transmission and Evolution.** In: eLS. John Wiley & Sons Ltd, Chichester doi: 10.1002/9780470015902.a0022858.

Cuni-Sanchez A, Omeny P, Pfeifer M, Olaka L, Mamo MB, Marchant R, Burgess ND (2018) **Climate change and pastoralists: perceptions and adaptation in montane Kenya.** *Climate and Development* 11:513-524.

Dantas JIM, Nascimento ALB, Silva TC, Albuquerque UP (2020) **Mutation of cultural information on the use of plant complexes in local medical systems.** *Evidence-Based Complementary and Alternative Medicine* 2020:7630434.

Díaz-Reviriego I, Fernández-Llamazares A, Salpeteur M, Howard PL, Reyes-García V (2016) **Gendered medicinal plant knowledge contributions to adaptive capacity and health sovereignty in Amazonia.** *Ambio* 45: S263-S275.

Ferreira Júnior WS, Ladio AH, Albuquerque UP (2011) **Resilience and adaptation in the use of medicinal plants with suspected anti-inflammatory activity in the Brazilian Northeast.** *Journal of Ethnopharmacology* 138:238-252.

Ferreira Júnior WS, Nascimento ALB, Ramos MA, Medeiros PM, Soldati GT, Santoro FR, Reyes-García V, Albuquerque UP (2015) **Resilience and adaptation of social-ecological systems.** In: Albuquerque UP, Medeiros PM, Casas A (eds) Evolutionary Ethnobiology. Springer: New York, pp. 105-119.

Ferreira Júnior WS, Medeiros PM, Albuquerque UP (2019) **Evolutionary Ethnobiology.** In: Els. John Wiley & Sons, Ltd: Chichester.

Ferreira Júnior WS, Campos LZ, Medeiros PM (2021) **Unconventional food plants: food or medicine?** In: Jacob MCM, Albuquerque UP (eds) Local food plants of Brazil. Springer: New York , pp. 29-47.

Gama ADS, Paula M, Silva RRV, Ferreira Júnior WS, Medeiros PM (2018) **Exotic species as models to understand biocultural adaptation: Challenges to mainstream views of human-nature relations.** *PLoS ONE* 13:e0196091.

Hart G, Gaoue OG, de la Torre L, Navarrete H, Muriel P, Macía MJ, Balslev H, León-Yánez S, Jorgensen P, Duffy DC (2017) **Availability, diversification and versatility explain human selection of introduced plants in Ecuadorian traditional medicine.** *PLoS ONE* 12(9): e0184369.

Henrich J, Broesch J (2011) **On the nature of cultural transmission networks: evidence from Fijian villages for adaptive learning biases.** *Philosophical Transactions of The Royal Society B* 366:1139-1148.

Hurrell JA, Albuquerque UP (2012) **Is Ethnobotany an Ecological science? Steps towards a complex ethnobotany.** *Ethnobiology and Conservation* 1:4.

Kuruppu N, Liverman D (2011) **Mental preparation for climate adaptation: The role of cognition and culture in enhancing adaptive capacity of water management in Kiribati.** *Global Environmental Change* 21:657-669.

Ladio A, Lozada M, Weigandt M (2007) **Comparison of traditional wild plant knowledge between aboriginal communities inhabiting arid and forest environments in Patagonia, Argentina.** *Journal of Arid Environments* 69:695-715.

Leonti M, Staub PO, Cabras S, Castellanos ME, Casu L (2015) **From cumulative cultural transmission to evidence-based medicine: evolution of medicinal plant knowledge in Southern Italy.** *Frontiers in Pharmacology* 6:207.

Levis C, Costa FRC, Bongers F, Peña-Claros M, Clement CR, Junqueira AB et al. (2017) **Persistent effects of pre-Columbian plant domestication on Amazonian forest composition.** *Science*

355:925-931.

Lins Neto EMF, Albuquerque UP (2018) **Theories of Niche Construction and Optimum Foraging: weaknesses and virtues in understanding the early stages of domestication.** *Ethnobiology and Conservation* 7:1-5.

Linstädter A, Kemmerling B, Baumann G, Kirscht H (2013) **The importance of being reliable – Local ecological knowledge and management of forage plants in a dryland pastoral system (Morocco).** *Journal of Arid Environments* 95:30-40.

Medeiros PM, Soldati GT, Alencar NL (2012) **The use of medicinal plants by migrant people: adaptation, maintenance, and replacement.** *Evidence-Based Complementary and Alternative Medicine* 2012:807452.

Medeiros PM (2013) **Why is change feared? Exotic species in local pharmacopoeias.** *Ethnobiology and Conservation* 2:3.

Medeiros PM, Figueiredo KF, Gonçalves PHS, Caetano RA, Santos EMC, Santos GMC, Barbosa DM, Paula M, Mapeli AM (2021a) **Wild plants and the food-medicine continuum—an ethnobotanical survey in Chapada Diamantina (Northeastern Brazil).** *Journal of Ethnobiology and Ethnomedicine* 17:37.

Medeiros PM, Barbosa DM, Santos GMC, Silva RRV (2021b) **Wild food plant popularization and biocultural conservation: challenges and perspectives.** In: Jacob MCM, Albuquerque UP (eds) Local food plants of Brazil. Springer: New York , pp. 341-349.

Menendez-Baceta G, Aceituno-Mata L, Reyes-García V, Tardío J, Salpeteur M, Pardo-de-Santayana M (2015) **The importance of cultural factors in the distribution of medicinal plant knowledge: A case study in four Basque regions.** *Journal of Ethnopharmacology* 161:116-127.

Molares S, Ladio A (2009) **Chemosensory perception and medicinal pants for digestive ailments in a Mapuche community in NW Patagonia, Argentina.** *Journal of Ethnopharmacology* 123:397-406.

Moura JMB, Silva RH, Ferreira Júnior WS, Silva TC, Albuquerque UP (2020) **Theoretical insights of Evolutionary Psychology: new opportunities for studies in Evolutionary Ethnobiology.** *Evolutionary Biology* 47:6-17.

Moura JMB, Silva RH, Ferreira Júnior WS, Silva TC, Albuquerque UP (2021) **Memory for medicinal plants remains in ancient and modern environments suggesting an evolved adaptedness.** *PLoS ONE* 16:e0258986.

Nascimento ALB, Lozano A, Melo JG, Alves RRN, Albuquerque UP (2016) **Functional aspects of the use of plants and animals in local medical systems and their implications for resilience.** *Journal of Ethnopharmacology* 194:348-357.

Reyes-García V, Guèze M, Díaz-Reviriego I, Duda R, Fernández-Llamazares A, Gallois S, Napitupulu L, Orta-Martínez M, Pyhälä A (2016) **The adaptive nature of culture. A cross-cultural analysis of the returns of local environmental knowledge in three indigenous societies.** *Current Anthropology* 57:761-784.

Santoro FR, Ferreira Júnior WS, Araújo TAS, Ladio AH, Albuquerque UP (2015) **Does plant species richness guarantee the resilience of local medical systems? A perspective from utilitarian redundancy.** *PLoS ONE* 10:e0119826.

Santoro FR, Santos GC, Ferreira Júnior WS, Chaves LS, Araújo TAS, Nascimento ALB, Sobral A, Silva JS, Campos JLA, Albuquerque UP (2017) **Testing an ethnobiological evolutionary hypothesis on plant-based remedies to treat malaria in Africa.** *Evolutionary Biology* 44:216-226.

Santoro FR, Nascimento ALB, Soldati GT, Ferreira Júnior WS, Albuquerque UP (2018) **Evolutionary ethnobiology and cultural evolution: opportunities for research and dialog.** *Journal of Ethnobiology and Ethnomedicine* 14:1.

Santoro FR, Chaves LS, Albuquerque UP (2020) **Evolutionary aspects that guide the cultural transmission pathways in a local medical system in Northeast Brazil.** *Heliyon* 6:e04109.

Santoro FR, Albuquerque UP (2020) **What factors guide healthcare strategies over time? A diachronic study focused on the role of biomedicine and the perception of diseases in the dynamics of a local medical system.** *Acta Botanica Brasilica* 34:720-729.

Saslis-Lagoudakis CH, Savolainen V, Williamson EM, Forest F, Wagstaff SJ, Baral SR, Watson MF, Pendry CA, Hawkins JA (2012) **Phylogenies reveal predictive power of traditional medicine in bioprospecting.** *PNAS* 109:15835-15840.

Saslis-Lagoudakis CH, Clarke AC (2013) **Ethnobiology: the missing link in ecology and evolution.** *Trends in Ecology and Evolution* 28:67-68.

Silva RH, Ferreira Júnior WS, Moura JMB, Albuquerque UP (2020) **The link between adaptive memory and cultural attraction: new insights**

for evolutionary ethnobiology. *Evolutionary Biology* 47:273-284.

Silva TLM, Ferreira Júnior WS, Albuquerque UP (2020) **Is there a biological basis in the selection of medicinal plants in human species? An initial approach based on chemosensory perception of taste.** *Ethnobiology and Conservation* 9:3.

Steward JR, Stringer CB (2012) **Human evolution out of Africa: the role of refugia and climate change.** *Science* 335:1317.

Soldati GT, Hanazaki N, Crivos M, Albuquerque UP (2015) **Does environmental instability favor the production and horizontal transmission of knowledge regarding medicinal plants? A study in Southeast Brazil. PLoS ONE 10:e0126389.**

Sullivan AP, Bird DW, Perry GH (2017) **Human behavior as a long-term ecological driver of non-human evolution.** *Nature Ecology & Evolution* 1:65.

Trauth MH, Maslin MA, Deino AL, Junginger A, Lesoloyia M, Odada EO, Olago, DO, Olaka LA, Strecker MR, Tiedemann R (2010) **Human evolution in a variable environment: the amplifier lakes of Eastern Africa.** *Quaternary Science Reviews* 29:2981-2988.

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Table 1. Some examples of scenarios used by our research group involving Evolutionary Ethnobiology.

Scenario	Description	Examples
Resilience of social-ecological systems	The ability of the social-ecological system to maintain its functions and processes in the face of disturbances, although modifying its structure (Ferreira Júnior et al. 2015).	Ferreira Júnior et al. (2011); Santoro et al. (2015); Nascimento et al. (2016);
Resource selection process	EE seeks to understand the ecological and/or evolutionary factors that modulate the incorporation of new resources into social-ecological systems, as well as the differential use for different utilitarian domains.	Medeiros et al. (2017); Gama et al. (2018); Albuquerque et al. (2019a); Silva et al. (2020); Alves et al. (2021); Medeiros et al. (2021a)
Cultural evolution	From this scenario, EE assesses how biocultural traits can be learned, transmitted, and modified over time in social-ecological systems.	Soldati et al. (2015); Santoro et al. (2018); Dantas et al. (2020); Santoro et al. (2020); Silva et al. (2020)
Niche construction	This scenario explains how the behavior of organisms of a given species can modify the conditions of their environment in order to change the selective pressures that act on the species itself and on other species present in the environment (Odling-Smee et al. 2013).	Albuquerque et al. (2015); Santoro et al. (2017); Lins Neto and Albuquerque (2018); Albuquerque et al. (2019b)