Reyes-García, V., D. Zurro, J. Caro and M. Madella 2017. Small-scale societies and environmental transformations: coevolutionary dynamics. *Ecology and Society* 22(1):15. https://doi.org/10.5751/ES-09066-220115

Guest Editorial, part of a Special Feature on Small-Scale Societies and Environmental Transformations: Co-evolutionary Dynamics

Small-scale societies and environmental transformations: coevolutionary dynamics

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ABSTRACT. This editorial introduces the special feature of *Ecology and Society* entitled *Small-Scale Societies and Environmental Transformations: Coevolutionary Dynamics*. The contributions to this feature explore coevolutionary dynamics developed between small-scale societies and environmental features and the larger-scale effects of these interactions in spatial and chronological terms. Acknowledging the importance of small-scale societies in our evolutionary past and nowadays, contributions to this issue use insights from both archaeological and anthropological case studies, concepts, and methods. This editorial introduces the contributions in three different ways. We start by reviewing the use of the term "small-scale society" in the literature. Then, we briefly examine the concept of "co-evolutionary dynamics" by providing examples of how the process operates between past and present small-scale societies and their surrounding environments. In the last section, we introduce each of the papers.

Key Words: *coevolution; long-term dynamics; small-scale societies; social-ecological systems*

INTRODUCTION

The definition of a new geological era, the Anthropocene, has recently been proposed to mark the start of a period characterized by the global and detectable impacts of human activities on Earth's geology and ecosystems (Crutzen and Stoermer 2000, Steffen et al. 2011, Zalasiewicz et al. 2011, Lane 2015). Recent archaeological evidence suggests that the beginning of the Anthropocene could be set with the geological processes originating from the development of semisedentary cultures and/or farming, at least 8000 years ago, when ancient farmers started to clear forests to grow crops (Ruddiman 2013), although most authors propose to set the start of the Anthropocene with industrialization (Crutzen and Stoermer 2000). Even if the geological impact generated with development of farming and sedentary cultures during the Neolithic is still debated, scientific agreement is now growing that changes operated by small-scale societies on their environments have played, and continue to play, a major role in coevolutionary processes guiding human adaptation and shaping the landscapes we know today (Lambin et al. 2003). For example, research in the Amazon basin provides growing evidence that the landscapes and biodiversity that we currently observe result not only from natural phenomena but are also shaped by centuries of management by local societies (Denevan 1966, Heckenberger 2003, Lombardo et al. 2011). Indeed, as Ellis (2015) recently proposed when articulating the theory of "anthroecological change," a growing body of evidence suggest that "the ultimate causes of human transformation of the biosphere are inherently social and cultural, not biological, chemical, or physical" (p. 321). The idea that small-scale societies co-evolve with their surrounding environments is also supported by research with contemporary small-scale societies describing how biological and cultural diversity are inextricably linked within complex social-ecological systems (Maffi 2005). In that sense, the co-occurrence of high levels of biological and cultural diversity in certain geographic areas has been interpreted as the result of cultural and biological diverse coevolutionary processes that continue nowadays (Harmon 1996, Harmon and Loh 2004, Guèze et al. 2015).

Following these new lines of research, the contributions to this special feature explore coevolutionary dynamics developed between small-scale societies and environmental features and the larger-scale effects of these interactions in spatial and chronological terms. Acknowledging the importance of small-scale societies in our evolutionary past and nowadays, contributions to this feature use insights from both archaeological and anthropological case studies, concepts, and methods. This editorial introduces the contributions to the special feature in three different ways. We start by examining the term "small-scale societies" by reviewing how the term has been used in the literature. Then, we examine the concept of "coevolutionary dynamics" by providing examples of how the process operates between past and present small-scale societies and their surrounding environments. Finally, in the last section we introduce the papers of the special feature.

DEFINING "SMALL-SCALE SOCIETIES"

Since colonial times, European history has been marked by attempts to differentiate between European and non-European worldviews, usually describing the "others" (people that existed outside the Eurocentric worldview) in opposition to the predominant Western world (Robb 1992). For example, during the Renaissance, the "others" were considered as demonic beings that needed to be saved from the darkness of paganism; during the Enlightenment, they were characterized as ignorant, technically and intellectually lagging behind European knowledge and in a "natural" state that was presented in opposition to Western "civilization" (Borsboom 1988). Later, during the 19th century, with the geopolitical and economic expansion of Europe and the influence of the theory of evolution, the "others" became an example of the "previous ones"; examples of not fully evolved human societies linking evolved humans with the natural world (Bowler 1992).

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During the early part of the 20th-century differences with the "others" started to be articulated in cultural terms and attempts to avoid the use of pejorative expressions, such as "primitive" or "savage" began (Robb 1992). At that time, scientific publications started to use some vague descriptive terms when referring to "other" societies such as "non-industrialized", "non-Western", "traditional" or "small-scale societies". Firth (1951) was among the first authors to use the term "small-scale societies" in his book *Elements of social organization*. Firth defined "small-scale societies" as the "minimal cooperative unit within a society" and considered the term as a synonym of the term "primary groups" used in sociology to refer to the members of a society that are in contact during daily life (i.e., family units, neighborhood, work or play groups) (Firth 1951: 43-44). In other words, according to Firth, the criterion of scale for a society was based on the number and quality of relationships between members of a society. In a small-scale society the individual interacts with the same individuals in virtually all social situations, whereas in a large-scale society the individual has many impersonal or part-relationships, some ephemeral, some lasting, and both types of relations do not necessarily overlap.

The term was adopted in *The International Encyclopedia of the Social Sciences* (Sills and Merton 1968) and soon became popular in the anthropological literature. Thus, during the mid-20th century, the use of the expression substantially increased with cross-cultural studies aiming at finding, classifying, and comparing features displayed by different small-scale societies (Strodtbeck 1964, Frijda and Jahoda 1966, Ford 1967), a trend that continues nowadays with some recent works aiming at comparing essential human or social features across small- and large-scale societies (e.g., Henrich 2010, Henrich et al. 2010). Moreover, the popularity of the term is reflected in its use outside anthropology, as for example its use to refer to small productive sectors such as cooperatives in opposition to bigger industrial production (Berg 2013), or its use in archaeological studies, especially those dealing with long-term dynamics or evolutionary issues (Upham 1990, Coudart 1991, Gat 1999, Spielmann 2002).

A close look at the literature using the term "small-scale societies" suggests that authors do not necessarily always use the term in the same way. Thus, several authors have used the term just as a synonym of "hunter-gatherer" societies (Gurven et al. 2000, Hill and Kintigh 2009). Read (2003), for example, uses the term to refer to the !Kung San, whom he considers a paradigm of a small-scale society. Other authors have used the term according to criteria related to population size (Sønderskov 2011, Jordan et al. 2013). For example, when Jordan and colleagues write "we make a distinction between small-scale (groups of hundreds to a few thousands of individuals practicing mostly hunter-gatherer/foraging ways of life) and large-scale (groups of thousands upward to state-level complex societies of millions) sociality on a fuzzy basis" (2013: 88), they basically propose a definition of "small-scale societies" based on population size. Still other authors have given more importance to the political organization in order to categorize a society as "small-scale". For example, Spielmann defines them as "... those societies ranging from several hundreds to several thousand people in size and characterized by relatively uncentralized political systems" (2002: 195); and Bodley states that "by 'small-scale society' we mean one that maintains political autonomy at the level of one or a few local communities and, hence, numbers a few hundred to a few thousand inhabitants" (1996:12, cited by Smith and Wishnie 2000: 493). Still other publications have focused on economic and social characteristics such as the importance of cooperation for economic production, the degree of market integration, or group adherence to a world religion (Gächter et al. 2010: 2652).

In sum, the term "small-scale societies" has been largely used in the scientific literature since it was first introduced. Its popularity, however, seems to be related to the fact that the term appears to be a useful umbrella category, which allows researchers to move away from terms with negative connotations at the same time that it is open enough for researchers to include a broad range of different types of human societies under the term.

COEVOLUTIONARY DYNAMICS

In biology, the term coevolution is used to describe cases in which two (or more) species reciprocally affect each other's evolution, a case that is likely to happen when different species have close ecological interactions with one another. Within the social sciences, the term was used by Richard Norgaard in his seminal book *Development Betrayed* (1994), to provide a biological understanding of social-ecological systems as consisting of loosely interconnected parts (i.e., culture and ecology) that coevolve. In archaeology and anthropology, the term has recently started to be used to understand human-environment long-term dynamics, one of the main challenges of current scientific research (Kintigh et al. 2014). For example, a relatively well-known example of the coevolutionary human-environment dynamics is the ritualized system of rice production on the Indonesian island of Bali (Lansing 2006). Over centuries, Balinese farmers have modified the landscape to maximize the productive land surface by creating terraced paddy fields and constructing canals and tunnels to irrigate them. Terracing the sloping upland areas conserves soil and reduces the risk of landslides (Lansing and Fox 2011). The system also limits the impacts of pests because, by coordinating irrigation schedules, farmers deprive pests of a contiguous food supply and habitat (Lansing 2006). To maintain this complex and highly productive landscape, Balinese farmers have developed a complex social system that allows coordinating periods of flood and fallow over a sufficiently large area. The coordination of cropping patterns is embedded in a set of highly-ritualized institutions, the most important of which is the *subak*, or the association of farmers who own land irrigated by a common water source (Lansing 2006). The success of the coevolutionary dynamic is reflected in the fact that, when Balinese farmers abandoned traditional practices, institutions, and rituals in order to adopt farming techniques spread by the Green Revolution, the whole agricultural system collapsed and farmers began to suffer high levels of crop damage by pests and disease, until they returned back to their traditional system (Lansing 2006).

Archaeologists' and anthropologists' interest in human-environmental coevolutionary dynamics is relatively recent. Despite our current awareness of human capability to transform the Earth, until recently researchers argued that the only long-term substantial environmental modifications driven by anthropic activities were those arising from the domestication of plants and animals, as these activities brought fundamental changes in land use, such as deforestation soil erosion (Lane 2015). However, the new understanding of the effects of human action

on the environment, brought to light with studies in Earth Sciences proposing the concept of the Anthropocene (Crutzen and Stoermer 2000, Crutzen 2002), has sparked a growing interest in archaeology and anthropology to assess anthropic environmental modifications at different spatial and temporal scales.

Thus, recent archaeological evidence suggests the importance of anthropic management in understanding current ecosystems. In that sense, some archaeological works have started to consider anthropic environmental changes that might have occurred before the transformations associated with agriculture, with works focusing on the distribution and richness of biodiversity and its relation to human activity (Boivin et al. 2016), including the human-induced extinction of several animal species (Rule et al. 2012, Sandom et al. 2014), or climate change and changes in resources availability related to the presence of diverse cultural dynamics (Anderson et al. 2007). Some other works are focusing on anthropic soil formation (anthrosols; Woods 2003) or the identification of anthropic markers for human activities at different scales, from household (Rondelli et al. 2014) to landscape (Iriarte 2009). Within these studies about environmental modifications, most have focused on land use changes associated with the setting of agricultural landscapes during prehistory, and bringing forward either loss of biodiversity (Haberle 2007) or increased biodiversity (Anderson and Wohlgemuth 2012). However, ancient coevolutionary dynamics that may have had a significant impact on sea and coastal ecosystems are starting to become also relevant within the archaeological discourse (Erlandson 2001, Allen 2002, Bailey 2004, Morrison and Addison 2009).

Ethnographic evidence further points to the important role of contemporary small-scale societies in shaping the environment. For example, researchers recognize that contemporary indigenous peoples living in small-scale societies have managed landscapes to preserve large amounts of forest cover, thus enhancing biodiversity (Garí 2001, Zent and Zent 2002). As a result of this type of management, the territory inhabited by many contemporary small-scale societies often overlap with areas of high biodiversity (Toledo 2001, Sunderlin et al. 2005, Porter-Bolland et al. 2012). Examples of how local management can impact environmental outcomes include slash-and-burn agricultural systems practiced by small-scale societies, which can lead to an increase in landscape biodiversity through the creation of a mosaic of different habitats (Peters 2000, Wiersum 2004). Even micromanagement practices in the understory seem to result in subtle modifications of biodiversity that potentially increases cryptic disturbances (Peres et al. 2006). Such micromanagement practices might include enrichment planting (Barlow et al. 2011), or management of nontimber forest products (Takasaki et al. 2001, Lawrence et al. 2005; Byg et al. 2007), sometimes resulting in an increase in tree species diversity (Guèze et al. 2015). Interestingly, researchers have also noticed that, as small-scale societies face cultural change and are integrated into the market economy and the national systems, the way they manage their landscape also changes, often following a negative path (Lu 2007, Guèze et al. 2015), which suggest that there is a close link between cultural practices and landscapes.

THIS SPECIAL FEATURE

The papers presented in this special feature are framed in this new research interest as they aim at exploring the role operated by small-scale societies in human adaptation through the lens of coevolutionary socio-environmental processes. The paper by Reyes-García et al. (2016) explores the drivers of cultural change and their role to fully understand change in small-scale societies. Understanding culture as a nonlinear process determined by external and internal (decision-making) forces could help unravel the seemingly contradictory "persistence and change" in social-ecological systems. Lancelotti and colleagues (2016) explore the processes and transitions associated with agricultural production by proposing a theoretical conceptual model based on resilience and social-ecological systems theory. The novelty of this approach is that the proposed model could be implemented in agent-based simulations through a process of hypothesis building and testing.

A focused paper is the one from Balbo et al. (2016) surveying small-scale society resilience in drylands. The work discusses a long-term perspective on climatic adaptive capacity of these societies, highlighting key adaptive traits that have been relevant to foster resilience dynamics climate-related hazards regions. Continuing with drylands, the work by Biagetti et al. (2016) explores functional and social stresses at settlement level as part of small-scale societies' dynamics in the hyper arid environment of the Sahara. Moving to more recent times, long-term community responses to droughts are explored by Grau-Satorras et al. (2016) during the early modern period in the Mediterranean. The paper reconstructs past community adaptation practices to recurrent hydro-climatic crisis and explores the ways in which practices changed over time as influenced by climatic and societal factors.

The last two papers explore local perceptions in relation to climate and natural resource change among contemporary small-scale societies. Fernández-Llamazares et al. (2016) investigate how small-scale societies are capable of constructing robust institutional arrangements to manage natural resource sustainability through local perceptions that reflect a multifaceted complexity of cognition. These local perceptions eventually construct a better picture of the historical context of resource change and play an important role in creating or blocking societal change. Finally, Pyhälä et al. (2016) address global environmental change at human scale and conclude that incorporating and better understanding local perceptions of environmental change at a global level can help to explain why people react to environmental change the way they do. Through this, we would be better placed to work on long-term adaptation for the future and produce acceptable mitigating strategies.

Responses to this article can be read online at:
http://www.ecologyandsociety.org/issues/responses.php/9066

Acknowledgments:

Preliminary versions of the papers collected in this special feature were presented in a 2-day conference on small-scale societies and organized by the editors (http://www.s3et.net/). The guest editors

are grateful to all involved authors and reviewers for their time and effort. We acknowledge financial support of SimulPast (CSD 2010-00034) and LEK (ERC-FP7, Grant Agreement 261971). This work contributes to the ICTA 'Unit of Excellence' (MINECO, MDM2015-0552) and the CaSEs research group of the Generalitat de Catalunya (SGR-e 1417).

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