

## Environment Perceptions and Conservation Preferences along the Coatepec-La Antigua Watershed, México

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**ABSTRACT** In order to obtain and compare social perceptions on natural resources in the watershed area of Coatepec - La Antigua, in central Veracruz, Mexico and to determine the significance that each landscape has for people, a method based on a picture enquiry was used to measure landscape perception. Additional questions assessed the importance of landscape meaning and functions and revealed differences in perception among 370 respondents. The results afford important insights into public perception. Coffee plantations, urban setting, farm and river landscapes were preferred over grasslands, corn plantation, forest and town landscapes. Respondents showed a predilection for managed or cultivated environments and urban settings over other natural landscapes. It is concluded that a differentiation in views of nature and landscape can be identified in the different groups of social actors regarding landscape.

### INTRODUCTION

Increasing awareness and recognition of the relationship between human being and its environment contributed to the emergence of Environmental Psychology as an independent field of research (Proshansky et al. 1976; Bruce et al. 2003; Nagar 2006). Merleau-Ponty, a pioneer in this field, stresses the capacity of the human body to express meanings and attempts to replace a spectatorial conception of vision with an embodied ontology that accords transcendence to the depth of the visual world (Merleau-Ponty 1962).

Itelson et al. (1974) sums up the relationship between people and landscape as an externalization of culture (the “symbolic” perspective). People and landscape function together, but function is divided into two categories. Some functions satisfy present needs and preferences (the “instrumental” perspective), while other

functions (ought to) satisfy needs and preferences (the “ecological” perspective) of the future. In turn, Moos (1985) describes several physical factors of human behavior that fall into the categories: weather, architecture, population density and pollution. “Nature” is named as a physical factor but its manifestation is not further defined or addressed. However, landscapes, either natural or manipulated through human design and use, are not mentioned. Itelson (1978) pointed to two fundamental questions: “What is the nature of environmental perception?” and “What is the relationship between perceived environmental change and environmental action?” These questions are approached by analyzing the dimensions of environmental experience into four major categories: the environment as external object, as representation of self, as embodiment of value, and as arena for action.

According to Aoki (1999), early research on personal evaluation of landscapes and predictions of response to landscape parameters were based on relatively simple features. Subsequent model development has emphasized greater complexity with regard to photographic detail and/or the physical features of sites, such as vegetation. Also, researchers interested in the effects of cultural background on landscape evaluation have examined the effects of subjects’ personality, ethnicity and living environment, and have

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considered the influence of human ontogeny and phytogeny on landscape evaluation.

Farinaa et al. (2005) approached the definition of landscapes using cognitive paradigms and in order to explore the cognitive mechanisms defined neutral-based landscape (NbL), individual-based landscape (IbL) and observed-based landscape (ObL). According to them, the perceived landscape (PL) is a scale-dependent phenomenon composed by the sum of these three approaches of landscape perception. Nohl (2001) also considers human aesthetic perception as a basic cognition process, differentiating between four major levels of knowledge or of sense (perception, expression, symptomatic information, and symbolic meaning).

For Wylie (2006), landscape is not a way of seeing the world. Nor is it 'something seen', an external, inert surface. Rather, the term 'landscape' names the materialities and sensibilities with which are seen. However, Johnston (1998) considers that the relationship between perception and landscape is twofold. The explicit approach isolates perception within the landscape as something between the observed and the cognitized. In turn, an inherent approach does not isolate perception because it is embedded within ways of living - or being.

The study of landscape perception has two central issues closely related: whether or not there is consensus in judgments of any particular landscape, and the need for theory development in the area (Purcell and Lamb 1984). According to Nagar (2006), environmental perception requires a holistic approach by which individual processes and environmental components are seen as a functional unit. Perception represents a step beyond sensation. The three major conventional perspectives to perception include constructivism, structuralism and functionalism.

From a practical standpoint, one of the main interest areas for environment psychology has been getting an understanding of landscape and the gazing subject. Assessing public perception of landscape continues to be both an academic and a policy challenge. In fact, landscape perception research during the past decades has responded to legislative mandates and landscape management, planning and design issues (Shuttleworth 1984). Currently, forest planners, designers and managers have to incorporate visual landscape management into their plans as part

of sustainable ecosystem and forest management. The need for public participation also means that landscape perception, in a broad sense, has become very important (Bell 2001). For landscape planning and management practice it is impossible to neglect the social perception of landscape, that is, the ways people think about nature and landscape (Buijs et al. 2006).

Lothian (1999) proposes that landscape quality assessment may be approached on the basis of two contrasting paradigms, one which regards quality as inherent in the physical landscape (objectivist paradigm), and the other which regards quality as a product of the mind – eye of the beholder (subjectivist paradigm). From a literature review, Zube et al. (1982) identified four paradigms that have been followed in assessing perceived landscape values (expert, psychophysical, cognitive and experiential) but also noted the absence of an explicit theoretical foundation.

Daniel (2001) states that the history of landscape quality assessment has featured a contest between expert and perception-based approaches, paralleling a long-standing debate in the philosophy of aesthetics. The expert approach has dominated in environmental management practice and the perception-based approach has dominated in research. However, both approaches generally accept that landscape quality derives from an interaction between biophysical features of the landscape and perceptual/judgmental processes of the human viewer. The approaches differ in the conceptualizations of and the relative importance of the landscape and human viewer components. By the end of the past century, landscape quality assessment practice evolved toward a process by which both expert and perceptual approaches are applied in parallel and then merged in the final environmental management decision making process. Daniel (2001) advocates for a psychophysical approach to provide a more appropriate balance between biophysical and human perception/judgment components of an operationally delimited landscape quality assessment system.

Buijs et al. (2006) argue that the concept of landscape is nearer to the life world of people than the abstract notions of nature and biodiversity; hence, this implies a big challenge for landscape policies and for local landscape management initiatives to be developed. Moreover, experts' perception differs from the preferences

of the population (Jensen 1993). Different groups look at landscapes in a different way, attaching importance to different landscape features and finding different functions appropriate for such landscapes (Rogge et al. 2007). Recently, O'Brien et al. (2014) suggested that community perception combines heuristics and familiarity to make inferences.

An analysis of perceptions for rural landscape changes in Japan suggested that farmers may have higher normative criteria for rural landscapes than naturalists. Hence, any rural conservation planning effort should carefully consider that farmers and naturalists consider different aspects of landscapes as important (Natori and Chenoweth 2008). A study conducted in Wales showed that the public has strong attachments to managed rural landscapes in general, and wishes to see more integrative and participative strategies for landscape protection and management (Scott 2002). Such attitudes challenge planners and policy makers to rethink their approaches towards conventional landscape management strategies and planning. Also in Wales, Scott (2003) found that public express sophisticated and multi-functional views on local landscapes with strong attachments to the explicit character of rural and urban landscapes and wish to see more holistic, functional and participative strategies for landscape protection and management. Such attitudes endorse some contemporary policy initiatives but challenge planners and policy makers to rethink their approaches towards integrated landscape management, citizen involvement and future land-use policies. Ribe (2006), in a study done on perceptions of forestry alternatives in the US Pacific Northwest found that socially acceptable forestry attends to scenic beauty and serves wildlife needs, while also serving human needs but not at a high cost to these first two values. Finally, a study on perception and evaluation of the landscape carried out in the Netherlands concluded that in spite of great physical differences between the regions, there was some salient attributes: the nature of the landscape as a whole (unity), its function (use), maintenance, naturalness, spaciousness, development in time, soil and water, and sensory qualities such as color and smell, to be considered as basic qualities of the landscape (Coeterier 1996). More recently, Rollero and De Piccoli (2010) state that the relationship between people and places is charac-

terized by affective and cognitive dimensions, which in turn are defined by place attachment and identification. Place attachment and identification are two distinct but correlated components. Semantic contents related to the environmental perception are described in respect to different levels of attachment and identification. According to them, semantic contents related to the environmental perception can be described in respect to different levels of attachment and identification, so the affective and the cognitive dimensions are directly predicted by different demographical and psychosocial variables and are strictly associated to the perception of the place and its inhabitants.

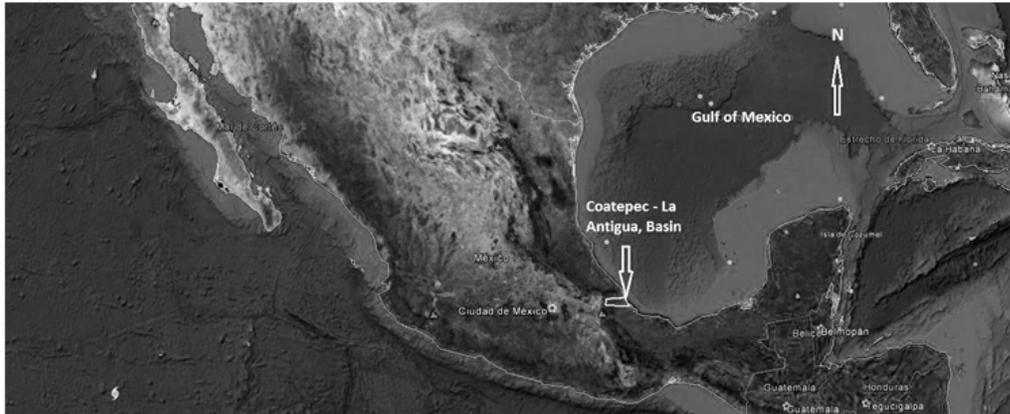
Environmental damage and life quality decrease only appear as a problem when society perceives it as such (Zhongwei et al. 2001). From then, the interest in knowing the value of environment and natural resources in circumstances of incremented use arises. The objective of this study was to obtain and compare social perception of natural resources in the watershed area of Coatepec - La Antigua, in central Veracruz, Mexico and to determine the significance that each landscape has for people, as a function of the quality of life each landscape provides.

## METHODOLOGY

### Study Area

The research was conducted at the Coatepec - La Antigua watershed area, a hydrologic region situated in the central portion of the state of Veracruz, Mexico and located at 19° 13' 12" - 18° 51' 00" N; 97° 16' 12" - 95° 55' 12" E, with a total area of 232 000 643 ha (Fig. 1). The watershed includes several affluents, the farthest of which is located at 4282 meters. Tributaries fuse at different points along the course and the parent river finally discharges into the Gulf of Mexico, approximately 20 kilometers northwest of the city of Veracruz. The average annual volume of this stream is estimated at 2 000 817 million cubic meters.

In general, climate is mild, with an average annual temperature that fluctuates between 12 °C and 26 °C and an overall humid regime with 1800 mm as average annual rainfall. There are at least 25 trees and shrubs species in the entire expanse of the watershed, forming plant communities ranging from cold temperate forest to



**Fig. 1. Location of the Coatepec-La Antigua river watershed. Veracruz, Mexico**

*Source: Google maps*

lowland grassland. Throughout the course there are several villages with different degrees of urban development. The main economic activities are agriculture, with coffee and sugarcane as main crops, industry, livestock, fisheries and tourism (Román-Jiménez et al. 2011).

### Research Design

Emphasis was placed on ground cover, based on the theoretical basis that forestry cover provides better environmental products and services impacting positively on human quality of life than other landscapes. By the analysis of social perceptions, the study focused on determining the social interest on the importance and value given to different land cover, based on the capture of preferences depending on the level of welfare that regional landscapes provide (for example, forest, coffee plantations, rivers, towns, cities, pastures, and barren land) as suggested by Whittington (1998) and Tisdell (1993). This case involved considering the importance of vegetation as existence value (Hannon 2001) on social preferences and welfare levels generated by the current land use. The purpose was not to value vegetation, but to identify how changes in landscape characteristics, or attributes, may affect the welfare function of individuals (Zas et al. 1998; Scarpa et al. 2001) by capturing the complexity of the values and the regional cultural landscape (Clark et al. 2002; Pouta et al. 2002).

Photographs have long been used to represent environmental conditions in the context of landscape quality assessments and environmen-

tal perception research and are surrogates for field observations in studies of perception and judgment of the visual environment (Stewart et al. 1984; Daniel and Meitner 2001; da Silva et al. 2014). In this study, a public survey presented respondents with landscape photos, explanatory narratives, and resource outputs related to nature and human needs. Participants were asked to rank the scenes according to what they would prefer from both, conservation and economic development viewpoints. The following landscapes were presented: town, corn plantation, pasture, forest, river, urban, coffee plantation, and barren land.

A well validated household questionnaire was also undertaken to represent public perceptions. A referendum type questionnaire was designed to assess the landscapes through questions about preferences on a Likert type scale from 1 to 5 (for example, bad, poor, fair, good and excellent). The questionnaire included questions on socio-demographic, natural resources, environment and livestock items.

The questionnaire was applied at the Coatepec - La Antigua river's upper part and at the low watershed area. In both areas, a stratified random sampling was utilized based on a proportional population structure similar to the official statistics provided by INEGI (2008) in relation to gender, age, education, place of residence and income in the study area, and in accordance to the recommendations of Turpie (2003) to assess the value of biodiversity. A sample size of individuals over 16 year-old was selected on the assumption that they were informed people pos-

sessing an independent judgment on the environment, land use and local circumstances.

### Statistical Analysis

Descriptive statistics was done for all the defined variables. In order to determine landscape preferences, medians for the variables were compared by Kruskal Wallis test. Statistical significance was declared at a 0.05 level.

## RESULTS AND DISCUSSION

There were 199 respondents at the river's upper part, mostly rural area inhabitants, and 171 individuals at the low watershed area, mostly urban residents. Field work was performed in six rural communities of three municipalities as well in the Veracruz- Boca del Río metropolitan area.

### Environmental Perceptions at the Cloud Forest

At the Cloud Forest, land use includes: woods and forests (49%), pasture and grassland (25%), agriculture (21%), and human settlements (5%). In this area, landscape preferences - indicated by a higher median value-, were for disturbed landscapes such as farm, urban, coffee plantations and river. Conversely, most natural environments such as forest scored lower. Answers seem to be related to landscapes that respondents are familiar with since birth; thus, they think of them as desirable. Findings of this study apparently contradicts those of Ogo et al. (2014), who investigating environmental implication of people's perception and attitude towards forest conservation in Ikono Local Government Area, Akwa Ibom State Nigeria found a positive attitude towards forest, but they did not asked about perceptions about other environments. According to Chokor (2004), poor are environmentally rational but often handicapped in doing the right thing. Resource scarcity, declining yields and associated inflation/high cost of living are seen as the major signs of resource degradation. Rural people have a holistic and long-term view of the environmental implications of natural resource use, but the self- and socio-economic survival goals appear to form the predominant contexts for the individual's environmental thinking and decision-making, instead of the community and the 'common good' as could

be expected. This view is supported by Alassaf et al. (2014) who in southwest Jordan found that responses from rural residents reflected a greater average concern and awareness of their environment than urban residents.

From the standpoint of conservation, medians were higher for coffee plantations, city, farm and river, and hence considered as landscapes of environmental quality. Lowest values were for barren land. Three distinct groups of opinion among respondents were found ( $p < 0.05$ ). Town, forest, and corn plantation landscapes were perceived as similar. In turn, grasslands, river, farm, city, and coffee plantations landscapes showed no difference among them. Data show that, from the point of view of conservation, the most important land cover for respondents was not the forest, but other landscapes.

From the standpoint of economic development, ranking was similar to preferences for conservation, even though grades granted were not as higher. Data suggest the most important land cover for the population from the economic development point of view is coffee plantations (Table 1). Mansky (2000) and Del Angel et al. (2006) suggest that in evaluations of landscape perceptions, subjective aspects and personal expectations are always present and are hard to remove for the respondent. Opinions arise from differences in income, consumption and education levels, thus the final selection has a multi-linear socio-economic background. Here, respondents' comments focused on the importance of income derived from cultivated environments. In this area, shade coffee has played an impor-

**Table 1: Preferences for landscapes depending on conservation and economic development, Coatepec-La Antigua river basin, Veracruz, Mexico**

Variable	Conservation*	Economic development**
Barren land	1 <sup>a</sup>	1 <sup>a</sup>
Town	3 <sup>b</sup>	3 <sup>b</sup>
Forest	3 <sup>b</sup>	3 <sup>b</sup>
Corn plantation	3 <sup>b</sup>	3 <sup>b</sup>
Grasslands	3 <sup>c</sup>	3 <sup>c</sup>
River	3 <sup>c</sup>	3 <sup>c</sup>
Farm	3 <sup>c</sup>	3 <sup>c</sup>
City	3 <sup>c</sup>	3 <sup>c</sup>
Coffee plantation	4 <sup>c</sup>	3 <sup>c</sup>

\*Median of landscape preferences.

\*\* Median values with different superscripts in the same column are statistically different ( $p < 0.05$ ).

tant role in the regional economy since colonial times. For urban environments, the view is that urban settings are important because people can no longer live in a rural area lacking services and utilities. Furthermore, cities are an important labor market. A relevant assumption underlying the use of photographic aids is that human viewers' responses to these representations provide valid indications of perceptions and judgments made in response to direct experience with the landscape conditions nominally represented.

### **Environmental Perceptions at the Watershed Low-lands**

The state of Veracruz is a biologically rich and a major cattle producer in the country, not only by the number of heads, but also because about half of the total surface is covered by pasture and grasslands (INEGI 2012). Hence, a relevant part of this study was focused on determining perceptions of people on livestock in the studied area. Soil use for livestock on the coastal plain of the Gulf of Mexico can be traced back to Colonial times. Livestock activities were a natural choice given the abundance of grasses and vegetation, as well as flooded areas used for grazing during the dry season. Probably for this reason, this study shows that the population of the coastal zone has internalized the existence of livestock as a necessary and important element; so in people's mind, grassland presence equates to livestock grazing, and the existence of natural pastures is not accounted for, since grasslands are perceived as economically inefficient.

According to Chiesura and de Groot (2003) and Ruijrok (2001), opinions on welfare are determined as a response to an economic rationality; however, Lewan and Soderqvist (2002) show that respondents recognize the visible or economic ecosystem services, rather than those services that have no market, making them invisible to the economic system that people is aware of. This indicates that human preferences regarding environment and nature are linked to concrete rather than to abstract experiences.

Grazing system in the studied area is seen as a single economic strategy whose environmental costs are paid by society because economic estimates do not consider environmental costs of natural resources (Clarkson et al. 2011). Although the massive scale of these changes is

historically recent, since mid-twentieth century the so-called "growth with stability" economic policy promoted agriculture development and resulted in worsening the environmental problems in Mexico, and should be of paramount concern to the institutions that make regional policies.

Findings in this study are similar to those of Ruiz and Gonzalez-Bernaldez (1983) in Spain who searched for the ideal landscape of traditional livestock raisers near Madrid using comparisons of range land photographs. They found that the ideal picture of the optimum landscape contains both physical and management aspects. Again, conflicts opposing different management criteria resulted in some landscape preference variance. The predominant model of landscape preference corresponds to a traditional strategy of self-sufficiency and balanced management in a severe, unpredictable environment which contrast with the modern trend towards intensive agriculture resulting in a very different landscape.

In this study, the perception of different landscapes show preferences oriented to landscapes that provide tangible economic benefits rather than ecological benefits that are perceived as intangible. At the upper watershed preferred landscapes include coffee plantations and grasslands, as well as city and farms. At the lower watershed the population shows great appreciation for livestock, not internalizing the existence of natural pastures but of grasslands for cattle grazing. In general terms, the level of welfare that the actual soil cover provides to respondents is satisfactory and is perceived in terms of utilitarian goods rather than of environmental services, so that predominant views are oriented to the continuity of the current scenarios. As Buijs et al. (2006) noted, social demand for landscape is growing and a shift from a functional image of nature and landscape to a more hedonistic image has taken place. The influence of urbanization is evident in this process.

### **Support to Legislation to Preserve and Improve Regional Natural Resources**

Livestock producers were asked about their support to the existence of rules that may improve regional natural resources, the need for adequacy and rigorous environmental standards for livestock production, and full implementa-

tion of the existing rules, even if they involve modifying or reducing livestock activities on land (for example, amendment on production systems such as type of technology used).

One of the foundations for implementing standards for environmental protection is public policies abiding the behavior of individuals. Hence, it was deemed appropriate to obtain social demands regarding environmental protection forms considered as viable and that individuals were willing to comply with. The six responses to this question are summarized in Figure 2.

This item was included for the purpose of knowing how social opinion considered the public utility of some landscape providing environmental values and services for society welfare such as carbon sequestration, water, biodiversity, and mitigation of natural disasters. Most of respondents' opinions (98%) can be grouped into two categories. The first does not involve a personal payment, but rather fiscal costs borne by the government, such as education for preservation and the use of targeted subsidies to various beneficiaries, including payments to farmers to carry out conservation activities, to charge environmental costs to the producer as

legal owner of the properties by impacting their private income, and including an increase in the price of agricultural products to subsidize environmental damage. A second approach was aimed at the application of penalties such as fines for not obeying rules or for harming the environment, and the expropriation of sites of public interest such as those recognized as priorities for the production of environmental services.

Subjective evaluations as the one intended here highlight some subjective aspects such as expectations arising from differences in income, education, and consumption levels, thus the selection of a response has a multilinear socio-economic background (Spash 2000; Mansky 2000). For instance, people who support the modification of natural prairies to grasslands demand the application of rigorous standards to ensure that production systems are modified to a more sustainable condition. Some case studies show a marked change in values attributed to nature and landscape by the end of last century. It is noteworthy that images of nature vary considerably between farmers, urban residents, conservationists and other stakeholders. The way people perceive landscape seems deter-

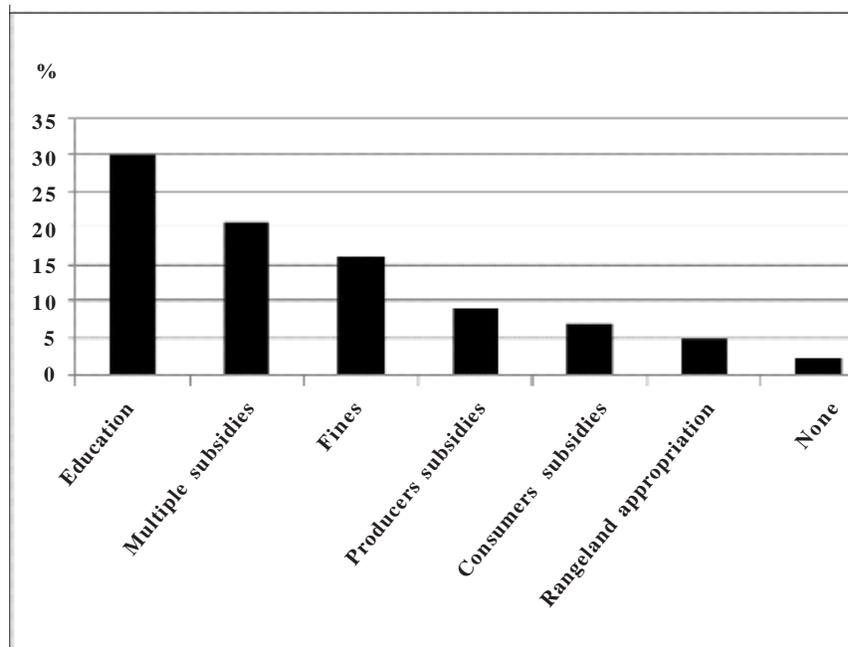


Fig. 2. Respondents support for actions to preserve and improve regional natural resources at Coatepec-La Antigua river watershed. Veracruz, Mexico.

mined by their functional ties with the landscape and the social praxis in which they encounter the landscape (Buijs et al. 2006).

To support decision making, it may be helpful to collect more data using different approaches. As Shimizu and Nakatsuji (2014) state, in landscape planning, watershed analysis can well describe a vertical structure from upstream to downstream, but it is necessary to perform an additional analysis that can describe horizontal connection of landscape. Also, Curtis et al. (2014) propose the integration of sketch maps with geographic information systems to understand environmental perception.

In this study, participants were asked if they would support the government to increase tax items for the improvement of environmental quality in livestock areas, most respondents remained positive. Similarly, participants showed a positive attitude with regard to supporting the existence and application of standards to improve environmental quality in livestock areas. Finally, there was not great support for appropriation as a way to preserve certain areas in the region.

Diversity faces drastic decline due to the changes following the socioeconomic circumstances regarding agriculture. Much of environmental analyses have focused on national and global issues rather than on local areas. This paper attempts an appraisal of the environmental perceptions, concerns and resource values of people living in an increasingly degraded environment. The involvement of the public in landscape matters has been and continues to be both controversial and problematic. Constraints of time and resources, together with a reluctance to delegate responsibility to the public, have generally limited the scope and influence of much participation to conventional reactive strategies. Individual and community responses shape the social experience of risk and are related to land use policy of the government (Chiang et al. 2014). Social justice and fairness to communities seems to be critical to sustainable development in poor areas; moreover, resources must be harnessed in such a way that they contribute directly to community asset building to improve socio-economic activities and protect the environment. This implies the difficult task of matching perceptions of the landscape between farmers, landscape experts and the general public. Effective restoration approaches must transform problems

into solutions by empowering local people (Celentano et al. 2014), but some environmental threats such as lack of maintenance of forests and agricultural lands and loss of economic functions of forests and farmland are structural problems, which cannot be solved only by people efforts. To support such community efforts some effective political measures in a regional scale might be integrated (Shimizu and Nakatsuji 2014).

## CONCLUSION

In the study, to identify public perception of landscape in households, questionnaires have been used to evaluate public perception in response to carefully selected photographic media. Respondents validated the nature of environmental problems and gave their priorities in relation to their experiences within the community. Respondents showed a predilection for managed or cultivated environments and urban settings. For rural people, traditional environmental resource conservation measures previously embraced by communities have been abandoned in order to meet the exigencies of short-term survival.

In regard to livestock grazing areas, overall, there was a favorable attitude among respondents to increasing taxes, governmental support and subsidies that allow improve environmental quality and natural resources, as well as adequately compensate farmers who comply with prescribed environmental quality goals. It was found a predominant support for strict enforcement of the existing legislation on the subject, and the potential to create additional rules that may improve natural resources and the regional environment. However, it is perceived that knowledge that the general public has of the rules that apply to the environment, natural resources and livestock, is deficient and incomplete in terms of its general provisions, purview, scope and limitations.

## RECOMMENDATIONS

The study demonstrates the need for a proper understanding of natural resource issues drawing not only on scientific and economic evaluations but also on community-centered approaches. Rural conservation will require cooperation among major stakeholders, and knowing how preferences for and perceptions of rural

and urban landscapes differ among them can help crafting and implementing effective conservation measures. Also, policies concerning landscape servicing by the farming community should incorporate appropriate incentives of communication and generate modes of understanding between different stakeholders.

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