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Sustainable Landscape Management. An Analysis with a Scientific and Social Perspective. Review

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Abstract

Context: The negative effects of climate change and the food production systems, based on an ever-growing, intensive, and unsustainable manner, are threatening the stability of landscapes, and therefore, their components, including humans. The implementation of land sustainable management offers a set of social and ecological benefits. However, it is mostly applied to very small spaces, as an agroecosystem.
Aim: To analyze the need for land sustainable management practice scaling of landscapes as a geographic space category, using a scientific approach.
Method: Documentary review was used along with the integration of land sustainable management approaches, and the need for landscape scaling, including other sustainability approaches, such as agroecology.
Results: The study found a theoretical gap in terms of land sustainable management practice scaling of landscapes as a geographic space category. The need for scaling is mainly explained by the fact that the extent of social and ecological problems goes beyond smaller spaces, such as a farm or an agroecosystem.
Conclusions: Landscape is an intrinsic part of cultural identity and heritage with high natural and anthropic values that must be highly regarded. The scaling of land sustainable management practices into the landscape is a necessity. The natural, economic, and social problems associated with land use must be addressed beyond the boundaries of a single agroecosystem.

Keywords: Sustainable land management, agroecology, landscape.

Introduction

The planet's ecosystems are changing at an accelerated speed as a result of global environmental alterations, as well as changes in land use and coverage. These changes can compromise the persistence of types of landscapes and help reduce the flow of benefits to human populations. Coherent adaptation and mitigation responses are required to ensure the existence of landscapes and their capacity to contribute to the sustainable development of a particular region. These must be run by all actors working together to produce the different spatial scales. Such responses must rely on solid scientific knowledge of the mechanisms (the social and ecological components) that respond to change processes, and their interactions, dynamics, and feedback processes (Mathez, Peralvo, & Báez, 2017). A group of procedures and techniques based on sustainable land management may represent a significant contribution to revert the ecological footprint of humans on the planet.

The theoretical background of sustainable land management was first introduced following the Second World War when quite a few scholars began to understand how much devastation could be caused to the planet to the point of risking the survival capacity of humans. Some intellectuals tried to find a rationale in the so-called noosphere, based on human thinking as a social phenomenon, like Vernadsky (2005), who considered it as a new geological

phenomenon observed on the planet. Then it was evident that the relation to land was only being economic, producing privileges, not obligations. It was associated with the ethics of the land, which promoted the expansion of the boundaries of communities to include the soil, water, plants, and animals, or the land, collectively (Leopold 2007).

Aided by technology, an ever-increasing food surplus was being created, which came along with the overexploitation of land. Among others, Lovelock (1985), warned about the consequences of rising the world's food production to meet the needs of an ever-growing population, with special care not to over-disrupt the ecosystems of regions where planetary control would depend on.

The Summit of the Earth in 1992, in Rio de Janeiro, Brazil, set the alarms off regarding the sustainability of natural resources. Then, the concept of sustainability was broadened with the notions of the limits of available resources, environmental impact, economic viability, biodiversity, and social justice.

Sustainable land management appeared as a new way of doing and thinking (FAO/PNUMA, 1999, cited by Cuellar et al., 2015). Its implementation is conditioned by the knowledge of those who execute it. On every farm, several multidisciplinary actions are taken to ensure integrated management of resources (McGarry, 2005, cited by Cuellar, et al., 2015).

Degradation and implementation of sustainable land management are high-priority challenges that work in synergy with the three Rio Conventions, an issue that was identified and tackled in the 2020 Goals of Aichi, and the 2030 Global Agenda of Sustainable Development (Colina & Luis, 2017). However, the effectiveness of several tools and methods to support decision-makers and working groups so they can collaborate in its implementation and deployment at different levels is under progress and adjustment. One of these levels corresponds to landscape as a category of geographic space.

The landscape is the visible part of the environment, the perception of the environment by individuals through their senses. It is the external, natural, and/or anthropic environment that may be perceived or experienced by a person who is observing or feeling a part of a wider physical setting. A landscape is a territorial zone or unit that varies according to the on-lookers and the observation place (Álvarez, 2011).

Landscape analysis is the result of social practices, a social construction, which permits showing a man's action throughout time, and to recognize historical aspects in today's landscape. As a testimony of human actions and the forms of life that have shaped it, the landscape is an intrinsic part of cultural identity, and the preservation of the footprints and traces of our civilization is an invaluable heritage that should be respected (Amores and Rodríguez-Bobada, 2003; Luginbühl, 2008 and Martínez de Pisón, 2009, cited by Álvarez, 2011).

Landscapes have properties derived from the functions and interactions of social and environmental processes, including ways of life and governance systems. In this context, the production of scientific knowledge for sustainability needs innovative approaches that link several disciplines to understand the complexity and dynamics of these systems (Mathez, et al., 2017).

Through value attribution, the actors become owners of their landscapes and their resources, making them parts of their everyday lives and identity. Overall, they are considered as something that must be cared for consciously using preservation and management efforts (Slocombe, 1999, cited by Gerritsen, 2018), though this type of management is not determined only by the geographical characteristics of the landscape, but also by the socioeconomic, cultural, and practical conditions of management. Today, approaches are directed to the realization of preservation and management works to safeguard the environmental and cultural values (Posey, 1999, cited Gerritsen, 2018), in a wider space such as a landscape.

Accordingly, the aim of this paper is to analyze the need for land sustainable management practice scaling of landscapes as a geographic space category, using a scientific approach. Special emphasis is made on understanding and assessing the social and ecological benefits of sustainable land management and scaling to landscape as an alternative to sustainable use of resources and the preservation of the resilience capacities.

Results and discussion

1. Current necessity of sustainable land management

Stating that humanity has always acted as an intellectual unit that manages the utilization of the existing means to offer the best to other men, and that has constantly sought the best tools to broaden man's domain over nature, is illogical (Núñez & Macías 2007).

The social impact generated by the destruction of natural environments is more evident as its influence is exerted as a self-regulated system that gravitates as part of the whole formed by nature and society. Human activity is an invasion of nature that is reverted against society, which has no alternative but

to create awareness of the existence of nature to survive under the emerging conditions set by life (Guzmán, Caballero & Mosler, 2005).

In farming areas, the main resource being degraded is the soil. It is the support of agricultural activities and the proliferating vegetation found in these production systems, which is home to the biodiversity that adapts to the settings transformed. Therefore, it is necessary to prevent soil degradation, unleash restoration processes when required, or strengthen social participation and the application of traditional knowledge in restoration processes (Martínez, 2019).

Several studies consider that the process of soil degradation is characterized by inappropriate management and exploitation, in addition to the climatic, topographic, and edaphological conditions worldwide, which have given rise to this process (Machado, Rajadel & Ponce 2015). Soil management is seen as a system of integrated and interdependent land use that combines local management with different land uses that impact the whole system at the landscape level.

To construct the definition of sustainable land management, it is necessary to refer to a set of actions for the utilization of goods and services offered by natural, social, and material resources, considering the characteristics of the setting in which they interact. Sustainability aims to natural resource use without compromising their capacity for natural regeneration, and land refers to a specified of the earth's surface that covers the soil, topography, ground deposits, water, climate, human communities, animal communities, and plant communities, which have developed as a result from those biophysical conditions (Urquiza, Alemán, Flores, Paula & Aguilar, 2011).

Sustainable land management is a more commonly used expression in the world whose purpose is to treat lands to obtain abundant quality products without compromising the status of their natural resources. It is manifested through several actions for sustainable use of goods and services from natural, social, and material resources, such as water and climate, and human, animal, and plant communities, which interact fully, according to UNDP (2009), cited by Paredes, Acosta & Pérez (2015).

Also, in 2011, Santos-Abreu et al., cited by Machado, Rajadel & Ponce (2015), defined sustainable land management as a working model that can be adjusted to the conditions of a specific scenario, which permits using the resources available to promote socioeconomic development that ensures the satisfaction or the ever-growing needs of society, the maintenance of the ecosystem's capacities and their resilience. It also favors the maintenance and optimization of the structure and form of the soil, the diversity of organisms, the cyclical capacity of nutrients, the skills to act as a substrate for plant growth, and the skills to regulate, retain, and filter the water, and the capacity to sequester carbon dioxide from the atmosphere (McBratney, Field, Morgan & Jarret, 2017).

Another term associated with sustainable land management is agroecology, which promotes the ecological management of biological systems through collective forms of social action that redirect the course of co-evolution between nature and society, to cope with the so-called modernity crisis (Sevilla & Woodgate, 2013). Genuinely, agroecology consists of guaranteeing that food systems become fairer and more sustainable in the future of how they trade, sell, and consume foods (FAO, 2018).

This ideology, along with the acceptance of other criteria, like the protection of the environment, the defense of human rights, inclusive policies, and others, including the emergence of new social actors, like non-governmental organizations and companies, leads to an increase in the number of dimensions used to define topics, issues, and solutions, conferring the process greater complexity. A critical change in the way in which society-nature relations is needed (Núñez & Macías 2007), which both agroecology and sustainable land management could assume as important contributions.

Agroecology is developed in systems that optimize and stabilize production. Socially speaking, it promotes multifunctional roles for agriculture and social justice; it nurtures identity and culture and strengthens the economic viability of rural areas. The farmers within a family are the people who, as a result of an adequate farming and ecological culture, have the tools to practice agroecology. They are real guardians of knowledge and wisdom needed for this discipline. Therefore, farmer families around the world are key elements of food production agroecologically (Jarrín, Balseca, Balseca, Heredia & Aguirre, 2018).

Policies must encourage lifestyles based on modernity, progress, and solidarity found in many rural scenarios. For instance, food sovereignty and safety as a fundamental man's right; the promotion of biological and cultural diversity; the implementation of sustainable development; the establishment of life quality; and the development of sustainable and ecological agriculture (Castillo & Martínez, 2014). It would favor agriculture, and especially, farmers, thus ruling out negative criterion associations like underdevelopment, unculture, or low social level.

The implementation of sustainable techniques as part of the principles of land sustainable management

provides several different products for sustenance or trade. They provide services to the ecosystems, such as the functions of hydrographic basins, nutrient recycling, soil health, and pollination. They permit species and ecosystems to continue to evolve and adapt, even to climate change. They supply genetic raw materials for plant and animal breeding. They offer the people social, cultural, aesthetic, and recreational values (Romero 2001, cited by Jarrín et al., 2018).

The practices of sustainable land management contribute to better soil fertility and structure, introduce large amounts of biomass to the soil, favor minimum intervention of the soil, conserve the soil and water depending on the existing fauna, and strengthen the basic cyclical mechanisms. It means greater nutrient contents to plants, and higher water retention capacity; it favors resilience capacities, besides contributing to food safety (Eririogu, et al., 2019). The adoption of proper sustainable land management practices also improves crop yields that at the same time can promote various services of the ecosystem, like carbon sequestration, climate change mitigation, biodiversity, and the reduction of anthropogenic alterations (Almagro, et al., 2016). All these aspects bring about economically viable and socially acceptable benefits (Giger, Liniger, Sauter & Schwilch, 2018).

Because of the degradation of Cuban soils and the economic hardships, alternatives have been sought to deal with this situation. Some of them are the implementation of temporary and permanent anti-erosion measures; the utilization of different organic matter carriers in the soils; the search for greater efficiency of these carriers; the utilization of green fertilizers; and the inclusion of biofertilizers (Martínez, et al., 2017), in due balance with the surrounding, to keep crop yield values, improve soil quality, and compensate for the absence of mineral fertilizers.

In this process, both farmers and nature can originate reciprocal transformations. Farmers execute it through their everyday practice, whereas nature influences the actions of farmers by the variety, quality, and quantity of goods and services it offers (Ploeg, 1987, cited by Gerritsen, 2018). Hence, natural landscapes may be produced sustainably, as a consequence of the activities of farmers that transform nature. Meanwhile, the socio-cultural patterns of populations are also given by the specific characteristics of the natural setting and its resources. (Gerritsen, 2018).

2. The need to extend demonstrative sustainable land management practices to broader spaces Landscape scaling up

Scientific research of complex, self-conscious systems as those relevant for risk analysis of environmental changes, particularly the study of landscapes, cope with a set of complexities at different levels: Physical reality directed to perceive the environment, the need to attend to the plurality of criteria, and the need to consider different objectives (Núñez & Macías 2007). To understand contemporary socio-environmental problems linked to landscape, it is necessary to understand the interactions between human societies and the natural settings, and the form in which these relations are being modified throughout history (Arrighi, 1999, cited by por Gerritsen, 2018).

The different problems that threaten sustainable land management, such as soil degradation, the loss of biological diversity, and climate change, are closely related to one another, making a complex system of multiple dependencies that should be boarded at different spatial scales: global, regional, national, subnational, and local (Ilan Stavi, 2015), (The United Nations Convention to Combat Desertification, 2015), (Kust, Andreeva & Cowie, 2017). Therefore, landscape as part of the structure of the geographical space has become a high-impact scenario on the convergence of natural and anthropic factors (Núñez & Macías 2007).

There are examples of interventions to improve sustainable land management and prevent or revert soil degradation at the farm, village, community, or hydrographic basin scale (Liniger, Critchley, Gurtner, Schwilch & Mekdaschi, 2007). However, the inability to scale up technological, institutional, and political solutions to regional, national, or international spaces, limits drastically the social capacities to cope with the global challenge of preventing and reverting soil degradation (Zucca, Bautista, Orr & Previtali, 2013).

The productive model of the Cuban farming sector, according to Rodríguez, 2012, cited by Almoguea Hernández & Terrero (2015) transits inevitably from conventional agriculture to sustainable agriculture with low chemical and energy supplies. It is in concert with the environment because of the ecological, economic, and social consequences of the conventional practices of industrial agriculture.

Commonly, sustainable land management applies to a very reduced space known as an agroecosystem, defined as an ecological system that integrates geophysical levels (soil and climate), biotic (plants and animals), and cultural or anthropic; The last one takes advantage of this and directs the trophic flow within a particular landscape (Montserrat and Villar Pérez, 1993, cited by Etcheverry & Génova, 2016). The means of sustenance and food safety of rural communities depend largely on the natural resources available. The problems of agroecosystem

sustainability are given by the under-utilization of the land, organic residues, little knowledge about the protection of natural resources, the implementation of technologies with minor environmental impacts, poor technical assistance to farmers, low genetic diversity, and poor diversity of pastures and forages for livestock nutrition (Almoguea et al., 2015).

As the agroecosystem is thought of as a relatively small unit within the geographical space that makes the landscape, the sustainability problems could exceed the possibilities for a solution within the agroecosystem if holistic, integrated approaches are not assumed, along with the capacity to comprehend the problem as a whole to implement solutions in larger spatial units, as well as the engagement of social actors and decision-makers (Ruiz, García, Lima & Gómez, 2015).

Given the relevance of landscape as a geographical space, the development of policies in favor of ecological processes and strategic environmental systems, the preservation of all forms of natural and socio-cultural diversity, the opportunity for sustainable utilization and exploitation of environmental systems and their resources, without exceeding the sustainability of the environmental systems per se. Hence, it is worth noting that there is a need to promote and foster farm landscapes that ensure optimum levels of biodiversity and sustainability as the base of economic and social development at multiple spatial scales (Clemente-Orta & Álvarez, 2019).

Considering the conservation of biodiversity and sustainable management of ecosystems is a key element in the policies and strategies for the reduction of poverty globally, nationally, and locally (Arias, González, Herrera & Alemán, 2015), it is necessary to rethink the actions taken, evaluate new contexts that affect the needs and motivations of people for their participation in change, reconstruct the environment, not forgetting that man is a social being, and consequently, must deal with the problems they have caused, implementing sustainable practices in concert with nature. (Paredes et al., 2015).

Defining the extent to which the sustainability of landscape can be established would be useful to conduct a new analysis of its use and management for various political, economic, and ideological purposes. The search or establishment of sustainable landscapes, which would also entail the inclusion of sustainability in the social productive process, could result in a conceptualization directed to establishing a place where human communities, the utilization of resources, and the burden capacity can be kept endlessly (Mateo, 1998). Accordingly, the resources will be identified and their availability will be assessed. It will include the physical-geographic characteristics, cultural costumes, and traditions of the communities that interact or are present in the landscape. Therefore, landscape, as a category of geographical space, is the ideal place to conduct actions of sustainability with a climate change approach.

The notion of landscapes has been added to the terminology and work of many scientific disciplines, but also other areas like literature and the arts. It has been included as a concept and a scientific category. (Mateo, 2006). There is also territorial assessment which has often established goals linked to landscapes or where it has been used as a tourist attraction (Corbera, 2016).

A landscape can be defined as a heterogeneous area of land made of a group of ecosystems that interact, which is repeated all over the same area (Forman & Godron, 1986). From a wildlife perspective, a landscape is a heterogeneous distribution of habitats in a marked geographic area (Bastidas, 2015).

A landscape can be conceived as a physical system that emerges from the interaction of socioeconomic and natural systems, which offers services whose benefits are used by humans. As the intensity of this link varies, not only does the structure and function of the landscape vary as well, but also the value that individuals, social groups, and communities give it (Cordoves, Vallejos & Hernández, 2019). The landscape is an intellectual construction, an object of study, and an instrument for political intervention or economic speculation (Corbera, 2016).

The landscape is thought of as a changing and dynamic phenomenon whose elements and components form a system with two major vectors: humans and nature; to understand landscape it is important to understand that these components make an indivisible binomial that complements itself (Morón, 2017), in which one conditions the other and vice versa, keeping a state of balance.

Landscape can be analyzed as the physiognomy, morphology, or formal expression of space, and the territories, and it shows the vision of the people of their surroundings (Mateo, 2006). Besides, the landscape is appreciated as a sensorial image that is perceived as something affective, symbolic, and material, with direct or indirect effects on psychology and society, creating a relationship between the natural and the results of human activity (Mateo, 2007).

Landscape functions thanks to exchanges of matter and energy that favor processes and dynamics with a geological perspective, and then followed by others that bear a human nature. Among them are those that refer to processes related to culture and identity,

ideology, scientific and technological advances, etc. (Morón, 2017).

Another term considers landscape as a space-time system, which is complex and open, and originates and evolves right in the nature-society interface. It is known as the material expression of the geographic space. It is the group of forms that in a particular moment can reveal the inheritance of successive relations between man and nature; the landscape is presented as a set of real and concrete objects. (Mateo, 2008). Approaching such space may be done by observing its physiognomy, which reveals the space-time relations of its elements, or by sensitive or emotional contemplation (Corbera, 2016).

These spaces may be used, analyzed, evaluated, and managed in the process of territorial ordering and sustainable development. The landscape ecology approaches offer a solid base for holistic and systemic analysis of territory and permit classifying and limiting homogeneous units depending on their features, which can be studied, evaluated, and managed during the process of space planning. Landscape units allow for soil, natural and environmental diversity ordering. However, they have certain constraints when ordering territories occupied by cities and their infrastructure, including their cultural and productive diversities, which respond to political-administrative territorial sets. To form landscape units, ecological and geomorphological criteria are established (Ruiz, et al., 2015).

The landscape approach offers space-time tools that integrate the physical natural dimensions into the economic and sociocultural dimension, associated with a holistic-temporary dimension when the landscape is seen as the result of the action and interaction of natural and human-caused phenomena that take place in a particular period (Mazzoni, 2014).

The term landscape is used to refer to the phenomenon that integrates the natural and anthropic sides in different ways, adopting different configurations according to the territory and the society that inhabits and perceives them. (Morón, 2017). Landscape assessment requires knowledge about the local challenges in terms of risk and threat management, territorial ordering plans, the impact of climate variability on productivity, environmental sustainability, and the preservation of biological diversity, including the generational replacement (Velandia, 2018).

The dimension landscape influences humanized ecosystems, not forgetting the existence of landscapes that can be classified into natural, whose administration and protection can no longer do without a comprehensive planning strategy that conjugate the modification of the environment with the preservation of elements, natural resources, and indispensable ecosystem relations to control and revert the deteriorating trends of the large regional ecosystems and the biosphere. Because of its complex nature, and environmental, economic, and social implications, the conception of landscape acquires a greater multidiscipline extent. Hence, new scientific and social transformation areas are identified and formulated (Medina-Sanson, Guevara-Hernández & Tejeda-Cruz, 2014).

Because the landscape is spatially heterogeneous, the supply of ecosystem services varies depending on how the landscape is configured (Fu & Jones, 2013). This configuration is closely related to decision-making in terms of landscaping, especially landscapes dominated by an exclusively agricultural form of production. This dynamic has led to the transformation of different regions worldwide as a response to the growing demand for foods, fiber, and fuels in the form of extensive homogeneous areas (Foley, et al., 2005) (Monfreda, Ramankutty & Hertel, 2009) where landscape functions have deteriorated, and in extreme cases, disappeared totally.

Modern agriculture has brought about the simplification of landscape that results from the removal of non-productive natural and semi-natural elements, causing unbalances in the role of ecosystem services based on decisions made in terms of landscape that leads to the alteration of key ecological processes that could eventually produce a returning effect that harms the whole system (Termorshuizen & Opdam, 2009). The same situation is reproduced around perceived risks since the social dynamics make them the consequence of alterations caused to the ecosystems that at some point affect those who produce or benefit from them (Beck, 2008).

From a sociological perspective, the risks of using landscape resources are a product of the society, understood as the harm to the future derived from present-day decisions. It can be constructed, interpreted, and selected by the actors, by establishing social norms and structures (Galindo, 2017) where its analysis and management are directly associated with social systems (Wong & Lockie, 2018). It brings transformation or invasions to the geographic space, which turn into vulnerabilities to the balance state of landscape resilience.

Thus, protecting the landscape means protecting the essence of a people's culture and history. It is the canvas on which humans outline their way of life, needs for foods, clothes, shelter, trade and exchanges, movements, tastes, games, and art creations. Then it is clear that there is a need to establish a legal framework for the protection and conservation of the

landscape. But it also demands complex tasks by integrating so many and so diverse elements developed and adjusted throughout so many years (Moreno 2018).

Conclusions

Sustainable land management aims to obtain sufficient products without compromising the state of natural resources being used. This working model can be adjusted to the specific working conditions of implementation areas, also contributing to the maintenance of biodiversity, the protection of the ecosystem, food sovereignty, and the maintenance of cultural identity.

The scaling of land sustainable management practices into the landscape is a necessity. The dimensions of the natural, economic, and social problems associated with land use must be addressed beyond the boundaries of a single agroecosystem.

Author contribution

Adrian Juan Espinosa: research planning, template design, analysis of results, redaction of the manuscript, final review.

Conflicts of interest

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