

Sustainability assessment system of natural resource management for tourism in the community of San Pedro Atlapulco, the state of Mexico, Mexico

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Introduction

The neoliberalism as an economic doctrine has generated many economic and social problems, created by the lack of productive opportunities for the rural and urban populations, due to the globalization process same that is quickly expanding in countries all over the world. The neoliberalism is polarizing societies in its eagerness to integrate them to the international economy. With the thinning of the state the possibilities of equal growth and satisfaction of social needs have been drastically reduced. Farmers are currently the most affected because they don not have the possibilities to join the new economic model, the export agriculture. In this sense people is forced to emigrate accepting jobs in very unforgiving circumstances, or they're forced to look for other surviving options like craftsmanship or in other cases incorporate natural and cultural resources to the tourism. Due to the abandonment of the government support farming communities returned to their old ways of participation to generate better profits. Currently several communities are making efforts to join other activities like tourism.

The tourism is an important alternative for rural communities, because in the past years the support politics for the farmers have been scarce and that let them without choice but to take advantage of its natural and cultural resources to push their own development, through the offering of recreational tourism to improve their earnings.

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This is what happened in San Pedro Atlapulco a rural community of indigenous origins that previously engaged in agriculture: harvesting wheat, oat and corn and the sale of natural resources such as wood and charcoal.

Currently the economy revolves around the practice of tourism for its closeness to the coniferous forest that provide a pleasant environment. This community is integrated by seven valleys : del conejo porterto, Rancho Viejo, Silencio, Cerrito del Angel Las monjas y Las Carboneras; of which only the first four have touristic activities. This community doesn't have lands that provide support that's why they've seen in recreational tourism a profit opportunity, that's planned by a community organization that determines the way the natural resources are used such as woods, land, and mainly water.

The community of San Pedro Atlapulco has a vast woods richness mainly of pine trees and fir. However they are not used in a proper way by its population, limiting their use of woods and taking advantage of the valleys for the development of recreational touristic activities. The touristic services offered at the valleys are rent of ATV's, horseback riding, food and drinks, sale of crafts and toys among others, this activities generated deforestation, woods fires and the soil erosion; in a way that constitutes factors that affect the environment and the woods of the community.

It is considered that the sustainable development is the alternative mean to support the natural resources, specially woods that are the main resource of the community, from this approach solutions are provided to solve the environment problems of the forest

From the perspective of sustainable development arises the study of tourism, considering the postulates of the World Tourism Organization (UNWTO) that points out that not just the needs of current tourists and receiving regions should be met but also has to protect and foment future activities. Considering tourism as a mean for development through manage of resources in a way that satisfies the economic and social needs respecting the cultural integrity of essential ecologic processes, ecologic diversity and the systems that support life.

The research was developed with the methodological proposal of the framework for the evaluation of natural resource management systems, incorporating the sustainability indicators from economic and social environmental indicators.

The life of the people from San Pedro Atlapulco have been related with the forest since pre- hispanic times, because from them water, fresh air, wood, mushrooms and medicinal plants are obtained.

In pre-hispanic times the forest were not commercially used but used for self-consumption with the hunt of animals like the wild chicken, rabbits, among others and the use of medicinal plants like the carricillo, pata de leon, lengua de vaca, gordolobo, flor de ocote among others. They also used the wood to build cabins.

Since colonial times San Pedro Atlapulco has delivered charcoal as a tribute to the Mint during the 1700-1900. Charcoal was the main fuel of the time and was sent to Mexico city. They also produced Pulque, crafts made with still life and wild seeds for its sale in local markets.

From the year 1900 the population started to protect the forest and reduce the over use of natural resources like wood or charcoal of dry trees that were sold in close communities, without putting aside the agricultural activities that always accompanied the development of indigenous towns in Mexico. The valleys of San Pedro Atlapulco where the touristic activity is taking place today, used to be meadows for grazing of animals and croplands; harvesting wheat, beans and oat.

The tourism attractiveness of this region lays essentially on its natural resources. The preservation of its forest has motivated the arrival of visitors to take part in outdoors recreational activities such as sports, horseback riding, camping, hiking and family time.

The touristic valleys are very popular especially on weekends and festivities to rest, breath fresh air and to do outdoors activities. This zone offers its services to visitors from big cities mainly.

By the above it's important to evaluate the activities that the community does in function of its natural resources, arising questionings such as: is the way the forest is used in San Pedro Atlapulco sustainable? What's the role of the community in making sure that the activities taking place in the forest are sustainable? What ecotourism options could be implemented in the community?

The community of San Pedro Atlapulco, Mexico State

The studied zone is located in the community of San Pedro Atlapulco that belongs to a section linked to the Toluca valley in which the basins and mountain system belong to a region known as the central highlands of Mexico.

The community of San Pedro Atlapulco is part of the municipality of Ocoyoacac Mexico State. The territory of the community is located between the limits of the Miguel Hidalgo national park and Acapulco; just 10 KM from the Marquesa-Chalma highway, Atlapulco communicates with Capulhuac and Santiago de Tianguistengo.

Two kinds of property exist in San Pedro Atlapulco: communal and private. The presidential resolution confirmed in a definitive way Atlapulco's communal goods giving it a definite extension of 7110 hectares, communal property is formed by three polygons: the first one of 6271 hectares that corresponds to Atlapulco; the second one of 654 hectares called San Miguel Amaya; and the third one of 184 hectares is Santa Maria Coaxusco. Although they're three different polygons, the legal representation falls in the hands of the commissioner of community property of San Pedro Atlapulco.

The polygon that corresponds to Atlapulco is divided in four zones: forest, touristic, agriculture and urban. 6915 hectares belong to the forest zone with forests of pine trees, firs and oak a small part belongs to the agriculture zone. The fauna is abundant there's squirrels, rabbits, birds, reptiles and possums. Its water supply is abundant because it has several creeks that come from the high parts of the community: the hills surrounding the community.

Physical and biological characteristics of the ecosystem of San Pedro Atlapulco

San Pedro Atlapulco is considered the third highest population in Mexico, located above 3010 Meters over the sea level, situation that allows it to provide an admirable sight of the Toluca Valley framed by the Xinatecatl volcano and the growing urbanization and industrialization of the city of Toluca, that everyday fuses itself with the ancient farmer towns of the region. The zone has low temperatures and a relatively more uniform humidity than the neighboring basin of Mexico. Modern weather maps based on the koppen classification, put the Toluca Valley as C(w2)w1 at the lower parts or sub-humid temperate with summer rains, but in the mountain zone of the marquesa region is defined as c(E)(w2)w2 which is equivalent to sub-humid semifreddo with summer rains. The

average yearly temperature ranges from 10 to 12 degrees Celsius and the average rain is 900 mm a year.

The climatic disposition shows a great uniformity under the 2800 meters over the sea level where the temperature ranges from 12 to 14 degrees Celsius, being the eastern part slightly colder. The community is slightly over the 2800 meter over the sea level that's why the temperature descends two degrees Celsius.

The conifers forest of the community provides and replenishes the groundwater. There is springs that supply the municipalities of Huixquilucan y Lerma and D.F. They're not part of Lerma's water basin but they supply the municipality with drinking water. The community has a usufruct agreement on water and the forest. Because this forest is located in the middle of Toluca, D.F. and Lerma it absorbs the pollution of these cities that's why they look defoliated in comparison with the forest in the south part of the community. Those are the greenest and flowery woods but also the more isolated from the population. It's one of the forests with problems caused by the urban growth and modernization, and is noticeably by the lack of natural regeneration.

The organization in San Pedro Atlapulco

There is a representation through the commission of community property in the same agricultural regime, that's formed by a president, a secretary and a treasurer. There is also a counsel of vigilance also called agricultural core that takes care of the forest and all the materials and resources on it.

In relation with the commoners that work inside the touristic valleys, these have to fulfill certain requirements. To be able to utilize the forest ecosystem its required to be originative of the community, request a written permit to the commission of community property, in which you note your request, that is regularly obtained through a permit of wood utilization, which will be used to elaborate beams, planks or other things, and the main advantage is that the given permit is free.

The population assures that the forest has an indirect importance in their life, because people do not depend on the use of this resource because the population has other jobs that had allowed them to improve their living standards in past years.

Because of the abundance of the forest the community has a really nice environment; it is recognized as a really important lure for the tourism, because nowadays the big cities does not have many recreational spots for their population, that is how the valleys of San Pedro Atlapulco cover the need of recreation for the large metropolitan zones, like Mexico city and Toluca. At the same time the commoners had been benefited by the great demand of their valleys and services they offer, that is how the tourism is now the main activity, job generator for the community and the main source of support for the families that belong to San Pedro Atlapulco.

The recreational touristic activity in the touristic valleys

Since the 40's the population started to participate in the tourism creating routes for hikers that arrive to the Miguel Hidalgo Y Costilla National Park better known as la marquesa, the profit were low due to the lack of visitors, it was until the 70's with the opening of the highway la marquesa-chelma that connects to tenango del valle that the recreational zone of la marquesa extends to the valleys of Atlapulco. That's how the valleys organization emerged so that all the population from the community had the opportunity to participate in tourism as long as they were from the community.

Up until now there's 8 valleys were the touristic activities are developing: Valle Del Potrero, Conejo, Zarco, Carbonera, Cielito Del Angel, Rancho Viejo, Silencio Y Las Monjas. The activities that are currently offering for the tourists in the valleys are: rental of ATV'S, horseback riding, rowing on the lake, outdoors games area, recreation areas, food sale, and picnics.

Method

According to the model to evaluate the Management of the Natural Resources System Incorporating Indicators for Sustainability (MESMIS), the sustainability of a natural resources handling system, can be only evaluated in a comparative way, comparing it with another system. In this case it was decided to do a comparison between the time of the handling system before and after doing the touristic activities.

Described below are the general characteristics of both handling systems before the touristic activity in the valleys. In the other hand following the MESMIS methodology an analysis was proposed based on five general attributes of the sustainability, productivity,

equity, stability, resilience, adaptability, and self-management. For this it was necessary to identify critical points and attributes of sustainability.

To evaluate the environmental impact of tourism and recreational activity on the community of San Pedro Atlapulco's forest, the main critical points relate to the determinants of the water resources, soil, forestry and community organization before and after the presence of tourism, when the villagers began to deforest and open valleys to tourism the environmental issues began.

Evaluation of the sustainability

Productivity. For the attribute of productivity the indicators that were selected are yield of the wooded area and profitability. The yield, in other words, the growth rate of forest reforestation, is hard to measure, but an estimate is made from the information of the Government of State of Mexico's forest use program. The profitability was calculated using a cost-benefit analysis to consider the total economic value of the tourism activity being undertaken, in other words what is the monetary, nonmonetary or environmental benefit that are result of the maintenance and use of forest resource.

Regarding this attribute (productivity), we find that previously the main economy of the community of San Pedro de Atlapulco was the agriculture, the condition of the forest was not as abundant now because the community members exploited the forest for personal consumption and sale of natural resources without measure, since 1996 when the Mexico-Toluca highway opened and tourism activity began in the tourism valleys they also started to replant and take care of their forests to attract tourists and get financial support from the government. As the forest, it doesn't payoff because there isn't use of the wood, or the resin, its use is limited. What does payoff is the tourism valleys, and these are different because they depend on many aspects such as tourism service location, branch in which they work, season of the year and others. However, we can say that each week there are families that receive more than 5 thousand pesos and others don't even reach a thousand pesos.

Equity. From the social point of view, it is very important to determine who benefits - and to what extent- with the monetary and nonmonetary products obtained from the forest and tourism. The diagnostic criteria that was selected was the distribution of benefits, and the

indicators were: economic equity, income received by families and participation of the population in tourism. These three indicators were assessed through direct interviews.

In terms of equity, we can say that, it exists, because all Atlapulco born population has the right to exploit natural resources so everyone can work in tourism in the valleys of the community, if requested and are assigned their rights and are made aware of their obligations. Therefore, 80% of the economically active population is involved in tourism, so everyone benefits from the forest and valleys, either through the provision of a service or resource that it provides them with such as wood, firewood, water, clean air.

Stability. The stability of the forest of the community of San Pedro Atlapulco depends on the Forest Management Program, as well as the directives of the Tourism Valleys and, on the other hand, the social-political context as well as internal stability of community organization and the cooperation with the federal government for the reforestation program.

Resiliency. In the resilience's case, it results particularly difficult to identify relevant indicators, because of the difficulties found in wooded areas, valleys, foothills and springs. The forest management program and analysis of soil and water quality were taken as indicators.

In terms of stability they indicate that the conditions for joining a tourist service is in relation to their investment opportunities, and they can do it because they can participate in different branches such as horse rentals, ATV's, sale of food or candy, and the investment can range from 1,000.00 to 30,000.00 but the recovery of investment ranges from three months to a year depending on the branch and quality.

The stability of the management of the forest of the community of San Pedro Atlapulco depends on political, economic and social organization factors. The strategic indicators that were selected are: a) Degree of reforestation b) Extent of deforestation.

According to information from the forest management program, the data on the quantity of trees for reforestation in the year 2003 were a total of 2000 trees and in the year of 2004 3000 trees of pine and fir, the firs are those in the lowland and mountain foot and the pines are in the top because of the condition of climate, soil and light needs.

The reforestation program is held every year in the rainy season, the number of trees to reforest depends on the amount of rain and government support.

Regarding the degree of deforestation it's difficult to measure, the residents take advantage of dead trees or those with disease, which they use as fuel in restaurants and homes. Each year the community cuts down 15 000 m³ of good timber trees to sell to the nearby communities. On the other hand, there is prohibited logging that has not been able to be controlled.

The community of San Pedro Atlapulco's forest has resilience, in other words it has the ability to recover, its high because of the volume of forest growth, even though it has difficulties because, as mentioned the farmers and fires cause the forest not regenerate, but the community is fixing these issues and seek the participation of 20 persons for the care of the forest. However, in the community there's a conflict of the political nature of forest exploitation and for this reason the management program is suspended.

Regarding the resilience of the soil, according to study samples and analysis of the Autonomous University of Mexico State edaphic laboratory the soil system in this area is very fragile. In the tourism valleys there's a problem of erosion and soil compaction. Worse it is only in the tourist areas because most of the soil of the community is unaffected. In the tourism valleys it's important to set aside areas for conservation.

The water resource of the area is abundant because of the amount of forest and rain, there are more than 40 springs. According to the analysis of water in the hydrological laboratory of the autonomous university of the state of Mexico the water is of good quality, has low turbidity and fulfills with the Official Mexican norm NOM-127-SSA1-1994, "environmental health, water use and permissible limits for human consumption, quality and processes that must be applied for water purification."

Self-management or self-reliance. Its related to the ability of the commissioner of the community to take decisions regarding the management of forest resources and its tourist valleys. The selected diagnostic criteria was the level of organization of communal property management community. The indicators chosen to represent this attribute were the forms of organization, participation of community members and the frequency of

meetings. To measure these indicators are formal and informal interviews and reviewed bibliographic and archival sources.

Self-management is given in the community through the way its organized. Although San Pedro de Atlapulco is part of Ocoyoacac municipality, its form of government is independent. Its organization is communal, all the actions and decisions are taken at the General Assembly with the participation of all community members, seniors born in the town. This form of organization is based on communal ownership of land, which has driven development "from below", where the community is who promotes their development through natural resource management to solve problems without participation in most cases of external agents. This practice is composed of important factors such as identity, ethnicity, religion, education, a common past of its inhabitants, and the decisions taken in popular form in terms of their needs. All this has allowed a certain independence from government authorities at municipal, state or federal, where the rules and regulations governing the internal life are recognized and accepted by the inhabitants themselves.

| System determinants | | Before Tourism (prevailing to 1996) | After tourism (Since 1966) |
|----------------------------|--|--|---|
| Original biofisics | | | |
| Technology and management | Resource characteristics | Conifer forest, pine, fir | Conifer forest, pine, fir, oak |
| | Forest harvesting techniques | No | Use dead trees for firewood, limited exploitation 15,000 m3 per year (started in 2005) |
| | Conservation practices | No | Forest management plan Reforestation program |
| Socioeconomic and cultural | Production target | Forest reserve general use | Forest and water reserve commercial exploitation |
| | Characteristics of the organization for the production | Regulation of forest use for commoners | Regulation of forest use for commoners |
| | Benefits | No | The sale of timber and tourism |

Results

The results that have been found in relation to economic indicators on the cost benefit of the forest, is in its conservation to maintain clean air, good water and fuel. Its use is not because of timber cutting and sale, but in the use of the valleys for tourism purposes, so a proportion of its territory is intended for the community members exploitation of natural resources. The investment cost is low because they often provide other resources such as horses, or consume wood for their food establishments, as the purchase of materials is minimal, or the purchase of ATVs. That is why the community members participate in various economic activities according to their investment opportunities. The income received for work in tourism activities are diverse, depending on the days worked, the branch and the valley in which they participate, and the influx of tourism. So we find people who can have an income of 5 000 per week or others with a thousand pesos. It is undeniable that the use of the valleys for tourism has led to the creation of jobs, since 80% of the community has jobs in tourism and have income to meet their basic needs.

Recreational tourism activities that are underway are showing some effects to soil resources, water and forest in this area. Eco-tourism could be one alternative for the community of San Pedro Atlapulco to exploit its resources, mentioned above, thereby improving the economic status of populations and the environment care.

The problems that are displayed in Atlapulco in relation to natural forest resource management is that the inclusion of tourism in natural areas has been done in an empirical way according to individual needs of tourism, little or nothing has been advised of specialists to manage their resources.

The concentration of activities in two valleys is causing soil depletion and general deterioration of natural resources in a matter of productivity in these areas is higher, which is why the population prefers to participate in these valleys and not in others. It is important to assess the effects of load capacity of these valleys and propose the diversification of others.

Although there is a communal orientation based planning, it is not appropriate since it does not allow the resource to be conserved, regenerate and control the erosion, due to tourism and grazing animals, as well as runoff and winds. It is necessary to reconsider the planning and resource management to encourage, maintain and preserve the tourist in the place and maintain in good conservation the forest.

Conclusions

The San Pedro Atlapulco's forest is an important resource for the community. The community members are taking advantage of forest, by tourism and the scenic beauty, clean air and proximity to Mexico City and the metropolitan area that attracts tourists.

The residents of Atlapulco try to take care of their forest resources to maintain the water through the support provided by the state government of Mexico.

The recreational tourism activities being undertaken are not presented in a sustainable manner, even though it improved the economic situation of the people, the negative effects that are occurring in the long term have a greater impact in this area.

The soil of the tourism valleys are not suitable for some of the recreational activities that are taking place, however they have the opportunity to be exploited to carry out eco-touristic activities aimed primarily to take care of the environment and are of lower impact. In the analysis of the soil based on sustainability, the tourism valleys of the community have been damaged by activities such as horseback riding and ATV use, that cause the problem of compaction and erosion of the soil.

The natural characteristics of the community of San Pedro Atlapulco are suitable for the practice of ecotourism, but the villagers have not displayed for their benefit, since they only take advantage of the valleys for tourism and recreational activities in mass, leaving aside the presence of forest resources, currently untapped, it has not found a way to use it individually. However, the eco-tourist activity is an alternative that can result in local productive sectors in the community, proposing new activities through a community organization that could begin to plan for tourism in a collective manner, and on the other, preserving and exploiting the natural resources of forest.

The management of tourism in the community is promoting local development. The existence of natural resources like the forest that generates economic benefits for the people who handle it directly, and environmental benefits for the entire society. Such economic benefit is almost entirely in the communities, since there are no costs to be paid abroad.

From the evaluation of forest sustainability through MESMIS methodology is that the forest resource is not being exploited in a sustainable way because the villagers are not using it

commercially, in other words, the residents do not use the forest properly because they prefer to maintain the existing hydrological cycle, without interfering in the conservation although it is the resource that brings a lot of revenue for the community. The forest also provides a pleasant environment which has allowed tourism to grow in the community and has provided the community members with new opportunities to improve their living conditions and the equipments within the community.

The community should assess the development of tourism in order to protect their natural resources from the negative effects and find some alternatives for sustainable momentum, based on ecotourism as an alternative for the preservation of the environment and improve the economy and quality of life for residents.

In this sense, the community must: establish strict conservation of nature to protect flora, fauna and the ecosystem, to determine the limits of absorptive capacity so that there isn't an excess growth of tourist installations on the environment, construction small-scale facilities in appropriate environmental sites, with local design style, using local materials, energy saving system and proper disposal of waste, create a visitor center with visual information about the site and appropriate conservation techniques, develop and disseminate codes of ecotourism to the behavior of tourists and operators, as well as monitoring compliance with these codes, train villagers as guides that provide tourists with accurate information on biodiversity and conservation techniques, and practice good conservation measures during tours.

The conservation of natural resources of the forest and valleys are made through community management. All residents of the community have opportunities to use their resources for their survival, only that it is necessary to put consideration of the general assembly of villagers that regulates and authorizes the forms of use.

Tourism is playing an important role in the community among the community with the use of natural resources, economy and social organization. Since tourism is now the mainstream economy, the community is developing its environmental, social and economic. The villagers have jobs that help reduce migration of young people before they went to Mexico City to find work.