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Toward an Historical Agroecology: an academic approach in which time and space matter

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ABSTRACT

We pose that Agroecology, which is already a hybrid science, is further overcoming disciplinary isolation and stagnation through explicit processes of interdisciplinary recombination, in what might be termed "second generation hybridization". We refer to the intellectual contact zone of Agroecology – mainly with Cultural Geography, Historical Ecology, Archeology, Ecological Anthropology, and Ethnoecology – as "Historical Agroecology". We discuss the following five theoretical methodological foundations of our proposal toward an Historical Agroecology: (1) regional agroecological histories, (2) agroecological landscapes as palimpsests: human-mediated disturbances and their cumulative effects, (3) alpha and beta as agrobiodiversity on the table: manifestations of human niche construction, (4) agroecological *ethos* as landscapes of knowledge, and (5) infrapolitics and collective action as other forms of agroecological resistance aside from social movements. We illustrate these points through case studies based on our research in peasant communities of the Maya lowlands in the Mexican states of Yucatan, Chiapas, and Campeche. We conclude by reflecting on the need to further develop historical agroecological perspectives in those regions with agricultural systems that have resulted from profound diachronic legacies that are spatially rooted in broad geographical areas.

KEYWORDS

Agroecology; interdisciplinary hybridization; historical contingency; palimpsests; Maya lowlands

Introduction

The term "Agroecology" was initially used scientifically in a very vague manner in Europe from the 1940s to the 70s, and in the 1980s began to be used in other parts of the world such as Latin America and the U.S. (Altieri and Nicholls 2017; Wezel et al. 2009). "Deep Mexico" should be considered as a center of theoretical development in Agroecology, given that in 1976, based on agronomic and ecological studies of traditional agriculture of the Maya of Yucatan and the Chontal Maya of Tabasco, Efraím Hernández-Xolocotzi first coined the concept of

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agroecosystem and, in 1981, Steve Gliessman formally defined agroecology as the study of the ecological foundations of agriculture (Astier et al. 2017; Rosado-May 2015). By the 1980s and 90's, these foundational concepts were embellished by John Vandermeer's studies on Agricultural Ecology, Miguel Altieri's alternative agriculture, Eduardo Sevilla-Guzmán's Agricultural Sociology, Peter Rosset´s food politics, Cuba´s experience of ecological agriculture after withdrawal of support by the Soviet Union, radical criticisms of the Green Revolution by grassroots and environmentalist organizations – principally in Brazil, and the Farmer to Farmer movement in Central America and Mexico (see, for example, da Costa et al. 2017; Funes et al. 2002; Sevilla-Guzmán and Woodgate 2014; Holt-Giménez 2006). By the turn of the century, Agroecology was not only considered to be an emerging science, but also a technical practice and a social movement (Wezel et al. 2009).

Just a few years after its emergence, each of these three dimensions of Agroecology has advanced notably. As a technical practice, many small-scale peasant groups have incorporated agroecological concepts and practices into their self-provisioning agriculture; commercial farming in rural and urban areas has transitioned toward Agroecology, together with a broad range of alternative agricultural markets; and many urban residents have returned to the countryside, through a process of re-peasantization (Altieri and Toledo 2011; Nigh and González Cabañas 2015; van der Ploeg 2010). As an example of an agroecological social movement, Via Campesina is an autonomous, ideologically diverse, multicultural political movement with a global agenda of over 200 million farmers from 73 countries in five continents. By placing pressure on international organizations, Via Campesina seeks to legitimate food sovereignty as a way of promoting social justice and water and seed rights, achieving holistic redistributive land reform, and dismantling agribusiness´s monolithic power (Desmarais 2007; Rosset and Martínez-Torres 2016). Finally, in order to further Agroecology as a science, research teams and postgraduate programs focusing on training scientists in this new field have been developed in a growing number of universities. Agroecology as a science has evaluated different territorial scales – from agricultural plots to ecosystems, while taking into account agri-food systems and public policy, and involving participatory methodological approaches that incorporate peasant knowledge as well as analysis from a broad range of academic fields (Francis et al. 2003; Mendez, Bacon, and Cohen 2013; Wezel and Soldat 2009).

As has occurred with other areas of knowledge such as Ecology, Geography, and Anthropology, Agroecology as a field under construction appears to be overcoming disciplinary isolation which might occur without interaction with other fields of knowledge (Dogan and Pahre 1993). Much of this has to do with the fact that Agroecology itself is what Toledo, Alarcón-Cháires, and Barón (2009) term a "hybrid discipline" – a field of knowledge which has resulted from interaction among several disciplines in a chance manner. Thus, Agroecology is a first-generation hybrid discipline between Agronomy and Ecology. However,

more recent explicit intentional cross-disciplinary recombination has resulted in a long list of adjectives modifying Agroecology as second-generation hybrid disciplines: Political, Agri-food, Economic, Territorial, Pedagogical, Conservation, Development agroecology, as well as Agroecology of Complexity (Benítez 2018; Gliessman 2015; González de Molina et al. 2019; McCune, Reardon, and Rosset 2014; Toledo and Barrera-Bassols 2017; Vandermeer and Perfecto 2017; Wezel et al. 2016).

The present study seeks to contribute to this second-generation hybridization of Agroecology as a framework of action research that is continually being renovated and is eclectic, adaptive, and postnormal. We propose an Historical Agroecology, which takes into account various theoretical-methodological frameworks over time and across geographies to contribute to Agroecology´s search for a transition toward sustainable food systems by designing, managing, and defending a type of agriculture which follows ecological and social justice principles. With the objective of developing this explicit, intentional recombination of disciplines which were already hybrid, we employ the notion of an "intellectual contact zone" (Meyer and Crumley 2011; Pratt 1991) to precisely outline new contributions that may promote exchanges between Agroecology and other disciplinary fields – principally geographical, anthropological, and archeological. We present the foundations of our proposal toward a Historical Agroecology, pointing out the theoretical-methodological contribution of each re-combination among disciplines, and illustrate our postulates based on analysis of cases in the Maya lowlands of Mexico – our principle geographic area of research which has received notable interdisciplinary scrutiny and has contributed significantly to the budding field of Agroecology.

Methodological approach

This study is based on a methodological perspective that combines ethnographic research and case studies (Creswell 1998). The ethnographic approach is used to study the meanings and implications of a cultural group´s daily life – or some aspect of it – through participant observation. This approach allows for prolonged immersion in a study area in order to carry out other methodological approaches, including life histories, interviews, secondary data analysis, and participatory mapping (Atkinson and Hammersley 1994; Bernard 2011). Ethnographies consist of multiple case studies employed in a complementary manner to more thoroughly explore a topic and generate theoretical postulates (Stake 1995; Yin 1994).

The first case study is of the region locally known as *Otoch Ma'ax Yetel Kooh* (Yucatec Mayan for House of the Monkey and the Jaguar, OMYK) and involves an ethnography with an Ethnoecological and Political Ecology

perspective carried out since 2102 by the two first authors of the present study. OMYK is a 5,367 ha landscape in the Yucatan Peninsula consisting of a broad variety of vegetation types (high jungles and medium semideciduous forests, low floodable jungles, floodable marsh grasslands, and secondary vegetation in different successional stages), associated with a complex system of lagoons, sinkholes, and large seasonally flooded depressions, with a wide variety of wild fauna; for this reason, in 2002 it was declared a Natural Protected Area, under the Flora and Fauna Protection category (García-Frapolli et al. 2007). As shown in Figure 1, OMYK is located on the border between the states of Quintana Roo and Yucatan, 18 km from the Coba Archeological Site. Since the 1950s, three small villages have occupied the area, with a total population of 350 inhabitants. These individuals originally came from the Maya municipalities of Xocén and Chemax, as well as Muyil. Currently, the communities carry out a strategy of use of a variety of natural resources, combining *milpa* (swidden-based polyculture consisting of corn, beans, squash, and other annual crops), family gardens, beekeeping, backyard animals, and traditional hunting with the more recent economic endeavors of ecotourism, handcraft production, and assistance with scientific studies (Rivera-Núñez 2014; Toledo et al. 2008).

The second case study is an ethnography with an Ecological Anthropology and Historical Ecology perspective that the third author of the present study has been carrying out for over 40 years in the Lacandon Maya village of *Lacanja' Chansayab* (LCh), in northeastern Chiapas state,

Figure 1. Location of the case studies in the Maya Lowlands.

municipality of Ocosingo (Figure 1) in high evergreen forests and medium sub-deciduous forests surrounding the Lacantu'n River (Nigh 2008). The village has approximately 300 inhabitants. The Lacandon Maya defines themselves as *jalach' winik* (Lacandon Mayan for "true men"), as they have inhabited the territory for over 200 years and have developed a way of life which is highly interrelated with the jungle (De Vos 2002; Marion Singer 2000; Nations and Nigh 1980). Although it is believed that this cultural group is descended from other Maya groups, they practice a complex natural resource management system, which includes *milpa* cultivation for self-provisioning, although recently ecotourism has become their principle economic activity (Pastor-Alfonso, Gómez López, and Espeso-Molinero 2012; Trench 2005).

The final case study involved a secondary analysis based on an ethnography with an Agri-food and Ethnobotanical perspective which Diana Cahuich and Ramón Mariaca have been carrying out since 2011 in the rural village of *Ejido X-Mejía* (EXM) (Cahuich-Campos and Mariaca-Méndez 2014; Mariaca Méndez 2012) in the municipality of Hopelchén, Campeche (Figure 1). This village is located north of the Calakmul Archeological Site and Biosphere Reserve (Cahuich-Campos, Huicochea Gómez, and Mariaca-Méndez 2014). EXM´s vegetation is dominated by medium sub-evergreen forests and sub-deciduous forests, and to a lesser extent sub-deciduous low floodable jungles (Porter-Bolland, Sánchez González, and Ellis 2008). EXM has 477 Yucatec Mayan speaking inhabitants. Their livelihood is based on *milpa* cultivation, family gardens, beekeeping, cattle raising, traditional hunting, and extraction and collection of firewood and herbaceous plants from the *monte* (the wild) (Cahuich-Campos 2012).

Contribution to foundations of a Historical Agroecology

In this article we propose a historical agroecology that would provide an inter- and transdisciplinary study of historical agricultural landscapes based on holistic diachronic analyses in order to contribute to their permanence or their transition based on the following agroecological principles: above and below ground (agro) biodiversity; sustainable natural resource management; minimal use of industrial inputs; just agri-food systems; horizontal relationships among farmers; healthy, diversified seasonally and culturally appropriate diets; political self-determination; and rootedness of spirituality in the Earth (Brym and Reeve 2016; Gliessman 2015; Parmentier 2014; Wibbelman et al. 2013).

Unlike the majority of academic approaches to Agroecology, rather than focusing on the agroecosystem as a unit of analysis we propose the notion of palimpsest [from the Greek "palimp" (again) and "psestos" (written)] to represent historical landscapes (Bailey 2007) in which successive temporal layers of relationships between society and the rest of nature occur through

agriculture, broadly understood to include horticulture, livestock raising, forestry, gathering, hunting, beekeeping, and fishing and other aquiculture systems, often in an integrated manner. Many authors understand an agroecosystem to be an agriculturally anthropized ecosystem made up of subsystems consisting of flows of matter, energy, and information in equilibrium (Altieri 1987; Conway 1987; Harper 1974; Hernández Xolocotzi 1977; Odum 1984). Rather than focusing on systemic ecological and biological foundations of the concept of agroecosystem, we propose to address the geographic, archeological, and anthropological aspects of monist landscapes (from the Greek "monas" (unity) as space-time totalities); (Balée 2006; Ingold 2002; Santos 2000; Sauer 1925; Thurston and Fisher 2007; Urquijo Torres and Barrera Bassols 2009) whose components are interconnected and in permanent non-equilibrium (Botkin 1990; Zimmerer 2000).

Palimpsest is an academic construction that allows for jointly analyzing those aspects involved in the process by which all societies develop agricultural landscapes and modify them over time. The study of historical agricultural landscapes should address the following aspects: physical (tangible elements), utilitarian (provision of resources), technical (knowledge of resource management), cosmological (belief systems), identitary (a sense of belonging), ethical (values), and esthetic (scenic composition). The notion of palimpsest that is the basis of our proposal of historical agroecology has little in common with the socioecological theoretical-methodological approach of "social metabolism" to historically study agroecosystems (González de Molina and Toledo 2014). Social metabolism is based on the Marxist analogy of social organisms (Fischer-Kowalski 1998; Giampietro, Mayumi, and Sorma 2012; Schmidt 1976), Systems Theory (Bertalanffy 1976; García 2006; Luhmann 1996), the principle of entropy of the second Law of Thermodynamics (Adams 1975; Prigogine 1971; Tyrtania 2009), the notion of information and feedback of Cybernetics (Ashby 1956; Bateson 1972), and the new languages of valuing of Ecological Economics (Costanza 1992; Georgescu-Roegen 1971; Martínez-Alier 1987). Social metabolism allows for analyzing the principal mechanisms of change of agroecosystems in rural, urban, and industrial societies by calculating the "efficiency of funds and flows" involved in mechanisms of appropriation, transformation, circulation, consumption, and excretion of matter, energy, and information (Infante-Amate, González de Molina, and Toledo 2017).

Our proposal of Historical Agroecology is also not equivalent to Agroecological History nor to the History of Agroecology. Agroecological History, understood as a subfield of history (Soluri 2005), is the fusion of Environmental History and Agroecology (González de Molina and Toledo 2014) and addresses the origins of – and socioenvironmental changes in – agroecosystems. Due to its intimate relationship with Environmental History, Agroecological History would be subject to the following autocritics made by academics of Environmental History: a tendency to historically document

agricultural and ecological destruction, given influence by environmental movements (McNeill 2003); a tendency to prioritize documentary and archival analysis over fieldwork; a focus on institutional scales such as municipalities or nation-states due to easier access to archival information; and a predominance of historiographic approaches which fail to take into account Historical Geography, Historical Anthropology, and Historical Ecology (Gallini 2009). Meanwhile, the History of Agroecology involves applying History, Philosophy, and Sociology of Science to Agroecology to carry out genealogical analyses of the origins, influences, and evolution of Agroecology as a practice, as well as its establishment as an academic discipline. A variety of such studies exist, principally in Latin America (Altieri and Nicholls 2017; Gliessman 2017) and Europe (Gallardo-López et al. 2018; González de Molina and Guzmán Casado 2016; Wezel et al. 2018).

With our Historical Agroecology, we do not seek to promote historiographic accounts of socioenvironmental change in agricultural systems, but rather to contribute to diachronic readings of knowledge and both sustainable and unsustainable practices that cultural groups develop in historical agricultural landscapes. Furthermore, we do not aim to contribute to a scientific genealogy of Agroecology, but rather point out the potential for interdisciplinarity that may help Agroecology as an academic field in construction to incorporate temporal and spatial dimensions of agricultural landscapes. For this purpose, we present five initial theoretical postulates that may be useful in developing an understanding of Historical Agroecology, and we point out the interdisciplinary potential of Agroecology with Geography, Anthropology, and Archeology. Finally, taking into account the false dichotomy pointed out by Feyerabend (1975) between generalizable Western science and particularistic historical knowledge, we do not seek to develop a replicable scientific tool, but rather provide a theoretical and methodological approach that may guide analyses of agricultural landscapes, not only in indigenous or "traditional" contexts as illustrated in this article, but rather in a variety of sociocultural contexts.

Regional agroecological histories

For the study of Agroecology – and to carry out any type of agroecological practice – it is essential to recognize that any territory is a result of processes that have occurred over decades, centuries, and even millennia involving complex society-nature interrelationships which are manifested in landscapes and may be analyzed by Agroecology upon comprehending the regional histories of those landscapes. For this, three consecutive academic groups of the Annales School of History, guided by the works of Febvre (1953), Braudel (1980), and Le Goff (1991) are particularly relevant as they facilitate the temporal organization of history which allows for historical analysis of

space. In this analysis, time periods of several years or decades are termed *événement* (occurrences) and involve short-term episodic phenomena; time periods from several decades to two centuries are termed *conjuncture* (cycles) and involve regional historical economic processes, crises, and revolutions; and time periods over centuries or millennia are termed *longue durée* (structures) and involve political and economic structures that maintain their stability in the history of a region.

Aside from the French school, within Agroecology, other theoretical approaches to historical analysis may help to understand the regional history of landscapes (Table 1). As a fundamental technique of obtaining a wealth of information, researchers should review the vast historical archives that tend to exist in regions where agroecological studies have been carried out, as well as life histories and life stories based on oral traditions which – while surely eroded – continue to be prevalent among key community actors who find increasingly less opportunity to transmit their knowledge to new generations (e.g., Balée 2013). Therefore, one way of continuing to legitimate this knowledge would be to engage in a dialogue of knowledge with academic actors (Bertaux 1989; De Vos 2004). However, the only manner to obtain information on the deep history (*longue durée*) of society-nature interrelations in many regions is through Landscape Archeology (Erickson and Balée 2006; Fisher 2005).

Below, through the OMYK case study, we exemplify how well-intentioned Agroecology researchers who do not take into account the regional history of the landscape, thereby ignoring and failing to incorporate the wealth of local historical knowledge and practices, may reproduce the notion that Wolf (1982) termed "peoples without history", rather promoting pre-fabricated visions of the society–nature relationship which supplant a contextualized agriculture. In OMYK, for example, it would be extremely limiting to carry out agroecological research that does not take into account 4000 years of regional landscape history, that has included six cultural periods with differentiated natural resource management schemes (Table 2).

Historical Agroecology could contribute to recovering historical practices such as intentional sedimentation and re-depositing of soils from lagoon systems and marshes to *milpas*, forest polycultures (*pet kot* in Yucatec Mayan) and family gardens, as a natural fertilizer to increase agricultural and forestry productivity. Such practices are part of the management scheme known as "*bajos*" which was widely practiced in the region thousands of years ago and could currently contribute to counteracting the growing use of industrialized agricultural inputs (Dunning et al. 2002; Fedick et al. 2000). Furthermore, there is a need for agroecological research to document agrodiversity associated with *milpas*, as well as with family gardens and historical sacred gardens in order to develop participatory action research to diversify agricultural systems which are drastically being simplified. Finally, perhaps one of the most necessary contributions of an understanding of regional agroecological history would be to establish informed

Table 1. Theoretical and methodological contributions of the intellectual contact zones in the proposal toward an Historical Agroecology.

Postulates	Intellectual contact zone	Theoretical-methodological contributions	Main works
Regional agroecological histories	Annales School of History Cultural Geography Material Environmental History Ethnohistory	Events, cycles, structures First-nature, cultural and domesticated landscapes Life histories; archive work	Bertaux 1989; Braudel 1980; Claval 1999; Crosby, 2004; Crumley and Marquardt 1990; Febvre 1953; De Vos 2004; Le Goff 1991; McNeill 2003; Sauer, 1956; Vidal de la Blache 1908
Agroecological landscapes as palimpsests	Historical Ecology Environmental Archeology Paleoecology New Ecology	Palimpsests, human-mediated disturbances, cumulative effects Climatic, hydrological and pollen records Nonequilibrium landscapes	Armstrong et al. 2017; Balée 2006; Botkin 1990; Crumley, 1994; Dodd and Stanton, 1990; Erickson and Balée 2006; Fisher 2005; Zimmerer 2000.
Alpha and beta as agrobiodiversity on the table	Human Niche Construction Theory Ethnobotany Anthropology of Food Agricultural Ecology	Mutual society-environment determinations; domestication and plant selection process; human-wildlife behavioral co-evolution Foodways Nature matrix Agrobiodiversity	Armstrong and Veteto 2015; Boivin et al. 2016; Ellis 2015; Kendal 2011; Mintz and Du Bois 2002; Nabhan 2016; Odling-Smee et al. 2003; Perfecto et al. 2009; Zimmerer et al. 2019.
Agroecological *ethos* as landscapes of knowledge	Ethnoecology Ecological Anthropology Environmental Epistemology Ecolinguistics	*Corpus, praxis* and *kosmos* Sacred ecologies Ecologies of mind Metaphorical thought	Bateson 1991; Brosius, Lovelace, and Martin 1986; Descola 1996; Fill and Penz, 2018; Moran 2016; Nazarea 2016; Toledo 1992
Infrapolitics and collective action as other forms of agroecological resistance	Collective Action Theory Human Ecology Political Ecology Rural Sociology	Infrapolitics Historical resistances Local institutions Social dilemmas	Ostrom 1990; Melluci 1994; Touraine 1984; Robbins 2011; Martínez-Alier 2002; González de Molina et al. 2019; Scott 1990; Sevilla-Guzmán 2006; Long and Roberts 2005.

dialogue between the population, on the one hand, and on the other local governmental officials and NGOs that currently impose – or support – strict conservation schemes in natural protected areas (West and Brockington 2006; Wilshusen et al. 2002). Such dialogue should address the historical role of local communities´ management practices on landscape plasticity (Chazdon et al. 2009; Harvey et al. 2008; Morales, Ferguson, and García-Barrios 2007; Vandermeer and Perfecto 2007). Such practices include hunting for self-consumption, gathering firewood and construction materials from the *monte* for subsistence use, controlled agricultural burnings, and lagoon fishing – strategies which are currently restricted or even legally penalized but should be recognized as common rights of original peoples so that they may reproduce their territory-based identity and patrimony (Bello Baltazar and Estrada Lugo 2011; Boege 2008).

Table 2. Regional history of natural resources management in Otoch Ma'ax Yetel Kooh, Yucatan, Mexico.

Cultural periods	Agricultural and other economic activities	Type of management	Historical Contingency
Mayan Preclassic (2,500 BC-300 AC)	Low-yield wetland agriculture Group hunting (*Batida*) Gathering in tropical forest	*Bajos*	*Longue durée* (structures)
Mayan Classic-Postclassic (300–1500 AC)	Home and sacred gardens *Milpa* and forest polycultures Garden hunting Gathering in tropical forest	Forest garden	
Colonial Period (1520's – 1810)	Population dispersion	Regeneration	
Caste War (1840's –1900)	Low-yield *milpa* polyculture Gathering in tropical forest Individual forest hunting	Small itinerant war-time encampments (*caseríos)*	*Conjoncture* (cycles)
Late-stand Land Distribution (1950's – 1990's)	Rubber and timber extraction Intensive *milpa* polyculture Home gardens Hunting in gardens and *batida* Gathering in tropical forest Lagoons fishing Charcoal production	Use of multiple natural resources	
Establishment of Natural Protected Areas (1994 – Today)	Ecotourism Handicraft production Research assistance Beekeeping Simplified *milpa* polycrop with restricted use of fire Simplified Home gardens Restriction of hunting, gathering and timber extraction	Conservationist	*Événement* (ocurrences)

Agroecological landscapes as palimpsests: human-mediated disturbances and their cumulative effects

Our proposal arises from the idea of the "pristine myth" identified by Denevan (1992), which holds that the great majority of environments on earth have been modified – to different extents over time – by human societies, and that it was the European colonizers, of the erroneously termed "New World", who developed the idea of "natives" – pre-Columbian peoples – as passive populations incapable of transforming their environments. Such images that historically legitimated strategies of domination upon portraying autochthonous populations as primitives incapable of making their environments flourish are today employed without a critical understanding by Conservation Biology and related fields (Clement and Junqueira 2010; Gómez-Pompa and Krauss 1992). We consider that the historical approach of Agroecology should transcend such simplistic notions and rather move toward historical analysis of landscapes – that is, an understanding of patterns of environmental change intentionally generated by cultural groups over time – in order to understand which such

practices should continue to be implemented, which should be recovered, and which may need to be modified or even suspended (Balée 1998; Crumley 1987; Sauer 1925). For this, the palimpsest metaphor (a manuscript written over what was already written) helps to elucidate the successive layers of disturbance of landscapes as units of analysis.

For this Historical Agroecology, the fundamental study object is human-mediated disturbances – long-lasting modifications of landscapes by cultural groups to satisfy their needs, which in some cases result in environmental damage and in others in increased sustainability and diversity (Balée 2006). The most common human-mediated disturbances around the world – and therefore the most studied – are: 1) controlled use of fire to gain cropland and fertilize the soil (Leopold and Boyd 1999; Mistry et al. 2005; Nigh and Diemont 2013); 2) management of anthropogenic soils by reorganizing and adding nutrients, altering drainage patterns, and developing and regenerating microbiological soils, such as *terra preta do indio* in the Amazonian basin (Glaser and Woods 2004; Marris 2006); 3) aquatic architecture, which includes transformation and management of water systems by deviating, narrowing, or expanding waterways for irrigation; transformation of wetlands for agriculture; and fish spillways in riparian environments (for example, raft agriculture on human-modified lagoons in the Basin of Mexico, known as *chinampas* – Nahuatl for reed basket); management of watersheds through ritual coordination of flow management irrigation for rice cultivation, such as in the *subaks* of Bali (Erickson 2000; Gliessman 1991; Gomez-Pompa et al. 1982; Lansing 2012); and 4) architecture of oligarchic forests by favoring fruit trees, precious woods, and plants used for food, medicine, and economic purposes posterior to anthropogenic fire, and later sharing this knowledge with other cultural groups, which generates meta-landscapes that favor α and β diversity for utilitarian purposes, as in some cases in Australia, Sub-Saharan Africa, eastern and southern Asia, and above all Mesoamerica and the Amazon (Clement et al. 2015; Gómez-Pompa 1987; Peters et al. 1989).

In the majority of landscapes, the level of sophistication of human-mediated disturbances depends on the historical impact that cultural groups have on their environments. Although there is no completely causal relationship, generally over time – through observation and experimentation – societies come to understand the functioning of surrounding spaces and the responses or adaptations of these spaces to both anthropogenic and natural disturbances. Based on this understanding, Figure 2 shows a conceptual proposal for studying and typifying landscapes based on historical human impact and levels of disturbance, in which long-term disturbances result in domesticated landscapes; mid-range disturbances result in cultural landscapes; and small disturbances result in first-nature landscapes. Therefore, one of the objectives of Historical Agroecology is to comprehend the phylogeny (origin and formation) of the palimpsests – by applying principles of agroecological transition – to impact the ontogeny (development) of landscapes so

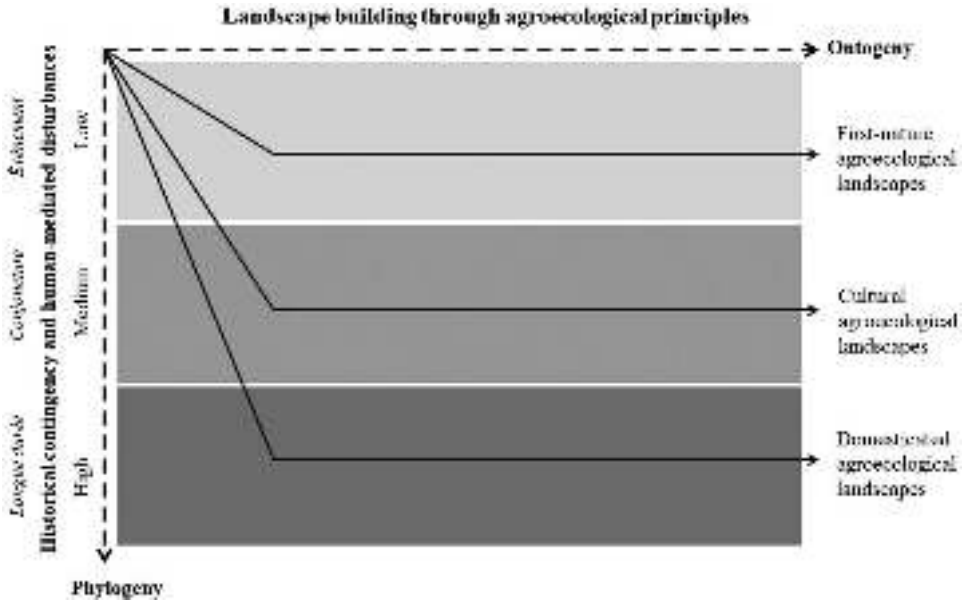

Figure 2. A conceptual proposal for historical agroecological action research on a landscape level.

that they are capable of responding to current agri-food needs and environmental challenges. In Table 1 we summarize the main areas of knowledge that can contribute to analyze these aspects for Historical Agroecology.

The example that best illustrates this proposal within the study region is the Maya forest garden, as documented by Ford and Nigh (2009). Based on long-term ethnographic and agroecological studies by Nigh in LCh (Nations and Nigh 1980; Nigh 2008) and the approaches of Historical Ecology and Paleoecology developed by Ford (2006, 2008) in the El Pilar Archeological Site and Flora and Fauna Reserve on the border between Belize and Guatemala, the authors present a novel proposal that Maya forests as a whole represent a domesticated meta-landscape based on the *milpa*-forest garden cycle. This is a cultural strategy common to most Maya villages of balancing management of forest cover with the local population´s agricultural needs as a result of thousands of years of experimentation and development of agroforestry systems (Ford and Nigh 2015; Gómez-Pompa 2003). The Maya *milpa* is a sophisticated, intensive agroforestry system (in terms of labor and yield) that is initiated by planting annual maize-bean-squash crops associated with over 90 other plant varieties belonging to 60 species (Nations and Nigh 1980; Terán and Rasmussen 2009). Space is made for planting by clearing vegetation and then burning at low temperatures (pyrolysis), which liberates nutrients (such as calcium in tropical zones); restores nitrogen; adds phosphorus, potassium, magnesium, and manganese to the soil; and generates significant accumulation of bio-available carbon while also reducing weed propagation as

a result of burning woody vegetation (Faust 2010; Nigh and Diemont 2013). In the Maya lowlands in general, during the first 4 or 5 years of management of vegetation succession, farmers focus on harvesting and re-planting annual crops while also managing and favoring perennial shrubs and trees which promote forest regeneration (Ford and Nigh 2015). After this first successional stage, two to four additional vegetation strata – depending on the micro-region – are created successively which, through competition previously generated by favoring certain shrubs and trees, become interwoven. Through this succession, the jungle is converted into a forest garden dominated by species that are useful to the local population, although the original ecosystemic functions continue in a holistic manner (Table 3) (Ford and Nigh 2009; Nigh 2008).

LCh is a case in which Agroecology could play an important role in preventing erosion of historical agroforestry knowledge, in restoring the agri-food and culinary systems, and in environmental conservation through local management and restoration practices. Today these practices are highly threatened due to cultural uprooting by Christian missionaries, the death of influential civic-religious leaders, the generation gap, establishment of local natural protected areas without consulting local populations, and ecotourism implemented by actors from outside the local communities which is becoming the local population´s principle economic activity (Cook 2016). There is a need to develop agroecological action research which is adapted to cultural conditions and stems from a historical perspective that takes into account the way in which the Lacandon Maya have interacted over centuries with the surrounding environment, transforming it into domesticated landscapes involving *milpa* polyculture that includes up to 56 useful plant species; family gardens with over 59 edible species; approximately 10 species of backyard livestock; hunting of over 10 animal species; fishing and collection of shrimp, crayfish, crocodiles, and snails in rivers and lakes; and gathering over 50 plant species cultivated or propitiated in the different successional stages of the forest garden which are used for food, medicine, construction, ceremonial purposes, restoring soil and forest cover, textiles, and tools for domestic use, agriculture, hunting, and navigation (Table 2) (Contreras-Cortés and Mariaca-Méndez 2016; Cook 2016; Nations and Nigh 1980).

Alpha and beta as agrobiodiversity on the table: manifestations of human niche construction

Pioneer research by Waddington (1959) and Levins and Lewontin (1985) marked a breakthrough in understanding evolutionary processes on a genetic level as well as an organism and ecosystem levels. These authors proposed

Table 3. Relationship between trees used in the Lacanja' Chansayab forest garden cycle and localtropical forest ecology.

Lacandon succesional stages	Lacandon names	Recorded plant uses	Academic understanding of tropical forest ecology
Robir = initial colonization (1-4 yr)			*Phase 1-Stand initiation phase (0-10 yr)*
Bidens ordarata	*Kuxnok'*	Medicine, food	Germination of seed-bank and newly dispersed seeds Resprouting of remnant trees
Baccharis trinervis	*SisicusAU*	Medicine, food	Colonization of shade-intolerant and shade-tolerant pioneer trees
Irenise difusa	*Ch'kubakeyok*		Rapid height and diameter growth of woody species
Schistocarpa eupatorioides	*Mumubakex*	Insecticide	High mortality of herbaceous old-field colonizing species High rates of seed predation
Smilax domingensis	*Shukur*	Medicine	Seedling establishment of bird- and bat-dispersed, shade-tolerant tree species
Erechtites hieracifolia	*SiscusHU*	Medicine	
Acalypha diversifolia	*Chiriptux*	Construction	
Mimosa ervendbergia	*Jarochkiix*	Ornamental	
Jurupche= Secondary forest (4-10 yr)			
*Heliocarpus appediculatus**	*S'akjaror*	Fiber, medicine	
*Spondias mombin**	*Jujup*	Food, medicine	
Piper aduncum+	*M'k'uram*	Construction	
Piper auritum +	*Jover*	Food	
Cecropia obtusifolia	*K'o'och*	Medicine	
*Bursera simaruba**	*Ch'acaj*	Medicine, handcraft, ceremonial	
*Podachaenium eminens**	*Kibok*		
Lochocarpus guatemalensis	*Yaxbache*	Construction, ceremonial	
Inga pavoninana	*Bitz*	Firewood, food	
Ochroma pyramidale *+	*Chujum*	Construction, medicine, fiber	

(*Continued*)

Table 3. (Continued).

Lacandon succesional stages	Lacandon names	Recorded plant uses	Academic understanding of tropical forest ecology
Nukuxche= Secondary forest (10-20 yr)			*Phase 2—Stem exclusion phase (10–25 yr)*
Pouteria sapota	*Jaas*	Food, medicine, insecticide	Canopy closure High mortality of lianas and shrubs
Brosimum alicastrum	*Ox*	Food, medicine, forage, utensil	Recruitment of shade-tolerant seedlings, saplings, and trees Growth suppression of shade-intolerant trees in understory and subcanopy
Blepharidium mexicanum	*Sak yuste*	Ornamental	High mortality of short-lived, shade-intolerant pioneer trees
Sweetenia macrophylla+	*Puna*	Construction, medicine, canoas	Development of canopy and understory tree strata Seedling establishment of bird- and bat-dispersed, shade-tolerant tree species
Calophyllum brasilense	*Babaj*	Construction, medicine, utensil	Recruitment of early-colonizing, shade-tolerant tree and palm species into the subcanopy
Schizolobium parahybum	*Petskin*	Ornamental, firewood	
Ceiba petandra	*Yaajche*	Cosmological center	
Cordia stellinifera	*Popojche*	Antidote	
Platymiscium dimorphandrum	*Sakchuru*	Construction, utensil	
Nectandra globosa	*Econte*	Medicine, construction	
Cedrela odorata+	*Kuche*	Medicine, Construction	

(*Continued*)

Table 3. (Continued).

Lacandon succesional stages	Lacandon names	Recorded plant uses	Academic understanding of tropical forest ecology
Tamanche= mature forest (20 yr)			*Phase 3—Understory reinitiation stage (25–200 yr)*
Chamaedorea alternans	*Chiip*	Food	Mortality of long-lived, shade-intolerant pioneer trees
Chamaedorea oblongata	*Sacboy*	Ornamental	Formation of canopy gaps
Geonoma oxycarpa	*Kunchepajok*	Construction	Canopy recruitment and reproductive maturity of shade-tolerant canopy and subcanopy tree and palm species
Chamaedorea elegans	*Chirixboy*	Ornamental, ceremonial	Increased heterogeneity in understory light availability Development of spatial aggregations of tree seedling
Chamaedorea ernest-augusti	*K'ewen*	Ornamental, food, utensil	
Heliconia librata	*S'kre*	Ornamental	
Clarisa biflora	*Chak' opche*	Bird atractor	
Dipholis minutiflora	*Subur*	Construction	
Rinorea hummelli	*Makanche*		
Ampelocera hottlei	*Rubin*	Medicine	
Sabal mexicana	*Xa'an*	Construction	
Poulsenia armata	*Ak ju'un*	Food, fiber, utensil	
Piper hispidum	*M'k'uramik ak*	Medicine	
Trichilia breviflora	*Majas'akuche*	Utensil to hunt birds	

*Species planted by the Lacandons which are dominant in the Jurupche phase that are replaced by othercanopy species during the Mehenche phase, thereby enhancing forest regeneration + species identified bythe Lacandons that improve soil fertility as well as forest regeneration and restoration. Source: (Contreras Cortés and Mariaca-Méndez 2016; Cook 2016; Ford and Nigh 2015; Nigh 2008.

that these biological units are not objects which are simply passive to external forces but rather co-create and modulate those forces. The authors coincide in three central aspects: they have a historical vision; they substitute the concept of adaptation with that of construction; and they use the landscape scale as their principle level of analysis. Based on these theoretical contributions, in recent decades an "eco-evo-devo" research agenda (Benítez 2018) has been developing a "post-Darwinist" understanding of the evolution of life which transcends the deterministic vision, rather moving toward a constructivist understanding of nature-culture coevolution (Blanton and Fargher 2012; Laland et al. 2014).

Nature-culture studies have also been influenced by this research trend, particularly through the Human Niche Construction Theory. This theory synthesizes and further develops the theses of gene-culture co-evolution, development systems, socio-constructivist learning in an evolutionary framework, and the structuration and actor-network theories (Fuentes 2015). The Human Niche Construction Theory poses the inherent capacity of *Homo sapiens* as a biological species to modify the functional relationships among other organisms and between these organisms and the environment through active, nonrandom modification of one or several ecological interactions and spatial patterns with the objective of favoring human occupation of the now modified selected environments (Odling-Smee et al. 2003). Researchers contributing to the theory from socioecological approaches point out the following fundamental aspects of the process of human niche construction: 1) it involves conscious creative innovation (Lansing and Fox 2011); 2) it transforms patterns of spatial configuration in what may be termed landscape architecture (Lindborg and Eriksson 2004); 3) as a consequence of this transformation, it modifies the functioning of systems or "engineers" landscapes (Lansing and Fox 2011); 4) it leads to historical co-evolutionary processes (Ellis 2015); 5) members of the cultural group tend to develop reflexive mechanisms for monitoring the landscape which allow them to comprehend the results of transformations of landscape structure and functioning (Kendal 2011); 6) a range of cultural activities exist for transmitting knowledge of – and practices carried out in – those processes involved in human niche construction (Kendal 2011); and 7) members of the cultural group seek to assure continuity of these processes among future generations (Odling-Smee, Laland, and Feldman 1996).

One of the principle expressions of human niche construction is modification in arrangements of α, β, and γ diversities on landscape scales (Boivin et al. 2016) in order to achieve some adaptive advantage (Figure 3). Human intervention in ecological distribution patterns of biological diversity to obtain food is of particular importance to Historical Agroecology. One of the most illustrative examples of this is the homegardens of Yucatan Peninsula Mayas which contain cultivated plants, domesticated animals, beehives, and houses of local

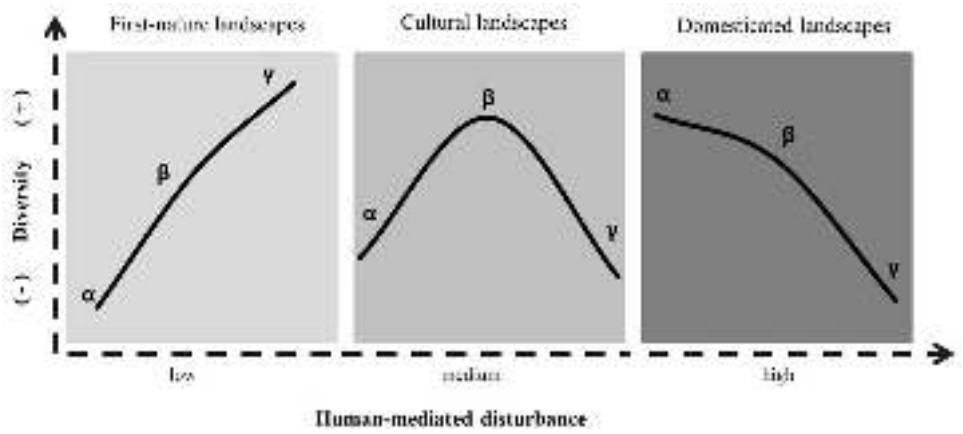

Figure 3. Hypothesis regarding cultural groups´ modification of biological diversity patterns on a landscape level to construct human niches.

materials, all of which are maintained with family labor (Mariaca Méndez 2012). In analytic terms, Maya homegardens are complex, adaptive forest-agroecosystems in which the family determines the garden´s structure, form, and function based on historical processes of selection, domestication, diversification, and conservation, principally oriented toward food provisioning (González-Jácome 2007; Mariaca Méndez, González Jácome, and Martínez 2007). This is indicated by the following ethnohistorical and ethnolinguistic sources cited by Mariaca Méndez (2012)

> "*Kuchil* [backyard] is the place or seat or recipient where any thing [from the *monte*] is put or kept that is not naturally from there [the family garden …]" (Motul Dictionary, own translation);
>
> " … they have many fruits and trees there [in the family garden], planted as well as wild … " (Relaciones de Dzonot, TII-90, own translation).

Family gardens are the result of a creative historical process resulting from a prehispanic legacy, further developed in the XVI century when Spanish invaders concentrated the dispersed indigenous population of the Yucatan Peninsula in villages. Through this creative process, families practiced landscape architecture and engineering, in which principally men selected potentially useful species from the *monte* for (principally) the women to plant in their backyards, thereby generating domestic landscapes with significant increases in α diversity as well as in landscape replacement or β diversity (for similar studies of other regions, see Balée 2010; Barthel, Crumley., and Svedin 2013; Groesbeck et al. 2014; Nabhan 2016).

In Ejido X-Mejía, in the municipality of Hopelchén in Campeche, Cahuich-Campos (2012) shows that, in Maya family gardens, agrodiversity

is constructed and conserved through the use of different species as food and to fulfill other basic needs, thereby providing women with the capacity to satisfy a large part of their families´ needs. This process is sociological as it is rooted in local cuisine, as well as bioecological as it involves underlying domestication and selection processes (Greenberg 2003; Jiménez-Osornio, Ruenes, and Montañez 1999). This study by Cahuich-Campos demonstrates the current viability of the family garden in Campeche, which may contain 185 edible plant species belonging to over 50 botanical families, as well as over 10 domesticated animal species. These species make up 62% of ingredients used to prepare over 50 daily or ceremonial dishes unique to Yucatec Maya cuisine. Furthermore, many cultural traditions, associated with the cuisine and involving these species, take place in the family garden, such as preparing dishes with rainwater collected in basins in the garden, and preparing food wrapped in banana leaves and baked in underground ovens (*pib* in Yucatec Mayan) covered with leaves and branches to conserve heat.

In summary, Yucatec Maya family gardens, as well as those of many other cultures, are small landscape units in which families combine hundreds of selected translocated species through domestication processes. Such gardens provide some of the greatest reservoirs of agrodiversity worldwide and greatly contribute to the increasingly threatened rural food sovereignty, as well as to local and regional markets where family members directly sell their products (Alayón-Gamboa 2014). Services provided by family gardens depend on the capacity of these spaces to link existing ecological processes with the cultural expressions and economies of those families who develop and live in them (Mariaca Méndez 2012). In this manner, due to the complexity of these gardens, Agroecology in practice as well as agroecological research on family gardens and other manifestations of human niche construction require inter- and transdisciplinary approaches in which the disciplines described in Table 1 play a central role.

Agroecological ethos as landscapes of knowledge

Cultural groups, that directly depend on landscape construction to subsist, develop strong interactions with their environment, along with deeply rooted cognitive, symbolic, linguistic, and practical systems of representing the world and acting within it which concord with the functioning of those landscapes with which they coexist (Descola 1996; Ingold 2002). These "landscapes of knowledge" may be referred to by the Greek notion *ethos*, which Aristotle initially defined as ways in which individuals and social groups act as a result of customs acquired throughout their existence. Aristotle´s concept has been recovered and further

developed by prominent natural and social scientists. For example, Russian physicist-mathematician Vladímir Verdanski and French Jesuit paleontologist-philosopher Pierre Teilhard de Chardin – influenced by the concept of *ethos* – each developed the idea of noosphere to refer to the layer of thought that exists in the biosphere that stems from processes of cultural differentiation and evolution (Wyndham 2000). The concepts of *ethos* and noosphere are implicit in the proposal of land ethics of Aldo Leopold (1933), Ecology of the Mind of Gregory Bateson (1973), and Mental Ecology of Leonardo Boff (Hathaway and Boff 2009). The common point of these three proposals is the teleological understanding that human societies are capable of adapting their actions to the intricate ecological network or "web of life" (Capra and Luisi 2014). Meanwhile, from a more sociological perspective, Max Weber and Pierre Bourdieu have contributed concepts of norms, attitudes, and behaviors that make *ethos* an objective system of empirical knowledge (Bourdieu 1990; Weber 2009).

We observe that agroecological studies have thus far been limited to exploring two aspects related to *ethos*: 1) establishing the practical and ethical foundations of agroecological systems and the opposing agroindustrial systems (Altieri and Nicholls 2008); and 2) documenting initiatives of the so-called "global south" that are building an *ethos* that rejects the ideas of progress and development; in Latin America, this is embodied in the concept of "buen vivir" (living well), also known as *Sumak Kawsay* by the Quechuas of Ecuador, *Suma Qamaña* by the Aymaras of Chile, *Ñandareko* by the Guaranis of Paraguay, Argentina, and Brazil, and *Lekil Kuxlejal* by speakers of Tzeltal and Tzotzil Mayan in Mexico (Giraldo 2019; Gudynas and Acosta 2011; Paoli 2003). Nevertheless, these agroecological epistemologies emphasize a polarized black and white vision of socio-ecological systems (see criticism by Bernstein 2014). There is a need to include other more place-based perspectives, recovering the *ethos* developed through the intrinsic connection between human knowledge systems and landscape functioning over time (Table 1).

As an analytical framework, we use the ethnolandscapes proposal of Barrera-Bassols and Toledo (2005) to present the Maya peasant *ethos* known as *Kanan Ka'ax* (well-care of the *monte*). According to these authors, ethnolandscapes integrate the following three components: 1) imagined landscape or *kosmos*, referring to symbolisms granted to the biophysical environment through native cosmovision; 2) cognitive landscape or *corpus*, referring to intellectual knowledge of the functioning of the biophysical environment; and 3) technical landscape or *praxis*, referring to the set of natural resource use and management practices carried out in the biophysical environment. Figure 4 shows a schematic representation of *Kanan Ka'ax*, developed with the oldest, most experienced peasants of OMYK, which shows that the *macehuales* (common peasants) are interconnected with the *monte* through three principle practices: cultivating

milpa, gathering plants and firewood in the jungle, and hunting – all of which are mediated by their cosmovision, according to which the *monte* has its own owners. Through a ceremony, the *macehuales* – intermediated by a *H'men* (Yucatec Maya shaman) and his *zastun* (power stone) – ask the deities of *Lu'um* (Earth) for permission to borrow resources from the *monte* in order to carry out agriculture, forestry, and hunting to provide them with the means of subsistence for their families and communities. Their complex management of the successional stages of the jungle is the principle component of the technical landscape. The Maya *macehuales* practice the *milpa*-garden forestry system, beginning with 3 years of polyculture (*kool*), which then gives way to a selective successional stage of *monte* (*sak'aab*) in which useful species are favored and which allows for regeneration of the jungle – which is used as a trough/trap for traditional individual hunting of ungulates (principally the sub-species white-tailed deer – *Odocoileus virginianus yucatanensis* or *yuc* in Yucatec Mayan, which has co-evolved with humans), as well as other small mammals and birds (Greenberg 1992; Santos-Fita et al. 2013). After approximately 15 years of succession – during the *hubche'* stage – the *macehuales* decide whether the composition of the vegetation is fit to continue the cycle until the *monte* is tall and mature – older than 30 years (*kanal k'aax* or *suhuy k'aax*; see Figure 4), or whether it should give way to forestry polycultures (*pet-kot*) or be returned to *milpa*.

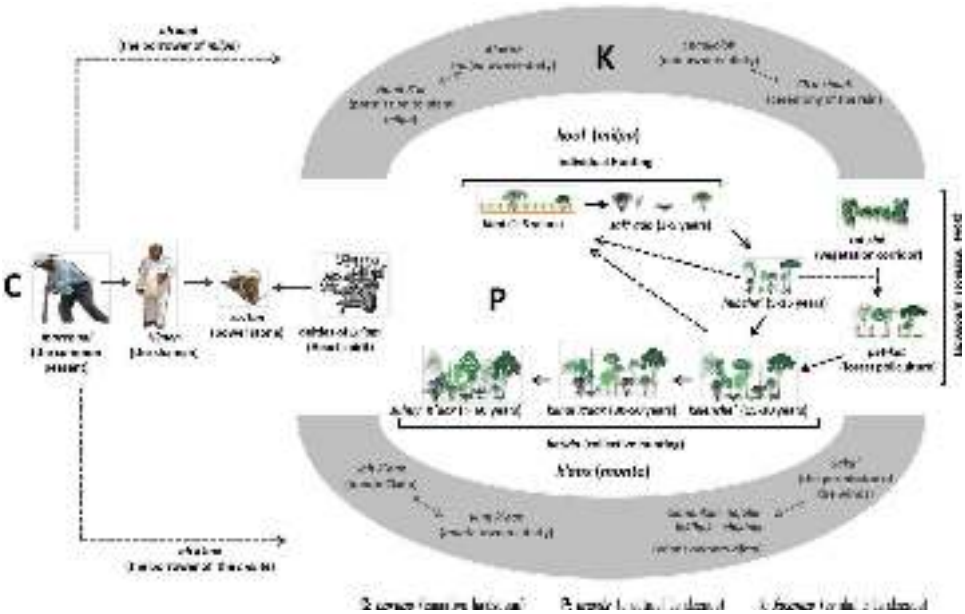

Figure 4. The Kanan K'aax Maya ethos and its ethnolandscape components in OtochMa'ax Yetel Kooh, Yucatan, Mexico.

The following life histories and interviews carried out in 2014 with influential OMYK community actors illustrate this agroecological *ethos* and succession management:

> My grandfather, who was a Maya priest, had seventeen children and none inherited his gift. That he passed on to me, although I didn´t know him – only through a photo that my father showed me when I was nine. When I was 21, he increasingly began to approach me through dreams to tell me that I had to learn his work; he called my spirit, as they say, and he told me where to find his *zastun*. In this manner, I began to work, to pray, and to cure. At the beginning, not even my father believed me as far as I know, but then the people little by little began to realize […] Then another *H'men* came from Chemax [a municipality in Yucatan State] – one of the teachers, and he told me that the whole group had been observing my work since a while before – that they already knew me though I didn´t know them, and they told me that if I want to advance in my work, I have to do my *U-lohol-Ah-Kin* [ceremony by which the *H'men* commits to serving his village by interceding with the owners of the *monte*] and transform myself to be able to deal with the *Yum Ka'ax* [lords of the *monte*] and perform agricultural ceremonies such as the *Ch'a chaak* [rain ceremony], *Hanil Kool* [permission for planting *milpa*], and even [the most complex] *Loh ka'ax* [re-alignment of the *monte*].
>
> Story by a Maya *H'men* from a micro-region that includes *Otoch Ma'ax Yetel Kooh*

> We call how we take care of the *monte* "*Kanan Ka´ax*". We don´t just say *ka´ax* [*monte*] or *kanal ka´ax* [tall *monte*] or *suhuy ka'ax* [mature *monte*] like in other places of the *mayeros* [Mayas]. That´s what our parents taught: we take care of the *monte* because we are part of it, and from the *monte* we get everything to live …
>
> Story by a Maya forest gardener (*monteador*), founder of the village of Punta Laguna

Thus, *Kanan Ka'ax* provides a sophisticated image of the society-environment-cosmos relationship – a holistic normative symbolic *ethos* involving pragmatic management of the landscape, inter-generational transmission of knowledge as a socialization mechanism, and logical, differentiated representations of and associations among the elements in their world with concrete linguistic meanings. We have empirically observed *Kanan K'aax* to currently be alive in the Maya regions of Yucatan and Quintana Roo, the Lacandon region of Chiapas, the Guatemalan Peten, and Maya areas of the Cayo District of Belize (Ford and Nigh 2015; Puc-Alcocer et al. 2019; Rivera-Núñez 2014). In these four regions, the jungle landscape matrix is highly conserved, and management practices associated with *Kanan K'aax* continue to result in significant supplies of food, medicine, and construction materials for traditional homes in Maya communities. The future development of agroecology will depend on researching this type of *ethos* in the many cultural contexts around the world where Agroecology is currently being practiced; recognition of these cultural contexts, revitalized with new practices and meanings, may allow for transitioning toward a variety of agroecological visions that large institutions will find increasingly difficult

to coopt (see Giraldo and Rosset 2017) and that will be increasingly more functional due to their rootedness in concrete cultural contexts.

Infrapolitics and collective action as other forms of agroecological resistance

In the past few decades, agroecological research has advanced significantly in developing the technical foundations that make it a viable as well as a necessary alternative for confronting food, environmental, and economic challenges of the XXI century (De Schutter 2011; Gliessman 2011). As the principle technical foundations of Agroecology have been defined, academic interest is growing in understanding the key social factors that will allow agroecology to benefit increasingly more families and territories (scaling-out) as well as with respect to developing more favorable public policy and markets (scaling-up) (Altieri and Nicholls 2008; Parmentier 2014; Rosset 2015). This process of massifying Agroecology has involved differentiating geographical spaces of resistance – or "agroecological beacons" – from spaces of domination (Rosset and Martínez-Torres 2014). Most research attention has focused on systematizing successful agroecological processes carried out by organized rural movements, implementation of favorable public policy by progressive governments, construction of alternative markets, and educational processes and social methodologies (Martínez-Torres and Rosset 2014; McCune and Sánchez 2018; Mier y Terán Giménez Cacho et al. 2018; Rosset and Altieri 2017). The tendency of researching these processes is beginning to be referred to as the "Agroecology of Social Movements" (Brescia 2017; Rosset and Martínez-Torres 2012); researchers focus on the regions in which such processes are being carried out and promoted, namely Cuba and its National Association of Small Farmers (Machín Sosa et al. 2013), the Landless Workers Movement in Brazil (Pellegrini 2009), the Farmer to Farmer Movement in Central America (Holt-Giménez 2006; McCune 2016), Zero Budget Natural Farming in India (Khadse et al. 2017), and the Zimbabwe Smallholder Organic Farmers´ Forum (Scoones et al. 2010).

Aside from these iconic "geographies of hope", what is happening with Agroecology? Are the only organizational and political actions capable of coordinating agroecological processes or resignifying agriculture those carried out by social movements? Such questions are rarely addressed by the research agenda referred to above. One approach to expanding the focus from social movements is infrapolitics and territorial collective action, including the "Sociology of Insubordination" of James Scott (1990) and the micro-sociological schools of North American symbolic interactionism and European social action (Table 1). The contribution of Scott´s work to Agroecology lies in distinguishing explicit insubordination, which is a motive of revolutions, from veiled disobedience (infrapolitics). Infrapolitics provides a set of discrete, indirect mechanisms and expressions

of resistance to which oppressed groups recur in order to overcome the multiple threats that hegemonic power structures present them. Such mechanisms include occult discourses, behavioral changes in the presence of certain actors, identitary counterideologies, apparent religious and ritual excesses, exclusive spaces, or niches of autonomy, and shared use of ambiguities to foment confusing interpretations (Scott 1990).

A synthesis of the North American school with the European school of collective action may provide tools for explaining which social and historical processes of cultural groups drive or may detonate collective action to defend territories and revindicate agroecological food and marketing systems through infrapolitics. Symbolic interactionism provides an approach for comprehending organized every-day infrapolitical behavior (Collins 1996), as well as the meanings and symbols involved in social action (Goffman 1969), as well as for determining how these meanings and symbols may mobilize individuals to reestablish threatened orders, heal a system, or even modify regimes of social control (Parsons 1964; Smelser 1989). In a complementary manner, the European School of Collective Action provides the necessary tools for scrutinizing the capacity of a cultural group to modify their reality (Melluci 1994) through a historical system of social and cultural traits by which they transform the functioning of the class relations governing their society (Alberoni 1984). With respect to this, Touraine (1984) identifies the following set of consecutive steps by which collective action is carried out: 1) subjects´ recognize themselves as part of a given society and as potential actors of change; 2) they identify adversaries and develop social opposition to threats (e.g. anti-peasant public policy), and 3) they defy historically oppressive conditions.

Applying these theoretical perspectives to the case of contemporary Yucatec Maya agriculture is illustrative in analyzing the role that Historical Agroecology may play as a practical scientific framework of social action that seeks to resignify traditional agricultural systems in those regions of the world or by those cultural groups that thus far have not been widely addressed by agroecological research. In the case of our study region, we must ask how the Yucatec Maya have been able to persist so strongly in terms of their identity and territory in the face of multiple threats to their cultural self-determination, particularly given the existence of very few social resistance movements in the region. For those who have had the opportunity to interact with groups of Yucatec Maya – the most widespread indigenous people of Mexico, the answer is clear: infrapolitics. We argue that their principle strategy for maintaining themselves as a cultural group is their use of multifaceted occult languages; they are experts at managing ambiguous discourses, defending spaces of exclusivity for members of their cultural group, carrying out ceremonies which serve as a smokescreen for their resistance, and maintaining a low political

profile. Precisely due to the Yucatec Maya´s "stubborn and hushed historical persistence" (Warman 1985), the *milpa* system and their holistic use of the *monte* continue to be a valid agricultural option for the region, with a large number of peasants still devoting a large land area to such practices (Terán and Rasmussen 2009). This is true despite the impact of simplification that time and generational turnover have had on these management practices, and despite the fact that a considerable proportion of the population has opted to abandon these practices and rather marginally involve themselves in the ways of life that "modernity" promises will be beneficial to them.

Recognizing that infrapolitics is one of the Yucatec Maya's principle strategies of cultural persistence, the following questions should be asked upon applying Historical Agroecology in this region. What enemies and threats do the Yucatec Maya perceive that inhibit the continuity of their agricultural systems? To what extent do they use silent environmental practices and occult cultural languages to maintain those aspects of their society–environment–cosmos relationship which they consider beneficial to them while detonating necessary cultural change? In this self-determination process, what bridges are they willing to build with other social actors (such as the academic community) with the aim of developing collective strategies for reestablishing social order, healing current confrontations, and promoting desired changes?

Concluding remarks

Although ethnosciences are recognized as one of the pillars of Agroecology (Altieri 1993, Sevilla Guzmán and Alonso 1994; Toledo 2005), little attention has been paid to analyzing the temporal and spatial scales of agroecological processes in territories with deep-rooted local knowledge and practices. For this reason, we propose a preliminary classification of three types of agroecology according to their historical development. First, recent forms of agroecology have emerged, for example, in peri-urban areas by groups of activists, migrants, and displaced communities in U.S. cities (Mares and Peña 2010; Guthman 2000). Second, forms of agroecology have arisen during times of conflict, such as Cuban agriculture after the fall of the Socialist Block (Machín Sosa et al. 2013), the search for food sovereignty in "Saudi" (petroleum-based) Venezuela (Herrera, Domené-Painenao, and Cruces 2017), and promotion of agroecology in Zimbabwe by member organizations of LVC in a context of dispute between promoters of agrarian reform and those that continually attempt a coup (Moyo 2011; Rosset and Martínez-Torres 2012). Finally, historical forms of agroecology arose in the Vavilov Centers of Origin of cultivated plants (Harlan 1971) and megadiverse regions, for example in Mesoamerica (González-Jácome 2011; Palerm and

Wolf 1972), The Andes (Altieri and Toledo 2011; Brush 1982; Tapia 2002), The Amazon (Clement 2006; Clement et al. 2015), and some parts of Asia (Dove 1999; Lansing 2012; van der Ploeg, Ye, and Pan 2014).

Each of these three types of agroecology has arisen in a variety of historical contexts and spatial scales. Therefore, the study of historical processes which have given rise to Agroecology may contribute to elucidating: processes of social organization which result from – and lead to – agroecological practice and discourses (emergent agroecologies); agroecology´s potential for ideological, territorial, and agri-food resistance in situations of conflict (agroecology "at the limit"); and profound agricultural and ecological legacies of cultural groups that have intimately interacted with their environments over long periods of time (historical agroecologies). Finally, we emphasize the need for academics to differentially analyze historical agroecologies as compared to other forms of agroecology since, as we have shown: (a) they generally involve complex agri-food and culinary systems capable of locally counteracting food empires; (b) they involve agricultural practices and *in situ* germplasm reservoirs that allow for technological independence from agribusiness; (c) they involve landscape management schemes that may provide alternatives to those promoted by government policies involving "fortress conservation"; and (d) they challenge the dominant narrative of the "Anthropocene" and the "ecological footprint", rather pointing to the existence of "Anthropogenesis" (Robbins and Moore 2013) and suggesting the concept of "agroecological handprint", understood as the ability to shape landscapes as a result of experience acquired over time and space (Ford 2018).

Declaration of interest statement

The authors declare no conflict of interest.

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