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Impacts of land-use and management changes on cultural agroecosystem services and environmental conflicts—A global review

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ABSTRACT

As an outcome of interactions and interdependencies with people, agroecosystems provide cultural ecosystem services (CES), such as traditional knowledge, recreation, and places for social gatherings. Today however, agroecosystems undergo biophysical changes because of land-use and management changes (LUMC), such as intensive agriculture, urbanisation, and land abandonment. Typically, environmental conflicts emerge between stakeholders with differing interests in land areas around the LUMC. Cumulatively, these changes and conflicts have substantial influence on the CES appreciation of the farmland, triggering different types of responses, including social mobilisation and resistance.

A comprehensive analysis of these processes was missing in the literature. Here we present a systematic review of CES provided by agroecosystems at the global level, we explore their interconnections through network analysis, and analyse the interrelation between LUMC, CES and environmental conflicts. The review includes 155 peer-reviewed articles, representing empirical data from 81 countries. Twenty main categories of CES and their subcategories delivered by agroecosystems are identified. Through the network analysis we demonstrate how CES are interrelated, with agricultural heritage as a connecting core. In a comprehensive map, we further identify which LUMC types have influence upon specific CES categories, and what are the causes, outcomes of, and responses to environmental conflicts that emerge from these processes. CES and agroecosystems cannot be seen separately from one another, as a reflection of secular or recently-created relationships people have with their environments. While these relationships are dynamic, LUMC may lead to their impairment or even loss, with ensuing impacts on biocultural diversity. The resulting environmental conflicts push most frequently for greater participation of actors involved in farming, socio-cultural revalorisation of farmland activities and the promotion of multi-functionality.

1. Introduction

The social-ecological interactions in the farming landscapes commonly result in agroecosystems with exceptional cultural benefits. These benefits are commonly referred as Cultural Ecosystem Services (CES) (Calvet-Mir et al., 2012b; Chan et al., 2012; Plieninger et al., 2015; Zorrilla-Miras et al., 2014). While being associated to intangible values (e.g. Milcu et al., 2013), CES can involve several tangible, material values, such as the access to wild products or agro-tourism development (Daugstad et al., 2006; Plieninger et al., 2015). While CES' potential role in enhancing ecosystem management is significant (Plieninger et al., 2015), their assessment and implementation into landscape planning is challenging (De Groot et al., 2010; Nieto-Romero et al., 2014; Satz et al., 2013).

CES in agricultural landscapes is still poorly investigated in comparison to other ES categories (Dominati et al., 2014; Fagerholm et al., 2016; Milcu et al., 2013). Focusing on only provisioning or regulating services from agro-ecosystems and disregarding CES and their interactions carries consequences, such as inequalities in power relations (Kull et al., 2015). CES may be strongly correlated with other ES categories in human modified landscapes (Reyes-García et al., 2015).

Many scholars argue however that CES may be undervalued or "invisible" (e.g. Aspe et al., 2016; Bernués et al., 2014; Bouahim et al., 2015; Frank et al., 2012; Grunewald et al., 2014; Nahuelhual et al., 2014), even within economic valuations. For example existing economic valuations of CES often leave unnoticed the socio-cultural attachment people have with their environment (Chiesura and De Groot, 2003; Ruoso et al., 2015; Zhang et al., 2015). Consequently, this may underestimate the important contribution that CES make to total ES delivery (Van Berkel and Verburg, 2014). Indeed, human non-

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materialistic needs, and the cognitive and the emotional components of the relations with ecosystems have a central role in shaping environmental attitudes (Chiesura and De Groot, 2003; Costanza et al., 1997). Thus, their cultural value is of interest in science and policy (Merlín-Uribe et al., 2012; Pretty, 2008).

Agricultural areas permanently undergo changes due to socio-economic and socio-political drivers, thus leading to coupled environmental and cultural transformations (Ribeiro Palacios et al., 2013). Both biophysical and cultural changes affect the CES delivery capacity of the farming landscape, and the CES appreciation by stakeholders. Changes in the biophysical and functional properties of agroecosystems (Pedroli et al., 2016) will in turn shape the capacity of these ecosystems to deliver CES for the human societies (Munteanu et al., 2014).

Land use and management changes (LUMC) are one of the major causes of the biophysical changes of agroecosystems, typically through intensification and homogenization (Munteanu et al., 2014; Zorrilla-Miras et al., 2014). Since the structural heterogeneity of the landscape correlates with its aesthetic and recreational values (Hahn et al., 2017), a simplification of structure due to intensification may result in the decrease of the CES delivery of the farming landscapes (Pilgrim and Pretty, 2010).

The CES appreciation of the farming landscapes can also be influenced by the access to- and control of natural resources by different land users (Brown and Raymond, 2014; Kumar Paul and Røskaft, 2013; Pacheco and Sanches Fernandes, 2016; Svampa, 2015). Only a few academic articles based on ES framework have specifically stated how access to- and benefits from ES varies across space and different groups (Wieland et al., 2016). An inclusive view of stakeholders is important in the interests of social justice, because values and interest of the most vulnerable and powerless are often excluded from the environmental management decision making (Jorda-Capdevila and Rodríguez-Labajos, 2014; Martinez-Alier, 2014; Reed et al., 2009a,b).

With this in mind, the major goal of this paper is to provide a comprehensive review on how LUMC influences CES in agroecosystems and what conflicts are arising from these changes. As we analyse these connections, we also categorise the CES related to agroecosystems, as well as types of environmental conflicts in agricultural management, both topics of relevance that, so far, lack a systematic assessment at the global scale. The following sections outline the background of CES, LUMC and conflicts. After that, we describe the methodology of the review and present and discuss the main results.

2. Cultural ecosystem services in agroecosystems

Agroecosystems in farming landscapes are multi-functional (Allan et al., 2015; Fibrank et al., 2013; Pretty, 2003) and culturally shaped (Power, 2010). CES in agroecosystems may include education, traditional knowledge, cultural gatherings, recreation or tourism, as well as traditional land use and seed exchange. Agricultural places and products are present in traditional rituals and customs that bond human communities (Power, 2010; Zorrilla-Miras et al., 2014). Knowledge about CES can be considered essential for understanding cultural identity, environmental sustainability and survival in different cultures (Brown and MacLeod, 2011; Tengberg et al., 2012).

While there is a growing interest in ES provided by agroecosystems (Calvet-Mir et al., 2012b; Milcu et al., 2013), CES until recently received little attention in empirical studies (Chan et al., 2012; Schaich et al., 2015). The challenges of quantifying, valuing and mapping CES play against their effective integration in the assessments (Casalegno et al., 2013; Nahuelhual et al., 2014). In fact, based only on economic valuation of CES, the relationship people build with their environment is overlooked (Ruoso et al., 2015).

Connectedness to nature is important to the extent of improving cognitive functions in humans (Berman et al., 2008). CES however, are sometimes referred to as “additional” services (Swinton et al., 2007). Yet, CES of a community cannot be captured by economic analyses alone (Carrasco et al., 2014). The relationship between agricultural revenues or cultural services is more complex than contingent valuations can indicate (Ruijs et al., 2013). CES are strongly interrelated, so the decline of one CES and its value might influence the value of another CES (Tilliger et al., 2015). In addition, standardised measuring of landscapes aesthetic value (e.g., tidal flats) is difficult, because every region differs in characteristics and culture (Kim, 2013). Thus, CES are closely linked to personal and local value systems (Nahuelhual et al., 2014).

In this respect, CES in agro-ecosystems remain largely unknown and under-appreciated (Aspe et al., 2016; Cerqueira et al., 2015), and have consequently been invisible in planning and management (Barrena et al., 2014). There is a need for better understanding of the ways in which societies use and shape ecosystems and relate it to cultural, spiritual and religious belief systems. Cultural landscapes are the place where culture and nature meet, such as centuries old tangible and intangible patrimony, cultural and biological diversity (Tengberg et al. 2012). Improving understanding of this linkage is still a key point of the agricultural and ES research agenda (Swinton et al., 2007).

3. Land use and management changes in agro-ecosystems

The literature distinguishes three main drivers of LUMC. Two are related to either direct or indirect impacts of climate change, and one is driven by socio-economic changes (Briner et al., 2013). These drivers are the outcome of a complex mixture of economic, policy, institutional and market forces (Munteanu et al., 2014; Zorrilla-Miras et al., 2014).

In many rural regions today, as a consequence of extreme temperatures, LUMC might be manifested in droughts with water shortages, desertification, floods and land runoff. These negative processes also have a high pressure on agroecosystems’ services delivery (Fu et al., 2017). A recent study in Chile showed how natural cycle fires have increased due to climate change, with a considerable impact on traditional vine production, and historical aesthetic beauty of the local vineyards (Martinez-Harms et al., 2017). Climate change has also a significant impact on spirituality and cultural identity of local communities, because the spiritual rituals are closely connected to glaciers and water sources in regions experimenting environmental change (Palomo et al., 2014).

Regarding the socio-economic changes, agricultural intensification, scale enlargement and abandonment led to significant changes in landscapes (Pedroli et al., 2016). Main influences and drivers of LUMC in general include decline in rural populations and migration from rural to urban areas; development and new agricultural techniques; regional, national, and international market forces; or regional and national governmental initiatives which subsidise monocultures and finance large scale infrastructure, such as irrigation systems; or effects of policies implementation, such as the Common Agricultural Policy (CAP) of the European Commission (García-Ruiz and Lana-Renault, 2011). Agricultural land abandonment, for instance, is at present the major issue occurring in Europe (Tarolli et al., 2014; Zakkak et al., 2015).

Changes in agriculture go beyond crop management. A study on land use changes of wood-pasture landscapes of Northern Lesbos shows a shift from traditional grazing and terraced arable fields to a more intensified and pure livestock grazing system, leading to an abandonment of arable farming and to a sharp decline in cultivation patterns (Schaich et al., 2015). Other LUMC with impacts on CES occurring in the last decade are urban, as well as rural development policy programs. Spain, for instance, experienced one of the most significant LUMC in all of Europe, with enormous economic and socio-cultural consequences (Quintas-Soriano et al., 2016). Widely homogeneous agricultural landscapes lead to the cultural standardisation imposed by the global market. As a result, many cropping systems of great ecological, historical and cultural value are under the threat of vanishing (Guarino et al., 2017).

Human-environment relationship refers to a process where culture