



Environmental policies in the peri-urban area of Mexico City: The perceived effects of three environmental programs



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ABSTRACT

Managing peri-urban areas is complicated due to the unique rural and urban characteristics and because sectorial policies are not always compatible. In Mexico City, peri-urban spaces (particularly the Conservation Zone in the south of the city) provide important ecosystem services for urban residents. However, despite this environmental importance, the Conservation Zone suffers from land-use changes as a result of the economic transition from rural to urban activities. Different government agencies have implemented environmental programs attempting to address this problem. The present paper focuses on the beneficiaries' perceptions of the effects of three such programs. The results demonstrate the importance of the conservation programs but at the same time show numerous unresolved issues, including excessive administrative fulfillments, social and political conflicts, and a lack of coherence among programs. An alternative could be an integrated spatial and environmental planning process in which federal and local authorities, beneficiaries, and city inhabitants participate.

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1. Introduction

Studies of peri-urban areas have reemerged over the past two decades (Lerner & Eakin, 2011; Allen, 2003; Fisher, 2003; Simon, 2008; Zasada, 2011). Urban sprawl and the economic transformation of peri-urban agriculture have attracted the attention of scholars in various fields, including geography (Ruiz & Delgado, 2008), economics (Cabus & Vanhaverbeke, 2003; Brinkley, 2012), sociology (Lindsay, Greig, & McQuaid, 2005), anthropology (Ruiz & Delgado, 2008), and planning (Willemen, Hein, & Verburg, 2010; Ruiz, 2013).

Peri-urban areas are easy to identify but difficult to conceptualize (Lerner & Eakin, 2011; Ruiz & Delgado, 2008). Nonetheless, there is consensus that such zones are not merely a juxtaposition of urban and rural landscapes. For instance, in some cases, industrial and conservation areas are important in defining what is understood as peri-urban (Portnov & Pearlmuter, 1999; Allen, 2003; Stoian, 2005; Keivani & Mattingly, 2007; Hornis & Eck, 2008a; Said-Mohamed, Neukermans, Kairo, Dahdouh-Guebas, & Koedman, 2009; Shu-Li, Wang, & Budd, 2009; Ayenew, Wurzimer, Tegegne, & Zollitsch, 2011; Kritsanaphan & Sajor, 2011; Vejre, Sondergaard, & Thorsen, 2011; Zasada, 2011;

Díaz-Cervantes, 2012). Moreover, there are new challenges in defining and managing these areas based on the need to include additional economic activities.

The economic and social transitions of many cities have challenged the way that urban and peri-urban lands have been managed (Allen, 2003; Simon, 2008; Ruiz, 2013; Lerner & Eakin, 2011). On the one hand, urban and industrial activities have traditionally pressured agricultural usage. On the other hand, recent concerns regarding environmental issues have positioned the discussion of compact cities at the center of numerous policies because the urban periphery is considered to consist of open and preserved spaces. However, problems arise with respect to how a space that is subject to various pressures and land uses should be managed when it does not have special status in law or in policy (Allen, 2003; Lerner & Eakin, 2011; Simon, 2008). Striking a balance among economic development, urban usage, sustainable exploitation and spatial conservation in peri-urban spaces is a major challenge faced by many governments (Pérez, Perevochtchikova, & Ávila-Foucat, 2011; Pérez, Perevochtchikova, & Ávila-Foucat, 2012; Ruiz, 2013).

In the context of this paper, peri-urban zones are important because they provide ecosystem services to the city and their land-use transformation affects the urban population in numerous ways (Colding, 2011). Water runoff, carbon storage, biodiversity and natural aesthetics are among the most important ecosystem services provided by peri-urban zones (Vejre et al., 2011; Niemela, 2012), and their preservation is thus crucial for the urban population (Simon, 2008; Vejre et al., 2011).

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Our main interest is the participation in environmental programs and more particularly how beneficiaries perceive the implementation, social, economic and environmental effects of such environmental programs. This understanding is relevant for understanding positive and negative aspects and for identifying specific necessities of those programs within a complex context in order to improve them and increase the probability of conservation through environmental instruments. This work aims to identify recommendations for improving government policies in peri-urban contexts. The three programs analyzed are Payment for Hydrological Environmental Services (PHES), Management Units for Conservation and Sustainable Use of Wildlife (UMAs) and the Communitarian Funds for Rural Sustainable Development Program (FOCOMDES).

Mexico City is challenging as the subject of study in this regard because the law forbids the transformation of forested areas in the peri-urban zone, but the law is not enforced. Thus, land-use changes (typically to urban and agricultural uses) and unsustainable economic activities are common. In response, the government has promoted land-use sustainability, and the mechanisms used to achieve these goals are environmental programs that require active social participation.

The next section focuses on the peri-urban zones transformation and the need for an environmental policy specifically designed for those areas. The second and third sections describe the study area and results. The article concludes with some final considerations.

2. Peri-urban spaces and environmental challenges

The peripheries of cities have been analyzed in various disciplines and studied from different perspectives (Ruiz & Delgado, 2008; Simon, 2008; Zasada, 2011). From a “classic urban point of view”, the primary role of peri-urban spaces is to serve as land reserves for future urbanization. However, “emergent views”³ instead emphasize the economic role of such peripheries in a globalized context (Keivani & Mattingly, 2007; Nelson & Nelson, 2010) and the importance of ecosystem services to the city (Portnov & Pearlmutter, 1999; Allen, 2003; Da Gamma Torres, 2008; Hornis & Eck, 2008a; Shu-Li et al., 2009; Kritsanaphan & Sajor, 2011).

Worldwide, urban peripheries have changed dramatically over the last 40 years (Simon, 2008). Those transformations are the result of multiple factors, including economic activities, natural assets, land and housing markets and the urban, rural and environmental planning strategies of local and national governments (Fisher, 2003; Simon, 2008). Although there are significant differences between and within countries, there are also common aspects that have provided new insights into the study of peripheries, including the following: urban expansion and land-use change (Nechyba & Walsh, 2004); the importance of non-agricultural activities, such as commerce, services (Zasada, 2011) and infrastructure construction; and the new political focus on environmental management (Allen, 2003), including the centrality of ecosystem services (Vejre et al., 2011).

Urban peripheries are complex spaces that require an interdisciplinary and integrated approach (Niemela, 2012). Peri-urban zones are not urban or rural or a combination of the two; they are a particular type of space with their own characteristics, including environmental characteristics (Colding, 2011). These spaces can be homogenous or heterogeneous transition zones (Simon, 2008). These zones are frequently home to complex processes that lead to the creation of areas with specific characteristics and cultures (Ruiz & Delgado, 2008). Moreover, combinations of land uses (rural, urban and environmental) occur within social and cultural contexts. Therefore, the conceptualization of the urban periphery must be changed to locate the characteristics and processes within a more integrated analytical framework.

³ Colding (2011) refers to them as “planning for development” and “sustainable development”, respectively.

The urban periphery cannot be exclusively regarded as a space for agricultural production for urban markets (Hudalah, Winarso, & Walter, 2007; Ayenew et al., 2011; Gant, Robinson, & Fazal, 2011). In this sense, peri-urban agriculture must adapt to cope with the challenges imposed by global agricultural markets, changes in the urban middle class diet and pressures to change land uses (Cavailles & Wavresky, 2003; Crossman, Brett, Ostendorf, & Collins, 2007). Consequently, specialized (more selective) agricultural practices—in conjunction with other activities, such as industry, tourism and payments for environmental services—have been implemented as part of a strategy to increase profits while maintaining agriculture as an important activity in the peri-urban space (Alix-Garcia and Wolff, 2014; Stoian, 2005; Wunder & Börner, 2010; Zasada, 2011).

Developing countries have their own important particularities. For example, in Latin America, trends of urban expansion have demonstrated that the real-estate sector is closely linked with the persistence of illegal settlements. Those settlements have a direct impact on soil and land degradation.

Unfortunately, the environmental management of peri-urban zones has not been an important consideration in many countries (Allen, 2003; Simon, 2008; Lerner & Eakin, 2011). The ecosystem services these areas provided for cities are generally overlooked, although these services are crucial for the survival of many cities. For instance, in Mexico City, approximately 70% of all potable water comes from the infiltration of water in the peri-urban Conservation Zone (Escolero, Edda Martínez, Kralish, & Perevochtchikova, 2009). Moreover, the peri-urban forest captures an important amount of the CO₂ (SEDESOL, 2013). In other cases, the importance of ecosystem services provided by urban peripheries is linked with agriculture. Certain agricultural practices have been shown to prevent soil degradation, preserve certain endangered species and provide income to farmers through either the sale of their products and/or ecotourism (Zasada, 2011; Brinkley, 2012). The relevance of hydrological services for urban uses has also been highlighted and the payment for environmental services studied in this context (Neitzel, Caro Borrero, & Daniel, 2013; Bremer, Farley, & Lopez-Carr, 2014). In the same way, outdoor recreation, green areas and wildlife tourism have also been recognized as important but are not well linked to environmental services or land-use planning.

3. Study area: conservation zone of Mexico City

3.1. General characteristics

The Federal District, also known as Mexico City, is the capital of Mexico and is situated in an area of approximately 148,000 km² with a population of more than 8.5 million, which makes it Mexico's most densely populated city. Mexico City is divided into two major areas: urban and conservation. The former corresponds to the built zone (the city), and the latter is an administrative category designed to protect natural and environmental resources. The Conservation Zone of Mexico City is an area designated by law in the territorial ordinance; according to the Environmental Plan, in Spanish the “Programa General de Ordenamiento Ecológico del Territorio” (PGOETDF, 2000), the Conservation Zone represents 58% of the total area of Mexico City (85,000 ha) (see Fig. 1). It is important to note that land property in the Conservation Zone is principally collective (communities and ejidos⁴).

Geomorphologically, Mexico City is highly diverse and consists of a valley, transition areas and mountain areas. According to Castelan and

⁴ Communities (Comunidades in Spanish) are rural farming units (areas), recognized by Mexico's National Agrarian Registry (NAR; Registro Agrario Nacional) that own and manage their commons resources.

Ejidos are a Mexican form of land property, recognized by NAR, and refer to the areas of communal land used for agriculture where members individually possess and work a specific parcel.

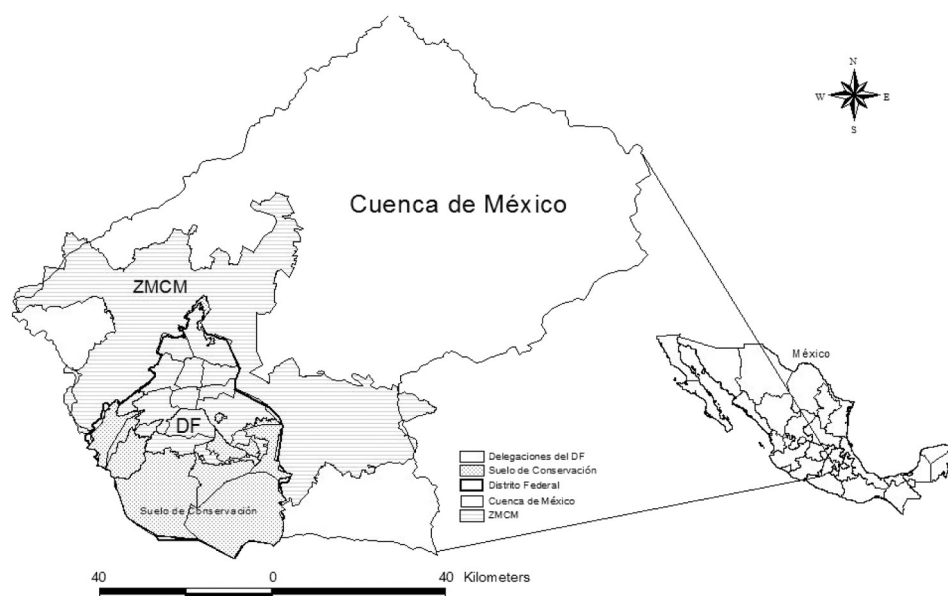


Fig. 1. Conservation zone.

Source: Perevochtchikova and Torruco-Colorado (2014).

Mejía (2011), forest and agriculture are the primary land uses, and these uses are also the largest contributors to ecosystem services as a result of soil characteristics and the forest (Aguilar & Santos, 2011a, 2011b; Saavedra, Ojeda, & López, 2011). The Conservation Zone is the source of 70% of all water consumed in Mexico City (Perevochtchikova & Vázquez, 2012); 90 tons/ha/year of carbon dioxide is captured by its forest, 18,000 plant and animal species live in the area, and the Zone is also home to clear recreational and landscape amenities (Castelan & Mejía, 2011).

According to the Environmental Plan, hunting, logging, grass harvesting, the introduction of foreign species, pesticide-employing agricultural practices, river modifications, urban waste disposal and altering the land use for urban usage are prohibited in the Conservation Zone. In recent decades, the Conservation Zone has faced intense land-use changes (urbanization) (Pérez et al., 2011, 2012) that are primarily the result of irregular settlements.

3.2. Environmental and urban policies of the conservation zone

The environmental policies affecting this zone involve numerous aspects such as agricultural and rural activities, forest conservation and socio-economic development. To address this variety of considerations, the government has created incentives and instruments to promote the sustainable use of natural resources. Particularly relevant for this paper are spatial planning instruments and environmental programs.

Spatial planning is the principal tool of landscape management and consists of two different instruments (Gobierno del Distrito Federal, 2000; Gobierno del Distrito Federal, 2010): Urban (Urban Plan – PGDUFD, 2003) and Environmental (Environmental Plan – PGOETDF, 2000). It is notable that the Urban Plan first established the Conservation Zone. Moreover, this program defines land use and infrastructure provisions in the Conservation Zone and proposes actions to address urban growth (primarily through social housing programs). The Environmental Plan is also responsible for land-use planning and proposes zoning plans for urban, agriculture, forest, and other land uses. To achieve its goals, the zoning proposed by this government program uses various instruments, including environmental instruments, which are of particular interest to this paper.

Federal and local administrators have implemented environmental protection policies through a combination of mandatory regulations

and voluntary environmental actions. The latter have mostly been in response to international trends that have influenced national policies to be more socially inclusive, i.e., members of the public can decide whether to be the beneficiary of a public program (Rodríguez & Avila, 2014). With respect to the Conservation Zone of Mexico City, both federal and local authorities have implemented voluntary programs.

In this paper, we review three of these programs that have the principal goal of promoting conservation and environmentally friendly activities in the context of environmental zoning determined by the Environmental Plan. PES and FOCOMDES are subsidy programs, whereas the UMA is an instrument for regulating wildlife management and use, but in 2010, a federation created a special budget for encouraging this instrument. PES and UMAs are federal programs, whereas FOCOMDES was a local program.

Predictably, simultaneously implementing spatial planning and voluntary environmental programs has resulted in some friction. All programs are required to respect the land uses proposed by the Environmental Plan; however, there is little enforcement of these directives (Aguilar & Santos, 2011b). Furthermore, there is little communication among governmental agencies to achieve specific goals. These activities are characterized by overlapping and contradictory objectives. For example, an area can receive cattle subsidy from one agency while being designated for conservation by another.

4. Methodology

4.1. The selection of environmental programs

As discussed above, implementing environmental policies in peri-urban zones is a difficult task. In Mexico, for example, environmental, agricultural and urban legislation is occasionally applied in a single space but with different objectives (Aguilar & Santos, 2011b). Therefore, in our first step, we collected the relevant environmental, rural and urban legislation. This step helped us define the principal characteristics of various government institutions with respect to spatial planning and their principal pro-environmental strategies and actions addressing land-use change.

To allow us to analyze the problem of overlapping legislation and programs, three different programs were selected in the second step. Each program reflects how different types of government agencies

perceive the problem of addressing land-use changes and environmental management. Each program must satisfy the following conditions: a) its main objective must be environmental; b) it must be voluntary; and c) the programs must be implemented at the community level, as has been suggested by Starkl, Brunner, López, and Martínez-Ruiz (2013).

We are interested in environmental programs because ecosystem services are generally neglected in peri-urban policies; thus, by analyzing the impacts of environmental programs on communities, it is possible to provide recommendations for their inclusion in a more integrated vision of landscape policy and environmental management. Also, we are interested in voluntary programs because mandatory and restrictive management is the dominant type of policy in the Conservation Zone and voluntary programs are needed. Second, our interest in analyzing federal and local programs is to determine the differences between them and improve their integration. Given these criteria, three programs were chosen: PES, FOCOMDES and UMAs.

- PES – Payments for Environmental Services Program. This program is federal, and its principal goal is to compensate landowners to encourage them to protect forests and the environmental services that forests foster and generate. The objective of the program is to reduce poverty while simultaneously incentivizing environmental protection. This objective was explicitly declared when the program was implemented in 2003 by the National Forest Commission from the example of a similar program in Costa Rica. Since 2008, the program has included technical instruction on best practices, which implies constant participation by communities and beneficiaries in decision making (Perevochtchikova & Vázquez, 2012).
- UMAs – Management Units for Conservation and Sustainable Use of Wildlife. These units are part of the National Program for Rural Diversification, which was created by the Ministry of Environment in 1997, and the National Law of Wildlife is the actual regulation framework. UMAs are intended to generate income for farmers using community and private lands that are derived from the sustainable use of wildlife species. According to Mexican law, UMAs are operated under a management plan approved by the Environmental Ministry. Income from UMAs is generated by both extractive (e.g., sport hunting by individuals for trophies) and non-extractive uses (such as ecotourism). The program did not include economic incentives until 2010; thus, during the period of study, the UMAs did not offer any subsidies. It is important to note that no study of UMAs has been performed in peri-urban areas, although this program is in use across the nation (Ávila-Foucat, 2012).
- FOCOMDES – Communitarian Funds for Rural Sustainable Development Program. This program was implemented for seven years (2001–2007); and as its name implies, its main objective was to promote sustainable rural development that contributes to social equity. Its principal activities were to promote both peri-urban agriculture and commercialization chains. Other activities included promoting sustainable activities, such as ecotourism (Pérez-Campuzano, 2011; Perevochtchikova & Torruco-Colorado, 2014).

4.2. Topics of analysis

Public policies can be implemented at the household, community or regional scale (such as protected natural areas or territorial ordinances). It is difficult to compare programs that are implemented at different scales in terms of the indicators used and the programs' effects. Thus, we selected those programs that are implemented on the same scale, i.e., at the community level, to facilitate comparisons. This choice allowed us to select and compare the same topics and indicators (shown below) in the analysis. The subjects of our analysis were based on the recommendations of Avila-Foucat, Ramírez Ruíz

Table 1
Indicators used in this study.

Topics	Specific aspects analyzed
Implementation	Knowledge of programs objectives, rules and responsibilities Administrative aspects of program: budget, diffusion and bureaucracy
Economic performance	Diversification of personal income Relevance of the program in the household income Market aspects
Social aspects	Participation in conservation activities Community organization (cohesion) for forest conservation Conflicts inside and outside of community
Conservation	Knowledge of forest importance Environmental problems in the community Management practices for conservation

de Velasco, and Ortíz Monasterio (2009), who suggest that the primary aspects that should be considered when assessing environmental programs is their implementation and how they perform environmentally, socially and economically. In this case, our analysis focused in the perceptions of beneficiaries (communities and ejidos), as principal actors in the implementation of environmental conservation programs (Perevochtchikova & Rojo-Negrete, 2014), based on following topics:

- *Implementation* essentially refers to the government's ability to achieve its goals and objectives. The principal indicators that we consider in this regard are the perceptions of beneficiaries with respect to their understanding of the program objective, administrative aspects, how the programs are implemented and synergy with other programs.
- *Economic performance* essentially concerns the economic benefits generated by each program. Economic performance is considered to clarify the relationship between monetary incentives and their impact on income and alleviating poverty because two of the three programs emphasize alleviating poverty through sustainable practices.
- *Social aspects* are considered to determine whether the program has generated social capital in terms of social cohesion. One of the most important aspects related to environmental management is the use or creation of social capital. In this paper, we do not measure the use or creation of social capital; instead, we attempt to evaluate whether the programs solve or create conflicts in the communities involved.
- *Environmental conservation* captures the programs' capacity to prevent land-use changes primarily by promoting environmentally friendly activities, transferring knowledge and advocating for sustainable practices related to economic activities.

4.3. Data collection and analysis

We conducted 62 questionnaires with closed and open questions with community members that received the programs in Conservation Zone (29 PES, 25 FOCOMDES, and 3 UMAs⁵) during 2009 and 2011. The PES beneficiaries included 29 representatives of 13 communities and represented 100% of the total communities that participated in this program in 2010. The sampled 25 representatives were a small sample of the total number of FOCOMDES beneficiaries (5% approximately). There were 3 UMA beneficiaries, and all were analyzed. Open-ended questions were divided into four groups of topics with a sequential order but allowing the interviewee to express their thoughts with flexibility. Because we have quantitative and qualitative data, the data for each beneficiary were captured in a spreadsheet where the rows corresponded to interviewees and columns to the responses in the four categories described above (Table 1). Specific results of each program have been

⁵ There were just three interviews with representatives of UMAs because there are only three in the zone.

Table 2

Summary. Perceptions of the objectives and results of programs. Source: own elaboration, based on interviews.

Implementation	Clarity on the objective of the program but lack of coherence between programs Excessive and confusing paperwork Short-term budget and contract Insufficient program diffusion
Economy	The programs promote economic diversification, but opportunity costs are too high Monetary transfers are regarded as subsidies and not mechanisms to promote social and economic growth
Social	Programs create mixed social effects. They have created organization, but there are some conflicts and unequal participation
Conservation	Programs are perceived as positive for conservation and management practices, but evaluations are not sufficient

reported elsewhere (Ávila-Foucat, 2012; Pérez-Campuzano, 2011; Perevochtchikova & Vázquez, 2012; Perevochtchikova & Torruco-Colorado, 2014). Subsequently, a second matrix was created with qualitative results for each program (Table 2). Using this matrix, common aspects in the four programs were identified. Thus, this paper presents a synthesis of common findings in the four programs in each topic, based on a qualitative analysis.

5. Results

5.1. Implementation

Program objectives are generally well understood in terms of the rules and responsibilities in which each actor is engaged. Beneficiaries are aware that they need to fulfill administrative requirements and conservation actions. However, a significant issue has been the lack of coherence among programs. Each program attempts to address its own objectives but does not consider those of other programs. There is no coordination between programs, and synergies are difficult. For example, the basis of the PES indicates that the program is incompatible with other programs in the same territory, which hampers the development of synergies. In contrast, FOCOMDES allows combination of different program resources, but its objectives are incompatible with those of other programs. UMAs are established in this region to attract tourists to see wildlife species such as deer; therefore, UMAs are compatible with tourism but not necessarily with other traditional livestock and agricultural programs.

Bureaucracy is one of the main issues associated with program implementation. For instance, beneficiaries⁶ are subject to copious paperwork that discourages them from completing the process to obtain the subsidy or registration. As their first step, all the programs require specific documents, such as proof of landownership or formal social organization (e.g., cooperatives), and a forest cover map as proof that minimum area requirements are met. Additionally, there are other requirements that few communities can afford to implement, such as an environmental or management program. Therefore, the beneficiaries are coordinated with academics or organized civil society to fulfill those requirements.

The beneficiaries believed that certain persons receive more favorable treatment than others. A further problem discussed in the interviews is the short temporality of the program contract (5 years contract or less) because the beneficiary is obliged only during this period of time to enforce certain conservation activities specified in the terms of reference. Once the subsidy ceases, the beneficiary can start actions that damage the environment. One comunero (community representative) said, “I will only preserve my property during the time I will

receive funding; once the funding is over, I will sell my property for an urban use”. Another respondent reported that the beneficiaries' compromise is to preserve the land as long as the government provides them funding. Therefore, the implementation of the program can be in danger over a long time scale.

Another important factor is the inequity in the information that households receive about the programs, generating in some cases discretion regarding who participates in the program. For example, in FOCOMDES, the ejidal president's relatives were frequently reported to have received incentives with no merit. In general terms, the three programs are not well disseminated in this peri-urban context.

5.2. Economic aspects

Many countries have relied increasingly on programs and incentives for conservation in pursuit of economic development. These programs are not the exception. The programs assessed allow diversification of income because they are an additional source of revenue. FOCOMDES and PES subsidies are intended to promote specific activities to improve sustainability. UMA is an instrument for diversifying rural activities based on species and habitat conservation. Although economic revenues are one of the aims of those programs, these revenues have not overcome the “opportunity costs” to prevent land-use changes.⁷ In the case of PES and FOCOMDES, the government budget is insufficient to address environmental deterioration issues. In the case of UMAs, markets are difficult to access, and prices are not representative of conservation costs.

Moreover, even though PES is conceptualized as a market mechanism, in our case study, it was a subsidy, the same as FOCOMDES (Perevochtchikova & Torruco-Colorado, 2014). Therefore, economic autonomy is not promoted because the program funds depend on the government budget. Thus, landowners are accustomed to receiving subsidies, not helping to generate local business while creating environmentally friendly activities. Both government officials and academics agree that the design of the environmental incentives in Mexico City has led to a type of beneficiary seeking immediate income who is not concerned with generating its own sources of income (Ávila-Foucat, 2012; Perevochtchikova & Vázquez, 2012). Moreover, the UMAs in the Conservation Zone cannot be fully developed because forest management is not permitted, which limits the extent to which wildlife habitats can be managed. The UMAs are primarily dedicated to non-consumptive wildlife tourism (wildlife observation, specifically the observation of deer in semi-captivity) to generate economic revenues and attract tourists, and these approaches can be combined with other tourist activities, such as mountain biking. However, consumptive wildlife use is not possible because of the lack of market incentives and promotion.

5.3. Social aspects

Participation equity considering women and young people is not the norm in these programs because older men (ejidatarios and comuneros) are the landowners involved in the community decision making, with women being relegated to a secondary role. For example, landowners select the programs for which the community should apply and when such programs are implemented; responsibilities for the activities involved in the programs are assigned based on gender. However, government programs cannot change traditional community decision-making. Moreover, as mentioned previously, diffusion of programs is not homogenous within the Conservation Zone.

⁷ For instance, preliminary results from recent fieldwork reveal that the price per square meter is around 90 USD, meanwhile PES bestows approximately 25 USD annually per hectare.

⁶ “Beneficiaries” in this paper refers to the population actually receiving incentives.

In contrast, those programs enforce organization among households that are interested on participating. That is, they need to be organized to ask for funding and to do all the activities that are required in the management programs. However, with other members of the community, conflicts might arise.

There are two main sources of conflict. First, in PES and FOCOMDES in nearly every community, there is a perception that funding is not equitably distributed. Individuals who do not have access to monetary support believe that only the leader's relatives/friends are receiving funding from the program. Second, in all the programs, there is conflict that derives from the absence of clear rules for distribution of the subsidy or income revenues. In some cases, the money is distributed equally among the program's participants; in other cases, money is "saved" to build infrastructure in the community. Problems arise when the rules are unclear or there are evident violations of previous agreements. This situation affects social cohesion.

However, in the case of UMAs, tourists watching deer was the first ecotourism attraction in the community, before the advent of numerous others, which helped consolidate other sustainable uses. UMA fosters community trust in the government and in conservation because these programs were begun to conserve a species, and they allow landowners to access other governmental programs. Government support generates approval for sustainable projects from other members of the community (in addition to the traditional authorities and/or local authorities) and thus spreads cohesion and trust among members of the community by increasing the number of individuals involved in sustainable activities. Thus, UMAs serve as a catalyst for the development of ecotourism initiatives and sustainable community actions.

5.4. Conservation aspects

In general, the beneficiaries agreed that the studied programs are positive for the conservation of forest cover and species. Management practices for soil retention in PES and species management in UMA are part of the communities' commitments for enrolling the programs; therefore, these practices initiated with the implementation of those programs. Beneficiaries agree to do management practices constantly. In that sense, part of the conservation goal of the programs is attained. The beneficiaries have a positive opinion toward the conservation effects of the programs; they think the programs are powerful instruments for conservation although they recognized that many actions could be improved. For instance, the beneficiaries knew that in order to have a wild deer population in SC, many other actions would need to be undertaken. However, this positive perception is sometimes related to the beneficiaries learned discourse on conservation. For example, although one beneficiary noted that "the forest should be protected and made productive", it was less clear how this goal should be achieved. Conservation is linked to government subsidies (Perevochtchikova & Vázquez, 2012), and, from the beneficiaries' perspective, conservation can only be achieved by means of monetary transfers from the federal and/or local government to the communities. Currently, only a few communities in the Conservation Zone are engaged in market actions that emphasize conservation (Ávila-Foucat, 2012).

Ecosystem services are also part of the discourse. There are common phrases, such as "the conservation land serves as the lung and the spring of the city", that represent a change in landowners' conceptions of conservation. In nearly all cases, the respondents contended that individuals living in the urban area should pay for the ecosystem services. This argument is important because the discourse has created a new expectation between beneficiaries, which is used to confront authorities. In this sense, the provision of ecosystem services is taken as a bargain chip by the landowners. As has been noted above, landowners use their land as a way to demand more economic resources.

The beneficiaries did suggest other actions to preserve the land. For example, the PES program intends to promote best practices of forest

management, which has a clear impact in terms of conservation because it permits the development of congruent activities and creates a record of them.

Despite the positive perception of the program on conservation, a substantial number of beneficiaries reported that there are no evaluations of the programs' ecological impacts. The consequence is that, as noted above, people envisage environmental programs as one more subsidy, and there is not a clear environmental improvement in the peri-urban space.

6. Discussion

The peri-urban zone of Mexico City and specifically the Conservation Zone is submerged in a complex dynamic due to the high numbers of activities, juxtaposition of government policies and urban pressure (see, among others, Aguilar & Santos, 2011a, 2011b). The results of the beneficiaries' perceptions allow the identification of some key aspects for improving environmental policies that address conservation but at the same time consider local population well-being. Implementation of difficulties associated with coherence between government policies is a crucial aspect that is not exclusive to peri-urban contexts. However, in this particular case, the lack of coherence between policies is explained due to the complexity of those regions and to the changes on the conceptualization of urban peripheries. For instance, urban and environmental planning in Mexico City faces serious challenges in terms of make both instruments compatible.

It is important to integrate both urban and environmental uses in one spatial planning system under the concept of use-modifying activities, such as Forest Certification (Wunder & Borner, 2011). That is, among select uses, the landowner can define one or more uses and generate income from those natural resources. At present, environmental planning incentives restrict the uses of land in the peri-urban zone (in the terms of "no touch"). As some of the interviewees pointed out, it is important to note that the zone requires the combination of activities to reach some sort of sustainability. As a collateral gain, people in the zone could increase their income and, subsequently, reduce the risk to land-use change. This benefit could be possible, as will be developed further below, through locally compensatory designed mechanisms, such as the creation of "fideocomisos" with diverse actors and sectorial participation (Fuentes Pangtay, 2008; Canales Gutiérrez, 2012).

In the Conservation Zone, the programs have limited diffusion. For UMAs and PES, this limitation is partly because they are federal programs prioritizing other regions with medium to highest forest cover, species diversity and extension of land. This pattern implies that the importance of peri-urban areas for ecosystem services conservation has not been a priority for the federal government. In this sense, it would be important to take into account the relationship between the city and its surroundings, beginning during the planning phase of the public policy. This point could serve to stop the pressure for land-use change through the increase of payments to beneficiaries.

Heterogeneity in local participation from gender or community member's perspective is linked to land tenure type—as explained before, almost all the landowners are men—but also to the fact that the programs are not compulsory programs, and therefore, only people convinced of the importance of ecosystem services and with a specific economic situation might be interested in those programs. Therefore, opportunity costs and environmental knowledge are key findings.

These patterns stimulate a discussion of the economic effects of these programs and the opportunity cost of transforming the land use. The programs contribute to income diversification but are a low proportion of household income. Again, this fact is related to the opportunity costs, which are very high in urban contexts, and to incipient markets for sustainable products that are not linked to regional economic dynamics (Ávila-Foucat & Pérez-Campuzano, 2015). Such products are competing with many other products that are not sustainable but with low prices. Moreover, as noted by Perevochtchikova and Vázquez

(2012), environmental programs that function like PES and FOCOMDES are subsidies instead of market instruments promoting a new vision of environmental management. The beneficiaries conclude that conservation is only possible if there is a constant flow of subsidies or revenues; without such revenue streams, conservation is not possible. This problem is more complicated in the peri-urban spaces, such as the conservation zone of Mexico City, where the opportunity cost is high for environmental uses compared with urban costs. The surplus obtained from converting a parcel of agricultural land to urban land is 20 times higher than maintaining it as agricultural land (Castelan & Mejía, 2011).

In other terms, it is important to clearly identify both local-buyers and -sellers of environmental services to develop a market (Wunder, 2005). As has been shown in the case of New York (Alix-García & Wolff, 2014), agreements among landowners in the upper watershed and the city help to provide water. The agreement also permits land-use management and improves the quality of water. It is important to note the specificity of locally designed compensatory schemes in which more actors are involved (Grammatikopoulou, Pouta, & Salmiovirta, 2013). Participation of local institutions has an important effect in terms of compliance of PES schemes (Taylor & Van Grieken, 2015). Both the construction of local market and active participation of the local institutions in environmental policy are important for project implementation and results. In the case of Mexico City, a local scheme has been recently established, and there are not results yet, but there are substantial expectations due to the importance of the actors involved in the project (i.e. private sector, communities and government).

The concept of PES can be expanded for different environmental services (Frost & Bond, 2007). For example, wildlife conservation and recreation are also environmental services that beneficiaries are conserving that are not compensated through the local scheme. This gap could be addressed by the creation of “packages” of ecosystems services that could increase the payment in an integrated system (Wunder, Wertz-Kanounnikoff, & Moreno-Sánchez, 2007). Moreover, consumers' involvement is necessary in local schemes: consciousness of the provision of environmental services and the benefits from them is crucial to establishing an adequate opportunity cost and positive social involvement.

The results show that organization can be boosted with those programs, but conflicts within communities arise when rules are not clear. This result is confirmed by Caro-Borrero et al. (2015). Those authors found, analyzing the social perception of the PES in two communities in the Conservation Zone of Mexico City, that the success of the program depended on the social organization of the community. The programs analyzed have positive effects on increasing the number of people interested on conservation or sustainable activities, and they need to be propelled within a spatial landscape plan. It is important to promote non-compulsory programs, not only command-and-control regulations, to involve more people in voluntary conservation; however, government programs could be effective if people obtain sufficient economic benefits to complement their income satisfactorily. In this sense, having clear rules and social cohesion is central to the success of the programs, including the environmental ones in the peri-urban zones.

Conservation effects of the programs are identified by the beneficiaries as positive, but there is a lack of monitoring and evaluation. There is no constant evaluation of the programs' progress or of progress toward accomplishing objectives. There is a regular evaluation of monetary transfers and the development of bureaucratic procedures, but there are no clear results on the programs' effects on conservation. Local residents, who experience the problems on a daily basis, report that the programs' financial transfers are effective. As noted elsewhere (Perevochtchikova & Vázquez, 2012), beneficiaries regard conservation programs as subsidies, not as a tool for improving environmental quality or welfare. In this sense, it is unclear whether the programs have helped conserve the ecosystem and in the long term create income beyond subsidies. Perevochtchikova and Torruco-Colorado (2014)

pointed out the lack of studies of the effects of the environmental programs in the peri-urban zones, particularly in Mexico City. The analysis of the effects should consider three different factors: the synergy/conflict among programs, the state of the ecosystems and the social benefits of the implementation. These kinds of analyses are essential if we want to seriously consider the importance of conservation programs.

In sum, environmental program implementation and social, economic and environmental effects have positive aspects but also challenges related to opportunity costs, diffusion, clarity of rules and monitoring. The interrelation with other programs and policies must be addressed with a spatial landscape plan not only based on zoning but also on institutional integration of programs and urban consciousness of environmental services. Environmental public instruments and program are absolutely necessary but not sufficient in peri-urban contexts.

7. Conclusions

This paper presents beneficiaries' perception of the effects of three environmental programs in the peri-urban zone of Mexico City (at federal and state levels). This zone is important at the regional scale due the multiple environmental services provided to the city. In this sense, knowing what beneficiaries think about the programs can boost more efficient instruments, in particular when opportunity costs are high due to the influence of an urban context. In general terms, the beneficiaries perceived the programs as positive although there are many issues to solve. The most important problems were the excessive paperwork and the temporality of the programs. Also, social conflict might arise when rules are not clear within the communities. The lack of environmental evaluation of the programs is also an issue. Another important aspect is that compensation does not include the opportunity cost; therefore, people's commitment is temporal. The problems confronted in the Conservation Zone indicate that an environmental policy is not sufficiently efficient when designed as a subsidy program with insufficient conservation impact in the long term.

Also, it is necessary to create functional markets and/or local financial schemes in which providers and users are clearly defined and the use of natural resources is not restricted. In this sense, consumer's identification and participation is very important. In this paper, consumers are not addressed, but in our understanding, their role is central. Environmental consumer's participation could improve the programs because they could generate more controls over decision-making and can demand reciprocity from landowners.

The positive effects of the programs are the social involvement in conservation actions, temporal economic income and the increase of the awareness among beneficiaries regarding environmental management. Even if the income increase is marginal, beneficiaries start to be committed to environmental management of the zone. This change is important because it creates awareness of the value of preserving the environmental conditions of the city.

Environmental instruments such as PES, UMA and FOCOMDES have positive and negative results and face important threats, as noted previously. Non-compulsory instruments compensating conservation action to environmental services providers are keys for peri-urban areas. To improve the success of this kind of instrument, we highlight the following aspects: instruments need to be part of an integrated planning process in which different program budgets are coordinated and environmental ones are assembled, with equal participation of different actors. The complexity of peri-urban areas does not allow us to have dispersed land-use policies.

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