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Theoretical reflections on ethnobiology in the third millennium

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Summary. As in several other scientific endeavors, ethnobiology has greatly diversified around the turn of the millennium. Despite several efforts being made during recent years, the discipline still gives the impression of being in needs to establish its identity among better defined fields of study. Trying to contribute to fill this gap, this review succinctly discusses the multidisciplinary foundations of ethnobiology and its paradigmatic, theoretical and conceptual diversification during recent decades. This field of study is characterized along these lines as "the investigation of the material and symbolic interrelationships between human beings and the rest of existing organisms." Major ethnobiological perspectives, putative subdivisions, main research foci, and preponderant subjects are proposed and roughly outlined, in addition to the foremost dualistic paradigmatic approaches and multifaceted aims common in this branch of knowledge. The relationships and hybridizations between ethnobiology and political ecology in a critical perspective conclude the review, with a final speculation on supplementary future steps and challenges amongst ethnobiology practitioners. [**Contrib Sci** 10:49-64 (2014)]

Ethnobiological research has reemerged in recent decades with manifold novel perspectives, yet still relatively few and partial theoretical and epistemological frameworks are put forward in the literature. This is partly due to its diffuse history, relatively recent designation (a bit more than a century ago), its pluridisciplinary origins, along with its predominantly descriptive and applied foci. Additional factors such as geographical ubiquity and heterogeneity of ethnobiological developments both at academic and non-academic levels, along with its dynamic and intricate history contribute to the fluidity of the discipline. As a consequence, theoretical frameworks on ethnobiology are usually scattered along the literature, without extensive and comparative works dealing with these natures thus far, except a few books and edited collections presented later. Having nurtured from a myriad of other fields of study, ranging from folk medicine and cognitive anthropology to conservation biology or bioprospecting, ethnobiology is increasingly becoming an academic context into which multiple questions and problems are intended to be studied, and if possible, solved. Nonetheless, still only few universities offer specific undergraduate or graduate degrees in ethnobiology *per se*, while for the most part still immersed within either anthropology or biology/botany departments, a limitation to transdisciplinarity that is still evident. A similar phenomenon happens—of course with a few exceptions—regarding academic funding sources, which tend to limit research projects according to their connection either to the natural, or the social sciences, but rarely both. To further

Keywords: history of ethnobiology · ethnobiological subdivisions · ethnobiological paradigms · research foci · critical ethnobiology

Table 1. Major phases in the history of Ethnobiology, from prehistory to current days according to different authors

Phase	Period	Characteristics	Clément 1998a	Hunn 2007	Svanberg et al. 2011
1. Pre-colonial (pre-classical)	Prior to 15th century	Background, roots Prehistory and ancient history	Pre-classical	Pre-modern	The recording man
2. Colonial (pre-classical)	15th to late 19th centuries	First major globalization and transculturation *The scholar turn*	Pre-classical	First steps	Nat. Hist. (Renaissance) Econom. bot. (18th c.) Explorers and armchair scholars (19th c.)
3. Formative (classical)	Late 19th century to 1940's	Birth of modern ethnobiology *The ethnographic turn*	Economic usages (1860-1899) Recollection of additional information (1900-1931) First syntheses (1932-1953)	First steps	Popular medicine Folklore & plant name research Plant use (late 19th c. onwards) Ethnographical studies (early 20th c.)
4. Emic (classical)	1950`s to mid 1970's	Cognitive ethnobiology *The emic turn*	Emic knowledge (1954-1968) Classification (1969-1980)	Cognitive ethnobiology	Prolongation of early 20th c. stages
5. Systemic (post-classical)	Late 1970's to 1991	Consolidation *The ecological and pharmacological turns*	Associations (1981- 1992)	Ethnoecology	Emergence as independent discipline in Europe
6. Contemporary (post-classical)	1992 to present	Diversification *The biocultural and reflexive turns*	Resources and their management (1993 onwards)	Indigenous ethnobiology	Current trends

Adapted from [19,51,84].

illustrate this underrepresentation of this sphere of investigation, by the year 2014, only a handful of independent academic schools and research institutes of ethnobotany, ethnobiology or ethnoecology is to be found in universities around the world, while most are still immersed within parental disciplines, cognate fields or related spheres of investigation.

In order to partially fill the aforementioned theoretical gap, the article you are about to read reflects on ethnobiology as a discipline and as a concept, reviewing briefly its historical developments along with representative works, as already established by several authors since ethnobiology's configuration [20]. The consolidation and diversification of this sphere of investigation since late 1970's are of special interest in this examination, as ethnobiology continues to explore its genesis, paths and boundaries, its research foci and paradigmatic foundations, amongst several other theoretical and methodological considerations [51,58,84]. The article continues with a description of key ethnobiological thematic and paradigmatic approaches in the recent decades, indicating major trends and foci. A final reflection is given on future directions of research as well as recent hybridizations between ethnobiology and other fields of study which more often than not tend to be analytically decoupled. Specifically connecting with political ecology, I propose at last for a critical ethnobiology, that is, the application of critical theory in the consideration of political ecology and economy within the discipline, along with the effect of social inequality, control and power relations on ethnobiological processes, phenomena, transformations and multifaceted conceptualizations. This review should be of interest to students and professionals engaged in the disciplines of ethnobiology (and subdisciplines), anthropological theory, economic and applied botany, environmental anthropology, conservation biology, political ecology, and philosophy of science, amongst others.

Brief historical considerations: past and present of ethnobiology as a discipline and as a concept

Historical developments in ethnobiology as a discipline have been reviewed by various authors in a number of journal articles and book chapters in edited books. Two major dichotomies arise when looking at the historiography of the discipline: On one side, reconstructions that give more emphasis either to anthropological or biomedical developments; on

Table 2. Relevant sources and works in the history of Ethnobiology until late 1940's

Phase	Period	Source	Exemplary contributions
Pre-colonial	Prior to 15th century	Trial and error Experience Knowledge transmission (oral and written) Innovation	Hunter-gatherers, agriculturalists, farmers, fishermen, healers, cooks, craftsmen, traders, spiritual leaders. Polymaths from classical civilizations (e.g., Shénnóng and Zhang Zhongjing in China; Charaka and Sushruta in India; Theophrastus, Dioscorides and Pliny the Elder in Europe)
Colonial	15th to late 19th centuries	Medicine & Pharmacy Botany & Agronomy Archaeology and museology Natural history Biological evolution	Authors: Chroniclers, explorers, polymaths (e.g., Li Shizhen, Avicenna, Ibn Al-Baytar, B. de Sahagún, M. de la Cruz, J. Badianus, A. de Mendaña, P.F. de Queirós, B. de las Casas, L. Fuchs, C. Linnaeus, A. von Humboldt; A.J.A. Bonpland; J. Cook, C.Darwin, A.R.Wallace, A. de Candolle, W.J. Hooker, R. Spruce).
Formative	Late 19th century to 1940's	Aboriginal botany Ethnography and cultural anthropology (USA) Ethnology and cultural geography (Eur.) Economic botany Folk medicine	Authors: B.R. Ross (1860's); H. Rusby.; E. Palmer; S.J. Powers; F.W. Putnam (1870's); R.E.C. Stearns (1880's); **J. Harshberger**, **O.T. Mason** (1890's); C. Bessey; M.C. Stevenson (1900's); B. Freire-Marreco (1910's); P. Font i Quer; S. Barrett; N. Vavilov; H.H. Smith (1920's); A.W. Hill; **E.F. Castetter**; A.E. Whiting (1930's); A.G. Haudricourt; P.A. Vestal; R. E. Schultes; V.H. Jones; F.R. Fosberg (1940s). Journals: *American Anthropologist*, *American Naturalist*

Sources: [19,20,40,51,68,84]. In bold, authors coining the terms ethnobotany, ethnozoology and ethnobiology.

the other, accounts that focus to the East or to the West of the North Atlantic. The historiography of ethnobiology with a tilt on North American contributions is detailed in various reviews [5,8,9,19,20,37–40,51,58], while the role and contributions of European scholars to the discipline are depicted in greater detail in the works of Cotton [24], but especially in Pardo-de-Santayana, Pieroni and Puri [68], and Svanberg et al. [84]. Regrettably, detailed historical developments with a focus on native ethnobiologists from other parts of the world are still missing for the Western audience, yet surely are very rich and varied.

Especially focusing on the North American tradition, Canadian Daniel Clément considers 3 major periods in ethnobiology's history (pre-classical, classical and post-classical) subdivided into 7 stages, in addition to the millennia prior to pre-classical (or pre-modern) times. These are: economic usages of plants and animals (1860–1899); recollection of additional information (1900–1931); first syntheses (1932–1953); emic knowledge (1954–1968); classification (1969-1980); associations (1981–1992); and resources and their management (1993 onwards). A decade later, Eugene Hunn considered ethnobiology to have developed though four major phases, including: pre-classical (prior to late 1940's); cognitive ethnobiology (1950's to mid 1970's); ethnoecology (late 1970's to 1980's); and indigenous rights (1990's onwards) [51]. On the other side, Svanberg et al. [84], focusing on European historiography of the discipline establish up to eleven stages showing the antiquity, vested interest, scholarship, and diversity of approaches in the Old World by the 19th century. Finally Martin [58] offers a more overarching account, which includes six foundational stages plus eight current trends, possibly in the most similar way as it is presented here. These overlapping phases and preponderant research subjects considered by the different authors have been slightly modified and combined in this review to six stages, which are summarized next (Table 1).

For simplicity and historical coherence, pre-colonial, colonial and formative phases (up to the 1950) are concisely described first, followed by emic, systemic and contemporary developments taking place from 1950's until nowadays.

Ethnobiology prior 1950's

Preformative and formative developments in ethnobiology are essential to understand the history of our discipline and the disparity of subjects, contributors and concepts at stake. Table 2 summarizes these initial phases in the history of ethnobiology as a field of study—until late 1940's—including influencing theoretical bases, as well as pertinent "proto"-ethnobiologists.

As Table 2 portrays, the origins of our discipline as a definite scientific field can be traced back to late 19th century [44,59] during the formative phase, although ethnobiological phenomena and their rationalization have existed for millennia since humans evolved, and most probably even earlier, as has also been observed and studied amongst other primates in what is called zoopharmacognosy [75]. During pre-colonial *times* (prior to 15th century), which lasted several millennia, most ethnobiological knowledge was transmitted orally, while written sources were limited to the ruling classes along with intellectuals and polymaths [58]. Hunter-gatherers, agriculturalists, farmers, fishermen, healers, cooks, craftsmen or traders, amongst many others, all indirectly contributed to the history and advancement of the discipline. As centuries passed by and knowledge built up, medicinal, agronomic along with other copious compilations common in most classical civilizations (e.g., the works of Dioscorides, Pliny the Elder, Zhang Zhongjing and Charaka in Greece, Rome, China and India respectively), in addition to later developments linked to the exploration of "new worlds", the invention of the printing press, the expansion of herbaria and museums filled with exotic objects, new ideas about biological evolution, and the consolidation of the science of plant life, constitute only a few key events during pre-classical stages of the discipline. Botanical gardens, arboreta, seed banks, encyclopedic works, museums and other collections expanding during the Middle Ages and beyond, clearly played a significant role to ethnobiology too, as *ex situ* conservation settings as well as primordial ethnobiological research centers.

The third phase, called here the *formative stage* spans from late 19th century to late 1940's. Still corresponds to Hunn's phase I or the "first steps" stage, when an official name and definition is given to several subdisciplines of ethnobiological research, chiefly in the USA. One of the major subdisciplines within ethnobiology, ethnobotany, was the first to be coined, in 1895 by Harsberger [44], as did ethnozoology four years later [59]. Ethnobiology, *per se,* was properly defined four decades later by Castetter, in 1935 [17]. Moreover, ethnoecology and ethnopharmacology were not coined until 1954 and 1967 by Harold Conklin [23] and the edited work by Efron, Holmstedt and Kline [30] respectively, with the advent of the ethnosciences by mid 20th century. Nineteen century disciplines such as applied botany, aboriginal botany and economic botany, coined prior to ethnobotany, and sharing many characteristics with ethnobotany, are viewed even today as synonyms or cognate terms. Nonetheless, ethnobotany seems to have gained relevance over the other three as more inclusive for anthropologists as well as in general terms. A similar phenomenon occurred with 20th century coined subdisciplines such as cultural, human or historical ecology, cultural geography, as well as environmental or ecological anthropology, sharing many characteristics with ethnobiology in their definitions, interests or approaches; however, subtle differences also exist amongst them, especially the interest of ethnobiology in both material and symbolic interactions of humans and the rest of living beings, regardless of the temporal and spatial dimensions, or a given theoretical or paradigmatic framework. For further reference on formative times, Clément [20] gives a detailed and thorough description on the occurrences during this stage, from De Candolle to Harshberger and beyond in what the author also considers the foundations of the discipline. For European developments Svanberg et al. [84] offer a supplementary detailed historiography, with a completely different picture, especially as each European country developed independently producing intensive contributions to our field of study from disparate angles. Additionally, Bennett [8,9] gives a nuanced distinction between ethnobotany and economic botany in their search through time for a demarcation that is worth taking into consideration.

Definitions about the aims of the discipline and cognate fields during the formative period did not vary greatly, as illustrated next with some examples. In the case of applied botany, for instance, was defined as the "study of the relations that exist between plants and the human species, comprising agricultural botany, medical botany, economic and industrial botany, historical botany, etc." [28], or for aboriginal botany, as "all the forms of the vegetable world which the aborigines use for medicine, food, textile fabrics, ornaments, etc" [72]. Regarding ethnobotany *per se*, initial delimitations comprised plants used by "primitive and aboriginal people" [44], or "the interrelationship of primitive man and plants" [53]. As shown in these examples, most conceptualizations were restricted either to aboriginal peoples or only to usage of plants. Other than the cited relevant figures during the 19th century of De Candolle, Powers and Harshberger, authors such as William Hooker and Richard Spruce in England, and James Mooney in the USA are worth mentioning for their works during formative times of ethnobiology. At the turn of the 20th century significant contributors to the field included amid others Charles Edwin Bessey, Matilda Coxe Evans Stevenson, Samuel Barrett, Frans Olbrechts, Arthur William Hill, Edward Castetter, André-Georges Haudricourt as well as Volney Jones.

In 1935, "the father of ethnobiology" Edward Castetter characterized ethnobiology as the study of "primitive con-

cepts of living things; the relation between organic environment and the lives, practices, thoughts and outlook upon life, of the group studied; the uses (for food, medicine, ceremony, practical arts, etc.) to which living things are put by a given people; the degree of their knowledge regarding the structure, functions and activities of living things; the nature of their concepts regarding the classification of organisms; and what may be learned regarding the workings of the primitive mind by the study of its concepts and names for living things and their parts and functions" [17]. During his work, Castetter makes an attempt to integrate ethnobotany and ethnozoology, considering the distinction meaningless, and stressing the importance of both biological and ethnographic training amongst ethnobiologist [18]. Castetter also considers that ethnobiology is not a new discipline or science but a field of investigation between biology and anthropology.

By the end of this phase the first works by R.E. Schultes set the stage—especially in the Americas—for later extensive works on ethnopharmacology and the use of entheogens, phenomenon which had already been initiated in Europe at least as early as 1784 by Swedish Samuel Ödmann, studying Vikings-fly agaric relations. The *Botanical Bulletin* (later-called *Botanical Gazette* and currently known as the *International Journal of Plant Sciences*) was a reference publication venue during early stages of the discipline in the USA. A similar role was carried out by the *Botanical Journal of the Linnean Society* in England, amid others. The works of the Bureau of American Ethnology from 1879 onwards also pioneered in the USA a new wave of publications on nature-culture relations.

Ethnobiology from 1950 onwards

As anthropology, biology, linguistics, and a myriad of other fields, subfields and methodologies progressed during the 20th century especially after WWII, so did ethnobiological inquiries and declinations. These recent developments in the history of ethnobiology since 1950's onwards are briefly summarized in Table 3, including influencing fields and research topics, as well as some exemplary authors, journals and countries of researcher's affiliation based on a Scopus bibliographic database search.

The *emic phase* is characterized—especially in North America—by the relevance given to cognitive aspects of ethnobiological relations and roughly spans from the 1950's to mid 1970's. It is considered to begin with the works of Conklin amongst the Hanunoo in the Philipines beginning in the 1950's [23], followed in the 1970's by the contributions of Berlin, Breedlove and Raven [12], Hunn [48–50] and Ellen [31] amongst others. These works set the start of comparative ethnobiology through ethnotaxonomy and the emic approach in the North American tradition with an apparent ecological perspective. Adding to the ethnoscientific focus, studies on folk biology (e.g., Nancy Turner in Canada), ethnoornitology (e.g., Ralph Bulmer in Oceania), and ethnopharmacology keep on being undertaken (e.g., Norman Bisset on ethnobotany of *Strychnos* and ethnopharmacology of alkaloids), as continued the works on entheogenic plants and fungi by R. E. Schultes and his students Timothy Plowman and Wade Davis in the USA. The emergence of paleoethnobotany (aka economic prehistory) during this period is also worth mentioning, with significant works carried out by Hans Helbaek, Willem van Zeist and Eric S. Higgs, to name a few.

The *Economic Botany* journal was first published by the New York Botanical Garden in 1947, it being the main publication venue for academic ethnobiological studies since mid 20th century. In 1959 the Society for Economic Botany is subsequently founded, with a first annual meeting of the Society the year after in Purdue University, Indiana. Some of the conceptualizations proposed during the emic phase for ethnobiology (and ethnobotany) include "[a] field open to those unafraid to transgress academic boundaries (that) lies in the no-man's-land between anthropology and botany and geography" [16]; the "interaction of man and the plant world" [54, cited in 9]; "…ethnobiology's interests include three precise dimensions: classification, nomenclature and identification of living organisms" [10]; or the "…direct interrelationships between humans and plants" [37, cited in 9]. As can be seen, authors stress in their definitions aspects of geography and transdisciplinarity, ethnoscience, or ecology, depending on their disciplinary background and interests.

Since the late 1970's the discipline has clearly consolidated and profoundly diversified into a myriad of topics and foci, more theory-driven and answering why questions into what is sometimes considered the post-classical stages of ethnobiology. These last decades have been called here the *systemic* (late 1970's to 1991) and *contemporary stages* (1992–onwards). In general, the first is characterized by the consolidation of the discipline with two main turns, the ecological (systemic) and the pharmaceutical (molecular), while the second is featured by a further diversification of approaches along with two main turns, the biocultural and the reflexive.

As an illustration of the consolidation of the discipline, the Society of Ethnobiology (registered in Arizona, USA) was established in 1977 with a first conference the following year in Prescott, Arizona. Volume 67 of Anthropological Papers

Table 3. Major phases in the recent history of Ethnobiology as a discipline, since 1950's onwards

Phase	Period	Fields and topics	Exemplary contributions*
Emic	1950`s to mid 1970's	Ethnosciences Linguistics Terms and taxonomies Popular medicine Phytochemistry Ethnopharmacology	Authors 1950s: **H. Conklin**; R.E. Schultes 1960's: D.J. Roger; S.Y. Hu; C. Lévi-Strauss; **Efron, Holmstedt & Kine** 1970s: B. Berlin; D.E. Breedlove, P.H. Raven; R. Ellen; E. Hunn; *N. Turner*; M. Bell; N. Bisset; R.I. Ford; *K. M. Peschel.* Journal: *Economic Botany*
Systemic	Late 1970's to 1991	Ecology & conservation Ethnotaxonomy TEK and its change Political economy and post-colonialism Bioprospecting Entheogens Archeobiology	Authors: N.L. Etkin; E.W. Davis; P.A.G.M. De Smet; J. Fleurentin; H. Fabrega; G.H.N. Towers; C.B. Heiser; O.R. Gottlieb; E.F. Anderson; E. Elisabetsky; G.A. Cordell; R.A. Bye; B. Holmstedt; P.A. Cox; L.A. Camino; N.G. Bisset; E. Messer; M.K. Nations; J.D. Phillipson; M.J. Plotkin; L. Rivier; P.J. Ross; F. Sandberg; R.E. Schultes; F.B. Walker. Journals: *J. of Ethnopharmacology, Economic Botany, Social Science and medicine, Fitoterapia, Human Ecology* Top 10 countries: USA (by far), UK, India, Canada, France, Netherlands, Brazil, Sweden, Mexico, China.
Contemporary	1992 to present	Indigenous rights & community development Globalization Sustainable development Food, medicine, health and agroecology Biocultural diversity Migrations and history Intracultural variation Global change Systems thinking Political ecology Research ethics and reflexivity	Authors: M. Heinrich; U.P. De Albuquerque; A. Pieroni; J. Van Staden; P. Van Damme; A. Begossi; R.W. Bussmann; N. Hanazaki; A.H. Ladio; A.J. Afolayan; J.T. Arnason; R.R.N. Alves; M. Rahmatullah; E. Elisabetsky; C.L Quave; M.A. Ramos; E. Rodrigues; A.M. Viljoen; I. Vandebroek; J. Vallès; M. Pardo-de-Santayana; M. Leonti; S. Ignacimuthu,; V. Reyes-Garcia; M.A. Khan; R. Jahan; A. Casas; D.D. Soejarto; M.J. Balick; E.O. Ajaiyeoba. Journals: *J. of Ethnopharmacology, J. of Ethnobiology and Ethnomedicine, Indian Journal of Traditional Knowledge, Economic Botany, J. of Ethnobiology, South African Journal of Botany, Pharmaceutical Biology, Biodiversity and Conservation, Acta Horticulturae* Top 10 countries: India, USA, Brazil, UK, China, South Africa, Italy, Spain, Mexico, Canada.

*Taking into account the limitations of a database search, Scopus was used to establish most productive authors, journals and countries from 1980 onwards. Authors for the period 1980–1991 include those with 2 or more publications in Scopus database. After 1991, exemplary works include those authors with 15 or more publications. Considered journals are also based on a Scopus search. Countries are referred by first author's affiliation.
In bold, authors coining the terms ethnoecology and ethnopharmacology. Sources: [19,40,51,68,,80,84].

published in 1978 devotes a series of articles to "[t]he nature and status of ethnobotany" [37]. By the year 1981, the first issue of the Journal of Ethnobiology is further published. The International Society of Ethnobiology is established in 1988 with a 1st Congress in Belem, Brazil which shaped the Declaration of Belem. Five years later, in the year 2003, the first volume of the journal *Ethnobotany Research & Applications* is released.

The ethnoecological and ethnopharmacological turns extend during the systemic period, while more countries engage in ethnobiological research, especially in Europe and emergent economies. Concepts such as bioprospecting, biodiversity, traditional ecological knowledge and biocultural diversity gained special relevance. In addition, attention to research ethics and reflexivity developed and grew since the 1990's. Whereas ethnographers and anthropologists had properly reflected on the ethical and interpretative implications of their research for at least four decades, field biologists and ethnobiologists started to consider issues relating to intersubjectivity, power relations in the field, the role of

the researcher and questions about rights and ownership over biological and cultural resources, at least two decades after ethnographers and anthropologists [3,4,14,83].

During these last contemporary times, several authored books, and most commonly edited books have been consecrated to the discipline—in a staggering proliferation—characteristic of the contemporary stage of the discipline. While in previous stages, most publications had a geographical or cultural concentration; recent endeavours are characterized by having a overarching scope. Examples, predominantly on ethnobotany include: *Ethnobiology, implications and applications* [73]; *Ethnobotany: evolution of a discipline* [79]; *Ethnobotany: a methods manual* [57]; *Plants, people and culture: the science of ethnobotany* [7]; *Ethnobotany: Principles and applications* [24] *Selected guidelines for ethnobotanical research* [3]; *Ehtnoecology: situated knowledge/located lives* [67]; *Ethnoecology: Knowledge, resources and rights* [42]; *Ethnobotany: a reader* [61]; *Ethnobiology at the millennium: past promise and future prospect* [39]; *Applied Ethnobotany: People, Wild Plant Use and Conservation* [25]; *Ethnobiology and biocultural diversity* [82]; *Women and plants: gender relations in biodiversity management and conservation* [47]; *Ethnobiology* [5]. Adding to these, edited books dealing with specific ethnic groups or geographical areas have continued to increase in recent decades.

The "People and Plants Initiative" (1992-2004) a collaborative effort by WWF, UNESCO-MAB, and RBGK became a significant program for ethnobiological initiatives and publication materials since the 1990's. This initiative has grown up in recent years into People and Plants international [74]. An additional publication series worth mentioning is *Advances in Economic Botany* from the New York Botanical Garden which has been publishing at irregular intervals 16 volumes since 1984. Another significant collection during more recent years is Berghahn books' series "Studies in environmental anthropology and ethnobiology" with 20 volumes being published since 2005, including both authored and edited books, and with Professor Roy Ellen as editor-in-chief [33]. Several of the titles in this series worth mentioning include: *Local science vs global science: Approaches to Indigenous Knowledge in International Development* [81]; *Travelling cultures and plants: the ethnobiology and ethnopharmacy of human migrations* [71]; *Landscape, process and power: Re-evaluating Traditional Environmental Knowledge* [46]; *Ethnobotany in the new Europe: people, health and wild plant resources* [69]; and *Landscape ethnoecology: Concepts of Biotic and Physical Space* [52]. Special issues in particular journals, add to the richness of sources in contemporary years too, such as volume 40 number 1 of *Anthropologica*, "L'Ethnobiologie / Ethnobiology" from 1998, and the special issue of volume 12 of the *Journal of the Royal Anthropological Institute* "Ethnobiology and the science of humankind" from 2006.

Since 1981 to 2013, more than 4500 articles, almost 900 reviews, in addition to more than 200 other document types can be accessed in Scopus bibliographic database including the words "ethnobotany, ethnobiology, ethnoecology, ethnozoology, ethnomicrobiology, ethnomedicine, ethnopharmacology, economic botany, ecological anthropology, environmental anthropology, biocultural diversity, ethnotaxonomy, folk classification or folk biology" in their titles, abstracts and/or keywords. These bibliographic references, obtained doing a search in Elsevier's-owned Scopus database—which holds more than 20,000 peer-reviewed journals and more than 50 million records—were used to explore major ethnobiological subjects, authors and journals in recent decades [80]. As the Scopus search results show, the USA, which had a tendency of being the country of affiliation of most researchers and publications, is now being equaled and even surpassed by countries such as India and Brazil. This shift is especially apparent around 2005. Journal articles on ethnobiology and cognate fields also increase in number and sources of publication almost exponentially in recent decades, peaking around the year 2010, while apparently plateauing or even decreasing thereafter. The amount of authors during the last decades researching about ethnobiological questions has also increased exponentially. Due to limitations of space, authors previously mentioned in Table 3 correspond to a small sample of current researchers, based on the Scopus search formerly explained, and are given mainly for reference and as much objectivity about research focus as possible.

To conclude this historical review, key concepts used to define ethnobiology in contemporary time are contrasted next. Schultes [78], for instance, when defining the discipline stresses notions such as "complete registration", "uses and concepts about plant life", and "primitive societies". Three years later, as a co-author with Von Reis [79], emphasis shifted to "human evaluation and manipulation of plant materials, substances and phenomena, including relevant concepts" still being restricted to "primitive or unlettered societies". Cotton [24], in a similar way, includes only "traditional peoples" in his definition, yet includes the idea of "mutual relationships", an influence of the ethnoecological systemic turn. Supplementary wide-ranging and systemic conceptualizations proposed around the 1990's, include "complex relationships of plants to present and past societies" [11], "field of biocultural inquiry, independent of any specific paradigm, yet rooted in scientific

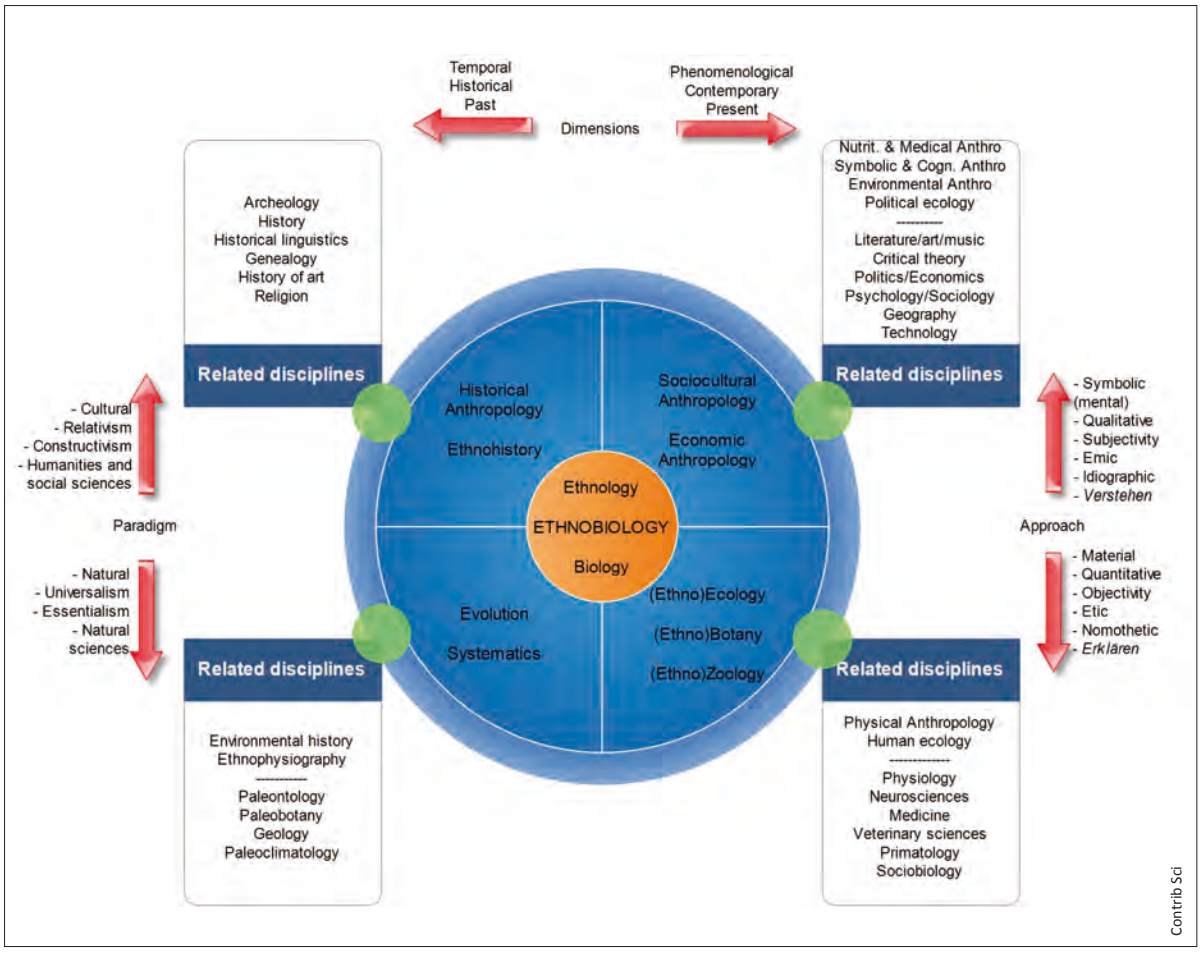

Fig. 1. Schematic view of contemporary ethnobiology (central orange and blue circles) in relation to other disciplines and areas of knowledge (outer rectangles), temporal dimensions (upper arrow dichotomy), along with dual paradigms and approaches (lateral arrow dichotomies). Figure adapted by author from [43].

epistemology" [6], "the science of people's interaction with plants" [86], or "the study of the interactions of plants and people, including the influence of plants on human culture" [7]. I adhere to definitions that are wide-ranging and do not exclude certain human groups, research foci or paradigms.

Major subdivisions and research foci amongst ethnobiologists

As outlined here, the ethnobiological field investigates the material and symbolic interrelationships—in space and time—between the environmental, biological, cultural, trans-cultural, counter-cultural, socioeconomic, political, philosophical, and psychological dimensions of human beings, and the rest of existing organisms, as well as the environment they all share [26]. In its reflexive aspect, ethnobiology is also concerned with the ideas that have been developed surrounding ethnobiological matters by academics and other professionals. It is therefore an area of enquiry that is holistic, both materialist and idealist, comparative, field-based, naturalistic, humanistic, and evolutionary; moreover, it ought to be reflexive, political and critical when necessary. A schematic view of the field of ethnobiology in relation to other disciplines and areas of study is presented in Fig. 1, showing the complexity and transdisciplinarity of the subject purported in the preceding historical section. Within most of the disciplines (including ethnobiology) a continuum between extreme paradigms and approaches also occurs internally, where middle ground perspectives are not rare.

Moreover, as has been shown while describing historical developments, ethnobiological studies can be classified according to several characteristics, including the major "parental" discipline or strand (biology or anthropology) and

within these, in relation to their specific areas or angles of study (Table 4).

While some of the thirty subdisciplines considered in Table 3 have existed since the first steps of the formation of the discipline (e.g., ethnobotany and ethnozoology), others have not been officially proposed yet (e.g., philosophical ethnobiology or religious ethnobiology). Clearly, natural scientists have been more preoccupied to subdivide the discipline than social scientists. Following the latter, it is not my intention here to fragment ethnobiology into independent pieces, but to give name to some of the derivations and perspectives that the discipline has had in the past and present, and their potential interconnections. As Carter suggested: "It is only because man has a finite brain that for ease of treatment we have split reality into small chunks, conveniently labeled biology, geology, pedology, botany, and so forth. We should never lose sight of the fact that the academic boundaries are but man-made, artificial divisions of convenience. At best they do violence to the unity of reality" [16]. Nonetheless, if ethnobiology was an undergraduate program *per se*, it should

Table 4. Typologies of ethnobiological research according to main strand (natural or cultural), along with some of their existing and suggested subdisciplines

Perspective	Subdisciplines	Area/Angle of study
Natural sciences (mainly biology)	Ethnobotany	Plant-culture relations
	Ethnomycology	Fungi-culture relations
	Ethnozoology	Animal-culture relations
	(e.g., ethnoornithology)	(e.g., bird-culture relations)
	Ethnomicrobiology	Microbe-culture relations
	Ethnoecology	Environment-culture relations
	(incl. ethnoagroecology)	(incl. agroecosystem-culture relations)
	Ethnopharmacology	Drugs-culture relations
	(≈ Ethnomedicine)	(≈ Health-culture relations)
	Paleoethnobiology	Pre-historical human-biota relations in the archeological record
	(≈ Archaeoethnobiology)	
	Evolutionary ethnobiology	Evolutionary theory applied to ethnobiology
	Holistic/Systemic ethnobiology	Complexity theory applied to ethnobiology
	(?) Ethnometeorology, ethnopedology, ethnohidrology	Meteorology- culture relations, soil- culture relations, water-culture relations
	(?) Zoopharmacognosy	Drugs-animal relations
	(≈Zoobotany)	
Social sciences & humanities (mainly anthropology & ethnology)	Cognitive/Linguistic ethnobiology	Language, ethnotaxonomy, cognition
	Socio-cultural & economic ethnobiology	Ethnography, sociocultural & economic aspects
	Critical/Political/Radical ethnobiology	Power and control, historical context, inequality
	Interpretive/Reflexive ethnobiology	Hermeneutics, reflexivity, autoethnography
	Ethnobiology of development & globalization	Modernization, urbanization, neoliberalism
	Psychological/Behavioral ethnobiology	Attitudes, explanations, behaviors
	Geography of ethnobiology	Space, landscape, migration, regional
	Historical ethnobiology	Historical perspective on culture-biota relations
	Artistic and literary ethnobiology	Culture-biota relations in the arts and literature
	Religious and sacred ethnobiology	Culture-biota relations in religious practices
	Legal ethnobiology	Culture-biota relations and legal affairs
	Philosophical ethnobiology	Philosophy in culture-biota relations
	History of ethnobiology	Temporal developments of the discipline
	(?) Metanarrative ethnobiology	Narratives of culture-biota relations
Miscellaneous (transversal)	Theoretical ethnobiology	Theoretical aspects in culture-biota relations
	Qualitative & quantitative methods	Methodological aspects of research
	Nutritional and medical ethnobiology	Food and health in culture-biota relations
	Pedagogical ethnobiology	Educational aspects in culture-biota relations
	Visual/Multimedia ethnobiology	Multimedia on culture-biota relations
	Computational ethnobiology	Quantification of culture-biota relations

Based on areas of study within ethnobiology attained performing a thorough bibliographic database search.

Table 5. Typologies of ethnobiological research according to main scientific paradigm, research aims and subject focus or topic considered by researchers. In some cases, mixed categories also exist

Element	Type	Main characteristics
Paradigm[a]	Realist ethnobiology	Materialist, positivist, empiricist, quantitative, etic, nomothetic
	Idealist ethnobiology	Symbolist, constructivist, subjectivist, qualitative, emic, idiographic
	Critical ethnobiology	Radicalist, interventionist, participatory, emancipatory, empowering
	Pragmatic ethnobiology	Pragmaticist, fallibilist, linking theory & practice, mixed methods
Aim[a]	Descriptive ethnobiology	Gives descriptions
	Causal ethnobiology	Looks for causality (explanation vs. understanding)
	Diagnostic ethnobiology	Tests concepts and methods
	Interventionist ethnobiology	Proposes an interference
	Revisionist ethnobiology	Reviews past or present disciplinary trends or concepts
	Radical ethnobiology	Challenges concepts and methods
Focus (& main topics)[b]	Uses of biota	Uses of plants (economic botany), fungi, animals and microbes
	Declarative and procedural knowledge	Nomenclature and classification systems, traditional ecological knowledge
	Molecules and pharmaceuticals	(TEK, IK) & its variation/transmission
	Socioecological systems	Secondary metabolites and other molecules, bioprospecting
	Symbols, agents and meanings	Agriculture, livelihoods, nutrition, medicine & the environment
	Access, power and control	Reflexivity, hermeneutics, beliefs, spirituality and consciousness
	Change	Critical, inequality, biopiracy, and property rights
		Development, modernization, migration & urbanization
		Biocultural diversity, conservation and transculturation
	Philosophy, theory and/or methods	Global change, adaptation and resilience
		Philosophical, ethical, theoretical and/or methodological aspects
Time frame[b]	Contemporary ethnobiology	Concurrent to the author's lifetime
	Historical ethnobiology	Dealing with times previous to the author's lifetime and the historical record
		Dealing with pre-historical times and the archeological record
	Paleoethnobiology	

[a]From various sources, especially [13] and secondarily [77].
[b]Based on [26,58,80].

include to my opinion a balance between some of these suggested subdisciplines, while the meticulous researcher will certainly explore a combination of these angles of study throughout his or her career. Certainly, most courses, seminars and congresses in ethnobiology rising during this new millennium, deal with one or several of these angles.

Adding to this classification into major subfields, basic and applied ethnobiological inquiries can also be subdivided according to paradigmatic frameworks followed by researchers (ontological and epistemological considerations), foremost research objectives (aims), main topic or focus of study, and the time frame considered in the study (Table 5).

As it is characteristic of other areas of human knowledge [88,91], the main tendencies within ethnobiological paradigms offered in Table 5 range between two main positions: on the one side preponderantly materialist, positivist, empiricist, quantitative, etic, and objectivist approaches most common in the natural sciences [36,62,41], and on the other idealist, symbolist, constructivist, qualitative, emic, and subjectivist approaches more frequent in the social sciences [1, 29,32,45,89]. Materialist paradigms tend to be experimental or quasi-experimental, correlational, reductionist, nomothetic, objectivist, for theory verification using deductive and retroductive logics, looking for causal explanation (*erklären*), and at times normative. Constructivist philosophies are, on the contrary, inclined to natural settings, phenomenology, context, hermeneutics, ideographic descriptions, intersubjectivism, interpretivism, ethnography, looking for interpretive understanding (*verstehen*) and theory generation by inductive and abductive logics [13,21,60]. To this classical disjunction, one could add two additional paradigms less represented in ethnobiological literature: the so-called critical,

radicalist or transformative approach, and the pragmatist or pragmaticist stance. The first is characterized by being participatory, emancipatory, interventionist, seeks advocacy, radically questions previous paradigms, and is oriented to empowerment issues and change [15,35]; the second and least common in ethnobiological inquiries, is concerned in linking theory and practice, epistemological aspects of research, anti-reifying concepts and theories, using mixed-methods approaches, fallibilism, as well as is in naturalistic and instrumentalist assumptions [66]. These four paradigmatic approaches can, in fact, be reconciled, integrated into a perspective that includes multiple standpoints in research design, as can be seen in several of the edited books on the discipline, including materialist, symbolist and critical perspectives.

Moreover, six main foci of study can also be distinguished when considering the literature: the descriptive (where descriptions of certain organisms, relations or phenomena are given), the causal (where a search for underlying reasons are sought either explaining or understanding), the diagnostic (where concepts or methodologies are tested), the interventionist (where some interference is proposed), the revisionist (where a review of historical or current trends of a certain aspect are analyzed), and the critical (where a challenging examination of theories and methods is performed). As occurred before, these foci combine in myriad of ways in the different works consulted and referenced in this review and elsewhere. Eight major broad research foci have also been linked to ethnobiological research in Table 5, with over 40 distinct narrower topics. Usually linked to the distinct subdisciplines presented earlier (Table 4), these foci include: Uses of biota such as animals of plants; declarative and procedural knowledge; molecules and pharmaceuticals; socioecological systems such as agroecosystems or medical systems; aspects dealing with symbolic representations, agency and meaning; questions of access, power and control; change both local and global; along with philosophical, theoretical and/or methodologi-

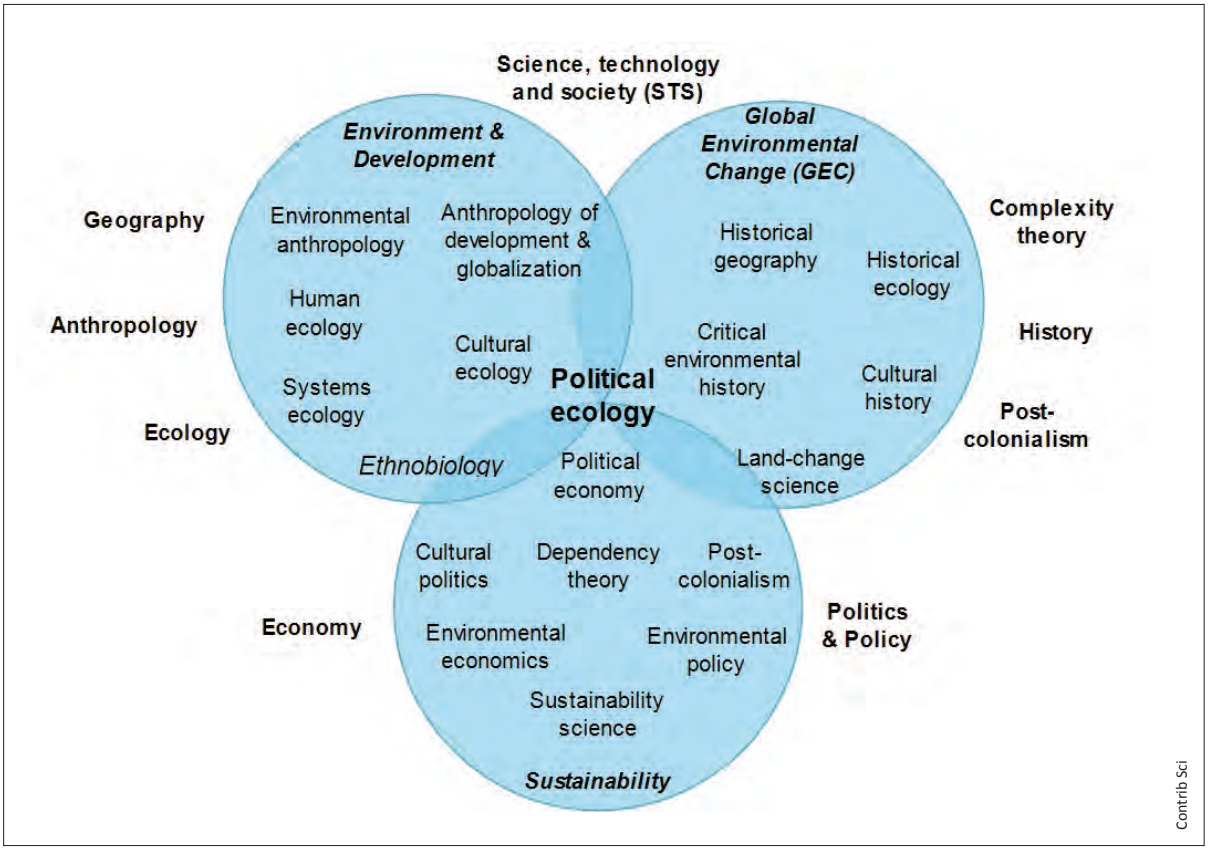

Fig. 2. Political ecology (center) at the intersection of 3 major research themes (blue circles). Other social and environmental disciplines (bold, outside the circles) and subdisciplines (non-bold inside the circles) interested in those themes are also taken into consideration. Blue circles correspond to overarching and pandisiciplinary research themes, highly similar to some of ethnobiological foci. Adapted from [87].

cal foci. Lastly, most foci have been studied in 3 main distinct time frames, including contemporary, historical and archeological records.

Interconnections between ethnobiology and political ecology, with supplementary future directions

To conclude, a final reflection is given on future directions of ethnobiological research as well as recent hybridizations between ethnobiology, and other fields of study. Especially connecting with political ecology and ethnobiological change, I propose herein for a critical ethnobiology, that is, the consideration of critical theory, and the application of political ecology and economy for the growth of our discipline, along with the effects of social inequality, control and power relations on ethnobiological processes, phenomena, transformations and conceptualizations. Finding this ethnobiology-political ecology nexus is nothing new [2,40], but putting it into new contexts and situations may help to develop new research frameworks [26]. In brief, political ecology is the study of the relationships between political, economical and social agency and structure, with environmental issues and changes. The term, coined in 1935 by Frank Thone [85], became newly popular in the 70's and 80's through the works of Cole [22], Wolf [90], and Enzensberger [34]. The importance of the term arose from the recognition that investigating local ecological changes required analysis of the influences of larger socioeconomic and political forces on local land use decision-making [63]. Three major research themes of interest here are investigated in political ecological terms: environment and development issues, global environmental change, and sustainability (Fig. 2).

Political ecology differs from apolitical ecological studies by politicizing environmental issues and phenomena, and can be a fruitful framework to analyze ethnobiological phenomena as well. Several concepts in political ecology resonate with ethnobiological spheres too. For political ecologists, for example, hybridity is a valuable concept for understanding the transgressive, generally favorable effects of integrations of myriad types. In postcolonial and postdevelopment theories, hybridity has functioned as a powerful idea with which to confront preset and detached theoretical conceptions [76]. In evolutionary biology, hybridity demonstrates the preponderance and relevance of symbiosis, chimeric organisms, and the consequent reticular evolution, quite opposite to that of the prevalent 'competition, arboreal evolution, and survival of the fittest' paradigm [56]. In other disciplines, such as political ecology, it has also served as an incisive appraisal of modernist binaries and normative conjectures based on long-standing concepts of division and directionality. If theorized as a process, hybridity is an important and useful theoretical concept in nature-culture studies and a potential space within which transformation can, and does, indeed occur. Articulation and conjuncture are another two key concepts of political ecology [55,70] worth tying with ethnobiology. Articulation acknowledges the prearranged quality of different ethnobiological characteristics yet gives importance to the contingency of the ways in which, at specific conjunctures, they are coupled or articulated. Conjuncture, on the other hand, challenges us to examine unique biologies, anthropologies, histories and geographies, without losing track of their connection to explanations of identity, livelihood and landscape, which tend to be produced across diverse temporal and geographical scales [64,65].

To finish this review, while adding to the connections between ethnobiology and political ecology, some of the most promising recent derivations of nature-culture relational studies worth reflecting include aspects of global change and conservation, food and health transitions, symbolic and interpretive approaches, human migrations, urban environments, as well as the application of complexity theory into the discipline. These and other topics will continue to provide nuanced information and more refined methodologies in the following years. As several authors have pointed out [27], quantitative and computational ethnobiology will also be a subdiscipline that will continue to develop in future years, both in terms of data collection techniques, as well as data management and analysis procedures. Combined with the permanent development of newer technologies of information and communication, quantitative approaches will bring highly relevant information to the table. Coupled with future advances in qualitative as well as mixed-methodologies, fieldwork will be greatly enriched with innovative techniques. Urban and peri-urban ethnobiology will surely benefit urban life in an ever-increasing population moving to cities, where aspects such as urban food gardens, multicultural markets, pets-citizens relations, socioenvironmental academic institutions and researchers, users of new entheogens, along other ethnobiological processes will bring fruitful discussions to future ethnobiologists, and most importantly answer important questions and solve pertinent problems. Cyborg ethnobiology may be a little premature to envision, but several new frontiers will surely open with still-unknown upcoming technologies and machinery. Political ethnobiolo-

gy—tightly linked to political ecology in its various forms, as well as with the value of historical considerations in ethnobiological inquiry—will presumably continue to grow too. As greater concern is given to reflexivity and local participation, autoethnography becomes a future prospect in ethnobiological research already being used by several groups. Obtaining ethnobiological data directly by local communities may bring new perspectives and considerations into the discipline and to their own development, with consequences still unknown.

Conclusions

Clearly, it has been not my intention to cover here all historical developments, paradigmatic aspects, authors, or areas of study within this and supplementary ethnobiological literature, one main reason being that the more one digs into the foundations and philosophy underlying the discipline, the more complex the network of interrelations becomes, both within and between other subjects. Hence, only a preliminary account is given here, with supplementary sources being remarked throughout the text for further reference. Moreover, when reviewing the literature a main limitation arises from the amount of languages one is able to read and the materials one is able to access. This is why I have included here works mostly in English and secondarily in Romance languages, especially Spanish, Portuguese and French. Unfortunately, this sets aside other potential works especially in Asian, African and Amerindian languages. A different limitation arises from the constant evolution of terms, concepts and even disciplines, hence recording the temporal transformation of concepts is key for historical reconstructions, but hard to fully achieve even in an unlimited space. Still an added constraint happens from restricted access to certain published materials, as most sources require institutional access or payment. I have done my best to minimize these drawbacks.

Ethnobiology's triple roots and character, between the natural sciences, the social sciences, and the humanities provide to the discipline reminiscence to European Renaissance times, when distinctions between areas of knowledge lied elsewhere. This may be just one of the main reasons explaining the relatively small, except during recent years, of robust theoretical frameworks, all-encompassing definitions, key concepts within the discipline, reflexivity and self-analysis, along with some of their epistemological grounds and consequences. Ethnobiology allows us to produce and combine varied views on human circumstances and practices with regard to the biological world (hence ourselves), when recognized in its totality. The interfacial nature of the discipline permits, in fact requires, the bridging of qualitative and quantitative research, material and symbolic considerations, with emic and etic viewpoints. This mixed-methods approach is increasingly encouraged and promoted by academic and research institutions in disparate fields. Nonetheless, this paradigmatic integration inevitably brings about a number of ontological and epistemological nuisances, as these matters rest mostly on a host of interpretive presumptions. Even so, through this review, I hope to expand upon the traditions of ethnobiology, in ways that help to broaden the field, bringing into it issues of past, present and future developments, as well as their relation to a myriad of authors, foci, and main concepts.

Citations throughout the text indicate that there is a growing body of literature on ethnobiology both based on field research as well as taking into consideration more theoretical and historical perspectives. An interesting contradiction arises from intending to establish a grand theory for ethnobiology, hence trying to separate it from other fields of study, while at the same time considering its necessity to merge with other approaches and frameworks. This may be linked to the difficulty of imposing boundaries on a continuum—such as reality—along with the need for greater ontological and epistemological discussion in ethnobiological research, helping to structure contradictory yet complementary theoretical frameworks and models. While this review has concentrated on a variety of theoretical aspects of ethnobiological research it does not, as yet, integrate them fully. Due to the holistic and pluridisciplinary nature of ethnobiology in general, along with the proliferation of academic subdisciplines, publications and viewpoints, finding strong and robust paradigmatic, theoretical, conceptual frameworks and meta-narratives engendered, are important challenges and undertakings within future ethnobiological inquiry. As Martin proposed right at the turn of the millennium, ethnobiology is in search of a new synthesis [58]. It gives the impression this broader definition may be starting to take place as ethnobiology keeps expanding into new representations and conceptualizations of human-biota relations.

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References

1. Alexiades MN (1999) Ethnobotany of the Ese Eja: Plants, health, and change in an Amazonian society. Doctoral Thesis. CUNY

2. Alexiades MN (2003) Ethnobotany in the Third Millennium: Expectations and unresolved issues. Delpinoa 45:15-28
3. Alexiades MN, Sheldon JW (1996) Selected guidelines for ethnobotanical research: a field manual. New York Botanical Garden, New York
4. Alexiades MN, Peluso DM (2002) Prior-informed consent: the anthropology and politics of cross-cultural exchange. Earthscan, London
5. Anderson EN, Pearsall D, Hunn EN, Turner N (2011) Ethnobiology. Wiley-Blackwell, London
6. Balée W (1994) Footprints of the forest: Ka'apor ethnobotany—the historical ecology of plant utilization by an Amazonian people. Columbia University Press, New York
7. Balick MJ, Cox PA (1996) Plants, people and culture: The Science of Ethnobotany. Scientific American, New York
8. Bennett BC (1996) A discipline in search of a definition. Book review of Ethnobotany: Evolution of a discipline. Timber Press. BioScience, Portland
9. Bennett BC (2002) Ethnobotany and economic botany: subjects in search of definitions. Encyclopedia of life support systems (EOLSS), Eolss Publishers, Paris
10. Berlin BC (1973) Folk systematics in relation to biological classification and nomenclature. Annu Rev Ecol Syst 4: 259-271
11. Berlin BC (1992) Ethnobiological classification: Principles of categorization of plants and animals in traditional societies. Princeton Univ. Press, Princeton
12. Berlin BC, Breedlove DE, Raven PH (1974) Principles of Tzeltal plant classification. An introduction to the botanical ethnography of a Mayan-speaking people of highland Chiapas. Academic Press, New York
13. Blaikie N (2010) Designing social research: the logic of anticipation. Polity Press, Malden
14. Boom BM (1990) Ethics in ethnopharmacology. Museu Paraense Emílio Goeldi, Belém, Brazil
15. Brosius JP, Tsing A, Zerner C (2005) Communities and conservation: histories and politics of community-based natural resource management. Altamira Press, Lanham
16. Carter GF (1950) Ecology, geography, ethnobotany. The Scientific Monthly, 70:73-80
17. Castetter EF (1935) Uncultivated native plants used as sources of food. Ethnobiological studies in the American Southwest I, Biological Series 4:1-44 University of New Mexico Bulletin 266, Albuquerque
18. Castetter EF (1944) The domain of ethnobiology. American Naturalist 78:158-170
19. Clément D (1998a) L'Ethnobiologie/Ethnobiology. Anthropologica 40:7-34
20. Clément D (1998b) The historical foundations of ethnobiology (1860-1899). J Ethnobiol 18:161-187
21. Creswell JW (2003) Research design: qualitative, quantitative, and mixed methods approaches (2nd edn). Sage, Thousand Oaks, CA
22. Cole JW (1972) Cultural adaptation in the Eastern Alps. Anthropological Quarterly 45:158-176
23. Conklin HC (1954) The relation of Hanunoo culture to the planl world. Ph.D. dissertation. Yale University, New Haven, CT
24. Cotton CM (1996) Ethnobotany. Principles and applications. Wiley, London
25. Cunningham A (2001) Applied ethnobotany: People, wild plant use and conservation. Taylor and Francis, Philadelphia
26. D'Ambrosio U (2013) Ngäbe agroculinary transitions in Costa Rica. PhD Dissertation. University of Kent at Canterbury, United Kingdom
27. De Albuquerque UP, Hanazaki N (2009) Five problems in current ethnobotanical research—and some suggestions for strengthening them. Hum Ecol 37:653–661
28. De Candolle A-P (1815 [1813]) Théorie élémentaire de la Botanique ou Exposition des Principes de la Classification naturel1e et de l'art de décrire et d'étudier les vegetaux. Deterville, Paris
29. Descola P (1994) In the society of nature: A native ecology in Amazonia. Cambridge University Press, Cambridge, UK
30. Efron DH, Holmstedt B, Kline NS (1967) Ethnopharmacologic search for psychoactive drugs. Government Printing Office, Washington, DC, USA
31. Ellen RF (1978) Nuaulu settlement and ecology. The environmental relations of an eastern Indonesian community. No.83. Martinus Nijhoff, The Hague
32. Ellen RF (1986) Ethnobiology, cognition, and the structure of prehension: Some general theoretical notes. J Ethnobiol 6:83-98
33. Ellen RF (ed.) (2006) Ethnobiology and the science of humankind. J Roy Anthropol Inst, 12
34. Enzensberger HM (1974) A critique of political ecology. New Left Rev 8:3-32
35. Escobar A (1998) Whose knowledge? Whose nature? Biodiversity, conservation, and the political ecology of social movements. J Polit Ecol 5:54-82
36. Etkin NL (1988) Ethnopharmacology: Behavioural approaches in the anthropological study of indigenous medicines. Annu Rev Anthropol 17:23-42
37. Ford RI (1978) Ethnobotany: Historical diversity and synthesis. University of Michigan Museum of Anthropology, Michigan
38. Ford RI (1985) Anthropological perspective of ethnobotany in the Greater Southwest. Econ Bot 39:400-415
39. Ford RI (2001) Ethnobiology at the millennium: past promise and future prospect. University of Michigan Museum, Michigan
40. Ford RI (2011) History of ethnobiology. Wiley-Blackwell, London
41. Godoy R, Reyes-Garcia V, Broesch J, Fitzpatrick IC, Giovannini P, Martinez MR, Huanca T, Leonard WR, Mcdade TW, Tanner S (2009) Long-term (secular) change of ethnobotanical knowledge of useful plants: Separating cohort and age effects. J Anthropol Res 65:51-67
42. Gragson T, Brount B (1999) Ethnoecology: Knowledge, resources and rights. University of Georgia Press, Athens
43. Haller D (2011) Akal-Atlas de etnología. Ediciones AKAL, Madrid
44. Harshberger JW (1896) Purposes of ethnobotany. Bot Gaz 21:146-154
45. Heckler ST (2004) Cultivating sociality: Aesthetic factors in the composition and function of Piaroa homegardens. J Ethnobiol 24:203-232
46. Heckler S (2009) Landscape, process and power: Re-evaluating traditional environmental knowledge. Berghahn Books, Oxford
47. Howard P (2003) Women and plants: Gender relations in biodiversity management and conservation. Zed Books, London
48. Hunn ES (1970) Cognitive processes in folk ornithology: the identification of gulls. Language Behavior Research Laboratory, Berkeley
49. Hunn ES (1974) Tzeltal folk zoology. The classification of discontinuities in Nature. Ph.D. Dissertation. University of California, Berkeley
50. Hunn ES (1977) Tzcltal folk zoology: The classification of discontinuities in nature. Academic Press, New York
51. Hunn ES (2007) Ethnobiology in four phases. J Ethnobiol 27:1–10
52. Johnson LM, Hunn ES (2012) Landscape ethnoecology: Concepts of biotic and physical space. Berghahn Books, Oxford, New York
53. Jones VH (1941) The nature and scope of ethnobotany. Chronica Botanica 6:219-221
54. Jones VH (1957) The development and present status of ethnobotany in the United States. Huittième Cong- Internat. de Botanique, Paris
55. Latour B (1993) We have never been modern. Harvard University Press, Cambridge
56. Margulis L (1981) Symbiosis in cell evolution. W.H. Freeman, New York
57. Martin GJ (1995) Ethnobotany: A methods manual. Chapman and Hall, London
58. Martin GJ (2001) Ethnobiology and ethnoecology. Encyclopedia of Biodiversity, 2:609-621
59. Mason OT (1899) Aboriginal American zootechny. American Anthropologist 1:45-81

60. Mertens DM (2005) Research methods in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods. Sage, Thousand Oaks, CA
61. Minnis PE (2000) Ethnobotany: A reader. University of Oklahoma Press, Oklahoma
62. Monteiro JM, Albuquerque UP, Lins-Neto EMF, Araújo EL, Amorim ELC (2006) Use patterns and knowledge of medicinal species among two rural communities in Brazil's semi-arid northeastern region. J Ethnopharmacol 105:173-186
63. Moore DS (1996) Marxism, culture, and political ecology: environmental struggles in Zimbabwe's eastern highlands. Routledge, London
64. Moore DS (1998) Subaltern struggles and the politics of place: remapping resistance in Zimbabwe's eastern highlands. Cultural Anthropology 13:344-381
65. Moore DS (1998) Clear waters and muddied histories: environmental history and the politics of community in Zimbabwe's eastern highlands. J Southern African Studies, 24:377-403
66. Morgan DL (2007) Paradigms lost and pragmatism regained: methodological implication of combining qualitative and quantitative methods. Journal of mixed methods research, 1:48-76
67. Nazarea VD (1999) Ehtnoecology: situated knowledge/located lives. University of Arizona Press, Tucson
68. Pardo-de-Santayana M, Pieroni A, Puri RK (2010a) The ethnobotany of Europe, past and present. In: Pardo-De-Santayana MA, Pieroni A, Puri R. Berghahn Press, Oxford
69. Pardo-de-Santayana M, Pieroni A, Puri RK (2010b) Ethnobotany in the New Europe: People, health and wild plant resources. Berghahn Books, Oxford, New York
70. Peet R, Watts M (1996) Liberation ecology: Development, sustainability, and environment in an age of market triumphalism. Routledge, London
71. Pieroni A, Vandebroek I (2009) Traveling cultures and plants. The ethnobiology and ethnopharmacy of human migrations. Berghahn Books, Oxford, New York
72. Powers SJ (1875) Aboriginal botany. California Academy of Sciences Proceedings 5:373-379
73. Posey DA, Overal WL (eds) (1990) Ethnobiology, implications and applications: proceedings of the First International Congress of Ethnobiology. Museu Paraense Emílio Goeldi, Belém
74. PPI (People and plants international) (2014) Official web site. 10 April 2014 [Online] Available at: http://peopleandplants.org/
75. Rodríguez E, Wrangham RW (1993) Zoopharmacognosy: The use of medicinal plants by animals. Plenum, New York
76. Said E (1978) Orientalism. Vintage books, New York
77. Saunders M, Lewis P, Thornhill A (2006) Research methods in business. Pearson Education Limited, London
78. Schultes RE (1992) Ethnobotany and technology in northwest Amazon: A partnership. Island Press, Washington DC
79. Schultes RE, Von Reis S (1995) Ethnobotany: Evolution of a discipline. Dioscorides Press, Portland
80. Scopus (2014). Bibliographic database Elsevier. Accessed 2 April 2014 [Online] Available at: http://www.elsevier.com/online-tools/scopus
81. Sillitoe P (2006) Local science vs global science: Approaches to indigenous knowledge in international development. Berghahn Books, Oxford, New York
82. Stepp JR, Wyndham FS, Zarger RK (2002) Ethnobiology and biocultural diversity. Georgia University Press, Georgia
83. Society for Economic Botany (SEB). (1994) Code of ethics. 14 March 2014 [Online] Available at: http://oldsite.econbot.org/_about_/index.php?sm=03
84. Svanberg I, Łuczaj L, Pardo-de-Santayana M, Pieroni A (2011) History and current trends of ethnobiological research in Europe. Wiley-Blackwell, London
85. Thone F (1935) Nature rambling: We fight for grass. The Science Newsletter 27:14
86. Turner N (1995) Ethnobotany today in northwestern North America. Dioscorides Press, Portland
87. Turner BL, Robbins P (2008) Land-change science and political ecology: Similarities, differences, and implications for sustainability science. Annu Rev Environ Resour 33:295-316
88. Valles M (1997) Técnicas cualitativas de investigación social: reflexión metodólógica y práctica profesional. Editorial Síntesis, Madrid
89. Waldstein A, Adams C (2006) The interface between medical anthropology and medical ethnobiology. J Roy Anthrop Inst S95-S118
90. Wolf E (1972) Ownership and political ecology. Anthropol Quart 45:201-205
91. Zent S (1996) Behavioural orientations toward ethnobotanical quantification. New York Botanical Garden, New York

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Resum. Com en d'altres camps de l'activitat científica, l'etnobiologia s'ha diversificat considerablement al tombant del nou mil·lenni. A pesar dels esforços fets durant els últims anys, la disciplina encara dóna la impressió de trobar-se en la necessitat d'establir la seva identitat respecte camps d'estudi millor definits. Amb la intenció de reduir aquestes mancances, la present revisió analitza breument els fonaments multidisciplinaris de l'etnobiologia i la seva diversificació paradigmàtica, teòrica i conceptual en dècades recents. Aquest camp d'estudi és caracteritzat en aquest text com a "la investigació de les interrelacions materials i simbòliques entre els humans i la resta d'organismes vius". Es proposen i delimiten bàsicament les principals perspectives etnobiològiques, possibles subdivisions, principals focus de recerca, i temes preponderants, així com també les aproximacions paradigmàtiques primordials i les finalitats polièdriques comunes en aquesta branca del coneixement. Les relacions i hibridacions entre l'etnobiologia i l'ecologia política amb una perspectiva crítica conclouen la revisió, oferint unes conjectures finals sobre els passos i reptes futurs entre els professionals de l'etnobiologia.

Paraules clau: història de l'etnobiologia · subdivisions etnobiològiques · paradigmes etnobiològics · focus de recerca · etnobiologia crítica