

## Community land use planning in la Gloria community

### Ordenamiento territorial comunitario en la comunidad la Gloria

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#### Abstract

The environmental deterioration in the Gloria Primera Seccion community due to the traditional land use and the natural resources has generated a preoccupation in the population, who before this panorama are looking for formalize their practices. In this research were identified the problems that are present in the community, in the social, economic, and environmental ambit, this based on the article 41 of the Reglamento de la Ley General de Equilibrio Ecológico y Protección al ambiente en Materia de Ordenamiento Ecológico. A Community Land Use Planning was made in the Gloria Primera Seccion community, this with the goal to distribute the land use in a correct way, through a land management action plan, posing activities that entail to a sustainable human development.

**Enviromental, Deterioration, Sustainable, Traditional, Formalize, Development**

#### Resumen

El deterioro ambiental que se tiene en la comunidad debido al uso tradicional del suelo y los recursos naturales ha generado preocupación en los habitantes, quienes ante este panorama buscan formalizar el conjunto de prácticas. En esta investigación se identificaron los problemas que presenta la comunidad en los ámbitos social, económico y ambiental, esto en base al artículo 41 del Reglamento de la Ley General de Equilibrio Ecológico y Protección al ambiente en Materia de Ordenamiento Ecológico. Se realizó un Ordenamiento Territorial Comunitario (OTC) en la comunidad La Gloria Primera Sección, con el fin de distribuir el uso de suelo de forma adecuada, mediante un plan de acción de manejo del territorio, planteando actividades que conlleven a un desarrollo humano sustentable.

**Ambiental, Deterioro, Sustentable, Tradicional, Formalizar, Desarrollo**

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## Introduction

Currently, worldwide, society has a great dependence on natural resources to satisfy industries, commerce, construction and food demand (Ramírez Hernández & Antero Arango, 2014). Population growth continues, for the case of Mexico according to the National Institute of Statistics and Geography [INEGI], (2020), in the Population and Housing Census conducted, the growth rate between 2010 and 2020 was 1.2 %, which in numbers represents that by 2010 there was a population of 112.3 million and by 2020 a little more than 126 million.

One of the basic needs to be satisfied is food security, which comes mainly from one of the most important economic activities in Mexico, agriculture, which is mostly practiced in rural areas, most of which are marginalized. Many of the farmers are not professionals in this branch, which represents an obstacle and an opportunity at the same time; empirical agricultural methods transmitted from generation to generation are used (Corona, 2016). This can lead producers to use new land, including forestry land. At the regional level (Chignahuapan - Zacatlán) the probability of a hectare of forest use changing to agricultural use ranges from 45 to 90 % and at the municipal level in Chignahuapan the probability is 60 % (Cruz-Huerta *et al.*, 2015).

The project arises from the environmental problems observed in the community, the interest of the villagers in improving their farming practices, their activities in the management of natural resources and preserving the environment.

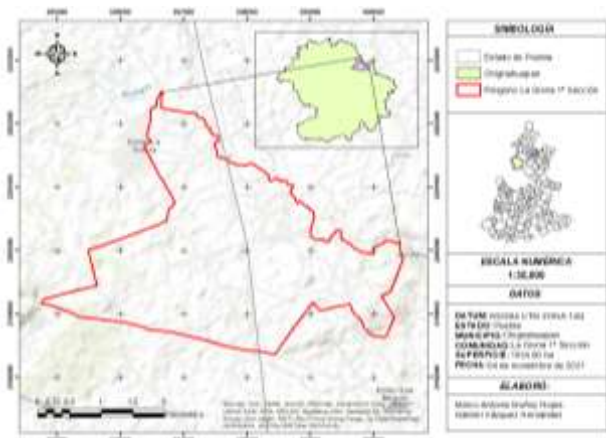
In the community of La Gloria Primera Sección, the main land use is agriculture, and there is moderate use of other resources, such as firewood extraction. The objective was to develop a proposal for community land use planning in the community, that is, to create an instrument through social participation. This proposal is a land use plan that will allow reorienting productive activities, thus minimizing the impact of society on natural resources and promoting sustainable development, guaranteeing the improvement of the living conditions of the inhabitants.

## Materials and Methods

### Location

The community La Gloria Primera Sección is located in the state of Puebla, specifically in the municipality of Chignahuapan, at UTM (Universal Transverse Mercator) coordinates 597581 E, 2200128 N; zone 14Q. It is located northwest of the center of Chignahuapan, approximately five to six kilometers (see Figure 1). The average elevation of the community is around 2,450 meters above sea level; in some parts the elevation is 2,330 meters above sea level and in others up to 2,700 meters above sea level.

The community has an area of 1,034.90 hectares, in which according to the Secretary of Social Development [SEDESOL] (2013), in its page for the year 2010 there was a registered population of 228 inhabitants, consisting of 109 men and 119 women.



**Figure 1** Macro and micro-localization of the community La Gloria Primera Sección, Chignahuapan, Puebla  
Source: Own Elaboration with data obtained from georeferencing in the field

### Methodology

This is a descriptive study that diagnosed the social, economic and environmental characteristics of the community, information that is the basis for determining proposals and/or actions to be carried out for the benefit of the community.

For the execution of this work, the stages indicated in Article 41 of the Regulations of the General Law of Ecological Equilibrium and Environmental Protection on Ecological Management, (2014) were followed. The stages are detailed below:

**Stage 1**

Characterization: The objective is to describe the state of the environmental, social and economic components of the study area. Surveys, interviews and field tours (reconnaissance of the area) were conducted for a detailed and updated description of the community.

**Stage 2**

Diagnosis: The purpose was to identify and analyze the conflicts of the environmental, social and economic components. Participatory workshops were conducted, complemented with surveys and interviews.

**Stage 3**

Prognosis: The evolution of environmental conflicts was examined, considering natural, social and economic variables that could influence changes in the pattern of land use and occupation. Scenarios were analyzed in a temporal panorama to indicate the current state and allow for the projection of probable scenarios.

**Stage 4**

Proposal: The objective is to obtain a land use pattern that maximizes consensus among sectors, minimizes environmental conflicts and favors sustainable development. Through the evaluation of the community's situation in the different areas (social, environmental and economic), management units were delimited, which are the basis for the execution of the Community Land Use Planning and in a future scenario to have a sustainable human development.

**Results and discussion****Environmental diagnosis**

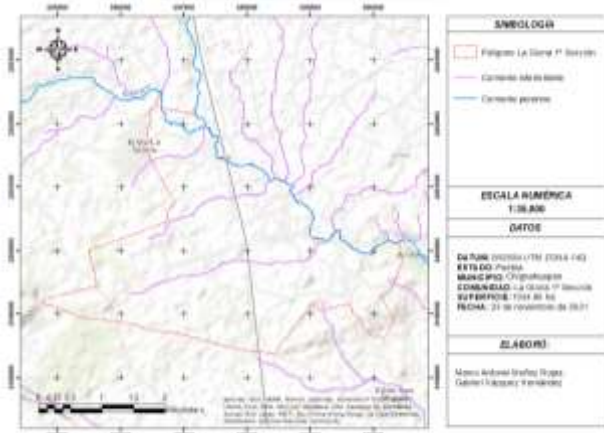
The community of La Gloria Primera Sección, Chignahuapan, Puebla is located in a plain zone, the altitudinal range goes from 2400 masl (meters above sea level) to 2650 masl in the highest parts.

The climate is denominated as C(w1), which according to Garcia et al. (1998) defines it as "Temperate, average annual temperature between 12 and 18 °C, temperature of the 14% coldest month between -3 and 18 °C and temperature of the hottest month below 22 °C, sub-humid, annual precipitation of 200 to 1800 mm and precipitation in the driest month of 0 to 40 mm; summer rainfall of 5 to 10.2% annually". Based on average annual precipitation data from meteorological stations established in Zacatlán, Pueblo Nuevo, Loma Alta and Chignahuapan (places near the community), an average for the community was estimated, resulting in 827.725 mm, with the main concentration of rainfall occurring from June to September. Average temperatures are: annual maximum of 19.6, annual average of 13.4 and annual minimum of 7.3 °C. The Agrio River runs through the community and crosses the territorial limits between the communities of Zacatlán and Chignahuapan. At the community boundary, it extends for 5.41 km.

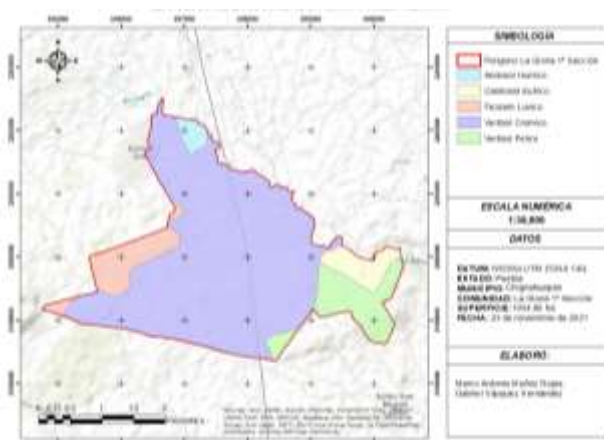
In the community La Gloria Primera Sección belonging to Chignahuapan, four different soil types were identified. The first according to the Food and Agriculture Organization of the United Nations is recognized as Andosols, soils originated by eruptions and are restricted to the vicinity of volcanoes. They have a high potential for agricultural production; however, they are easily eroded because they are very shallow, impermeable or poorly consolidated soils (FAO, 2008). The second was defined as Cambisols, which are soils with initial differentiation of horizons in the subsoil, evident by changes in their structure, color, clay content or carbonate content. These generally constitute good agricultural land and are used intensively; in temperate zones they are among the most productive soils on earth (FAO, 2008).

The third type of soil identified is Feozems, which are dark porous soils rich in organic matter, so they are used intensively in agriculture; however, droughts and water and wind erosion are their main limitations. It is found in temperate and humid climates (INEGI, 2007). The last soil type identified was Vertisols, which are extremely clayey soils that develop in sub-humid to dry climates; they are deep, very hard in drought and muddy when wet, making them difficult to work. In addition, their fertility is intrinsically low. They have considerable agricultural potential, but with proper management (FAO, 2008).

According to the Instituto Nacional de Estadística y Geografía (INEGI) in 2007, in its publication *Conjunto de datos Vectoriales Edafológico*, scale 1:250 000 Serie II (Continuo Nacional), Feozems, Luvisols, and Vertisols are the soils with the highest fertility and are appropriate for agricultural use. In the community there are two of these soils, Feozems and Vertisols, predominantly the Chromic Vertisol soil, however, due to the management that has been given to it, a large part of the agricultural soils, as well as the soils present in the community have been degraded due to poor management. Figures 2 and 3 show the water network and edaphology of the community la Gloria first section.



**Figure 2** Water network of the community La Gloria Primera Sección, Chignahuapan, Puebla  
 Source: Own Elaboration with data obtained from the National Institute of Statistics and Geography



**Figure 3** Soil ecology of the community La Gloria Primera Sección, Chignahuapan, Puebla  
 Source: Own Elaboration with data obtained from the National Institute of Statistics and Geography and the National Commission for the Knowledge and Use of Biodiversity

In the community there are three types of land use, annual seasonal agriculture is used in an area of 846.53 ha (see Table 1), while secondary vegetation is approximately 15 ha, therefore, it is inferred that agriculture is the main economic factor of the community.

Land use	Surface area (ha)	Occupancy rate (%)
ATA	846.53	81.80
F	15.13	1.46
VS	173.24	16.74
U	Dispersos	
Total	1034.9	100

ATA: Annual seasonal agriculture; F: Forestry; VS: Secondary vegetation; U: Urban

**Table 1** Land use in the community La Gloria Primera Sección, Chignahuapan, Puebla

Source: Own Elaboration with data obtained from surveys

Regarding the biodiversity present in the community of La Gloria (see Table 2), it was observed that the area is mainly a pine-oak forest, and there are other species, it was observed that there is a great diversity in the ecosystem. To obtain flora and fauna species, we worked together in a *Biocomuni* monitoring (see Table 3), the tree species identified are shown below.

Scientific name	Common name	Family
<i>Crataegus mexicana</i>	Tejocote	Rosaceae
<i>Pinus leiophylla</i>	Ocote	Pinaceae
<i>Pinus montezumae</i>	Ocote blanco	Pinaceae
<i>Pinus patula</i>	Pino colorado	Pinaceae
<i>Pinus pseudostrobus</i>	Pino blanco	Pinaceae
<i>Pinus teocote</i>	Ocote chino	Pinaceae
<i>Quercus mexicana</i>	Encino	Fagaceae
<i>Quercus rugosa</i>	Encino	Fagaceae
<i>Ageratina pazcuarensis</i>	Raíz de serpiente	Asteraceae
<i>Baccharis conferta</i>	Escoba	Asteraceae
<i>Senecio barba-johannis</i>	Gordolobo	Asteraceae
<i>Berberis moranensis</i>	Ixcapul	Berberidaceae
<i>Buddleja cordata</i>	Tepozán	Buddlejaceae
<i>Garrya laurifolia</i>	Garria	Garryaceae
<i>Juniperus deppeana</i>	Sabino	Cupressaceae
<i>Marrubium vulgare</i>	Marrubio	Lamiaceae
<i>Pinus leiophylla</i>	Ocote	Pinaceae
<i>Pinus montezumae</i>	Ocote blanco	Pinaceae
<i>Pinus patula</i>	Pino colorado	Pinaceae
<i>Prunus serótina</i>	Capulín	Rosaceae
<i>Quercus mexicana</i>	Encino	Fagaceae
<i>Quercus obtusata</i>	Encino	Fagaceae
<i>Symphoricarpos microphyllus</i>	Huihuilan	Caprifoliaceae
<i>Viburnum stenocalyx</i>	Tlamahuacatl	Adoxaceae

**Table 2** Biodiversity in the community La Gloria Primera Sección, Chignahuapan, Puebla

Source: Own Elaboration with experimental data

Grupo Biológico	Family	Species	Common name	Status	NOM-059-SEMARNAT-2010
Amphibians	Hylidae	<i>Hyla eximia</i>	Rana arborícola de montaña	En	SC
	Anguillidae	<i>Barisia imbricata</i>	Lagarto alicante del Popocatepetl	En	Pr
	Colubridae	<i>Thamnophis proximus</i>	Culebra listonada occidental	R	A
	Colubridae	<i>Thamnophis scaliger</i>	Culebra listonada de montaña cola corta	En	A
	Phrynosomatidae	<i>Sceloporus mucronatus</i>	Lagarto Hendido	En	SC
	Viperidae	<i>Crotalus ravus</i>	Vibora cascabel pigmea mexicana	En	A
Birds	Accipitridae	<i>Accipiter striatus</i>	Gavilán pecho rufo	R	Pr
	Accipitridae	<i>Buteo platypterus</i>	Aguililla alas anchas	R	Pr
	Accipitridae	<i>Buteo jamaicensis socorroensis</i>	Aguililla cola roja	En	Pr
	Ardeidae	<i>Ardea alba</i>	Garza Blanca	C	SC
	Ardeidae	<i>Egretta caerulea</i>	Garza Azul	C	SC
	Cardinalidae	<i>Piranga rubra</i>	Piranga roja	R	SC
	Cardinalidae	<i>Phenicicus melanoccephalus</i>	pico gordo tigrillo	R	SC
	Cathartidae	<i>Coragyps arranus</i>	Zopilote común	R	SC
	Columbidae	<i>Streptopelia decaocto</i>	Paloma de collar turca	I	SC
	Fringillidae	<i>Spinus psaltria</i>	Jilguero Dominicó	R	SC
	Hirundinidae	<i>Hirundo rustica</i>	Golondrina Tijereta	R	SC
	Icteridae	<i>Quiscalus mexicanus</i>	Zarate mayor	R	SC
	Mimidae	<i>Toxostoma curvirostre</i>	Cuilacoche pico curvo	R	SC
	Passerellidae	<i>Oriturus superciliosus</i>	Zacatonero serrano	R	SC
	Passerellidae	<i>Pipilo maculatus</i>	Rascador moteado	R	SC
	Picidae	<i>Dryobates scalaris</i>	Carpintero mexicano	En	SC
	Turdidae	<i>Myadestes occidentalis</i>	Clarín Jilguero	R	Pr
	Turdidae	<i>Turdus migratorius confinis</i>	Mirlo Primavera	En	Pr
Tyrannidae	<i>Empidonax minimus</i>	Mosquero Mínimo	R	SC	
Tyrannidae	<i>Pyrocephalus rubinus</i>	Mosquero Cardenal	R	SC	
Mammals	Canidae	<i>Urocyon cinereoargenteus</i>	Zorra gris	C	SC
	Didelphidae	<i>Didelphis marsupialis</i>	Tlacuache común	En	SC
	Leporidae	<i>Sylvilagus cunicularius</i>	Conejo Serrano	En	SC
	Procyonidae	<i>Bassariscus astutus</i>	Cacomixtle	En	A
	Sciuridae	<i>Sciurus oculatus</i>	Ardilla de Peter	En	Pr

A: threatened, C: quasi endemic, I: introduced, R: resident, En: endemic, SC: no risk category, Pr: subject to special protection.

**Table 3** Fauna of the community La Gloria Primera Sección, Chignahuapan, Puebla

Source: Own Elaboration with experimental data

### Social diagnosis

According to INEGI data, (2021) the community is in a medium marginalization status, inhabited by approximately 228 people, 119 women and 109 men, surveys and interviews were applied to 12.28 % of the people of adult age to obtain quantitative and qualitative information regarding population, education, housing, health, basic services, transportation and migration. Twenty-three students and three teachers were interviewed on education only. These aspects addressed in this diagnosis are detailed below.

The locality has 228 inhabitants, the educational level of adults, with respect to the surveys is 54% studied primary school, 32% secondary school and 7% high school, the average number of children they have in the community is 3. In terms of education, there are 71 students of which 21% work, 28% study and work, 48% have a scholarship, 13% do not have any economic support and 29% are unknown.

Regarding housing, 75% have their own house, 25% are rented, the material with which the houses are made is adobe (54%) and block/brick (46%) and the average number of people living in the home is 4 to 5.

Regarding health, which is a right that everyone should have, in the community of La Gloria Primera Sección Chignahuapan, Puebla, there is a health center which is not in service to the community. And finally the basic services such as drinking water, 93% of the population has it while public lighting is only 57%, drainage only 7%, 36% of the population has telephone, only 4% has internet, there is no surveillance in the town, 93% of the population has electricity and 57% has a television.

In terms of transportation, there is a local route from La Gloria to Chignahuapan, public transportation runs 3 days a week (Monday, Tuesday and Friday) with two runs per day, being deficient in the number of schedules available for transportation, In the case of migration, the majority of the inhabitants (64%) mentioned that they have relatives, friends and/or acquaintances who have migrated, 46% stated that, if they had the possibilities, they would migrate either to another state or in their case and most commonly to another country (United States), the rest of the population commented that they would not be willing to migrate.

### Economic diagnosis

The main economic activity is agriculture in conjunction with livestock practices, mainly backyard livestock, and they also mentioned that they also look for other jobs to obtain more income. The crops grown on their plots range from staple crops such as corn, beans, barley, wheat, peas, oats and a few people grow strawberries and tomatoes in greenhouses.

A projection was made of the benefit/cost ratio (see Table 4) that they would have if they sold their production, for which the production costs were obtained, including all the inputs used in the preparation and management of the land, labor and harvest. For income, the average price in the region was used, with the result that in most of the crops there is a profit ( $\geq 1$ ).

However, a large part of the crops are used for self-consumption, due to the fact that their land extensions are small and only those with large extensions are the ones that commercialize their production (see Figure 4).

According to interviews and surveys, 39% earn between \$1,200.00 and \$2,000.00, 36% earn between \$2,000.00 and \$2,800.00, 14% earn between \$500.00 and \$1,200.00 and two people who said they do not farm earn more than \$2,800.00.



**Figure 4** Agricultural work in the community of La Gloria Primera Sección

Source: Captured in the field

Cultivation	PRO	R (T/Ha)	PV (\$/T)	IN/Ha (\$)	C/Ha (\$)	IN/T (\$)	RL B/C
Corn		3	6,200	18,600	18,101	499	1.03
	✓	3	6,200	18,600	17,101	1,499	1.09
Barley		2.5	4,700	11,750	11,966	-216	0.98
	✓	2.5	4,700	11,750	10,966	784	1.07
Bean		0.5	26,000	13,000	15,066	-2,066	0.86
	✓	0.5	26,000	13,000	14,066	-1,066	0.92
Wheat		3	4,700	14,100	11,730	2,370	1.20
	✓	3	4,700	14,100	10,730	3,370	1.31
Haba		0.5	30,500	15,250	13,416	1,834	1.14
	✓	0.5	30,500	15,250	12,416	2,834	1.23
Alverjon		2.5	12,500	31,250	11,930	19,320	2.62
	✓	2.5	12,500	31,250	10,930	20,320	2.86
Avena		3	4,500	13,500	11,875	1,625	1.14
	✓	3	4,500	13,500	10,875	2,625	1.24

Where PRO: PROCAMPO; R: Yield; PV: Sales price; IN: Net income; C: Cost; RL: Ratio; B: Profit; T: Tons; Ha: Hectare; \$: Mexican pesos.

**Table 4** Projection of the benefit/cost ratio of possible agricultural production in the community La Gloria Primera Sección

Source: Own Elaboration with experimental data

**Land Use Planning Model (MOT)**

As part of the activities to be carried out in the TCO, the main problems present in the community were identified (see Table 5).

Socioeconomic		
Socioeconomic	Cause	Effect
Deficient health center.	Not enough support from the municipality and/or government.	They cannot take care of their health right there and have to go elsewhere.
Limited energy network.	Not enough support from the municipality and/or government.	Limited to one development.
Reduced drainage network for the entire community.	Not enough support from the municipality and/or government.	Those who do not have drainage must resort to other methods.
Low income from milk sales.	Lack of knowledge in the management and diversification of milk by-products.	Disinterest in continuing to produce due to the low profits generated by the activity and possible waste due to the fact that the product is not taken out.
Low livestock development.	Lack of technical advice and little support from the authorities.	Self-sufficiency livestock.
No technical assistance for agricultural production.	There is not enough support from the municipality and/or government. And if they want to have advice, it entails an economic expense.	Production is carried out with traditional knowledge, which can lead to low production; without knowing if new techniques and/or activities are required.
Street lighting is scarce and sometimes deficient.	Not enough support from the municipality and/or government.	Areas without lighting and when lighting fails, attention is usually delayed.
Lack of telephone line and internet.	Economy, high wiring costs, housing dispersion, and lack of management by the authorities.	Not everyone has some source of communication and for those who study it is difficult without the necessary resources such as the internet today.
Limited reach of the waste collection truck.	Insufficient organization on the part of the inhabitants to concentrate all the waste in the center of the community.	Garbage is burned or buried, generating environmental impacts.
Low presence of public transportation.	Not enough support from the municipality and/or government.	Enables higher and more difficult expenses, restricts community development.
Ignorance of community boundaries.	Lack of management by the authorities.	May cause problems with neighboring communities and/or ejidos.
Mistrust of strangers.	There is insufficient information on who enters.	It generates distrust and they will be aware of who enters the community.
<b>ENVIRONMENTAL</b>		
Change of land use.	Extension of agricultural production.	Loss of areas and environmental services provided by forest vegetation.
Decrease in the flow of the water tributary.	Need for water supply.	Loss of water resources.
Contamination of the river, as well as of forests by garbage..	The garbage truck only passes through the main street, which means that the residents who live far away from the site have to take other alternatives to dispose of their waste.	Environmental contamination.
Soil contamination.	Excessive use of chemical fertilizers and pesticides on staple crops.	It favors the loss of the physical-biological conditions of the soil, facilitating its degradation.
Firewood extraction.	Most of the villagers use firewood as fuel.	Loss of forest areas.
Wildlife hunting.	Lack of knowledge of the importance of fauna and the tradition of hunting animals, as well as fear of some of them.	Loss of fauna diversity.
Possible contamination by wastewater and solid waste from the rose greenhouses.	Rose greenhouse company, which is expanding.	Environmental pollution.

**Table 5** Main socioeconomic problems in the community La Gloria Primera Sección

Source: Own Elaboration with experimental data

Based on these problems, a proposal for territorial division was developed, which are called Environmental Management Units (UGA) accompanied by projects to be carried out for the implementation of the CTO (see Table 6 and Figure 5).

**Forestry and fruit plantation:** The implementation was based on the existence of unused land with forestry potential, which can be used to perpetuate ecosystem goods, in addition to the fact that they could be eligible for government support and thus obtain income. In terms of fruit production, the area is suitable and has a potential market for establishment, production and marketing.

**Use with sustainable agricultural and livestock use:** The current land use was used as a basis for designating this area, so the agricultural areas already defined will be conserved, since it is not possible to redefine these areas because they are already parceled out. The aim is to implement sustainable use schemes through conservation practices and soil improvement, as well as the implementation of new productive alternatives.

**Backyard livestock farming** is included in this unit, since the livestock sector is distributed throughout the territory, next to households and/or in the plots.

**Restoration area:** Includes areas covered with eroded grassland and portions of land without vegetation, susceptible to the detachment of soil particles. Actions oriented to the retention, protection, and/or conservation of soil and recovery of vegetation cover will be implemented.

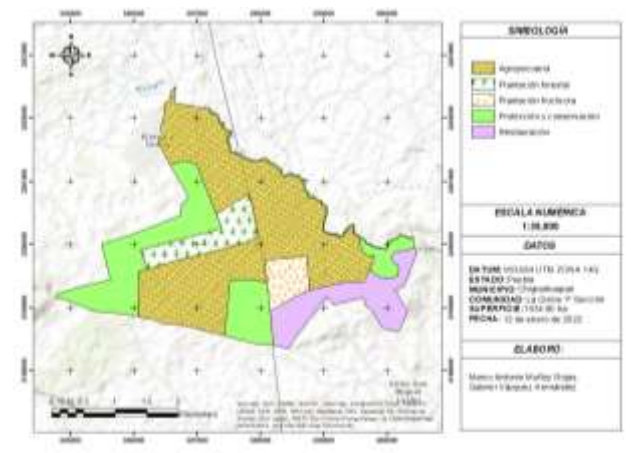
**Area for protection and conservation:** These areas have natural vegetation cover, however, the loss of portions of vegetation is notable, therefore, this unit can be accompanied by conservation works, such as reforestation with local species that are adapted to the conditions. This unit also includes the river, to which it was proposed to establish an area of influence of 15 to 20 m, in a length of 5.41 km.

Order	UGA	Surface area (ha)	Percentage occupied (%)
Uses	PF	75.71	7
	PFR	44.14	4
	UASA	537.10	52
Destination	AR	118.89	11
Reservation	APC	259.05	25

*FP: Forest plantation; PFR: Fruit plantation; UASA: Sustainable agricultural and livestock use; RA: Restoration area; APC: Protection and conservation area.*

**Table 6** Environmental Management Units of the community La Gloria Primera Sección, Chignahuapan Puebla

*Source: Own Elaboration with experimental data*



**Figure 5** Environmental Management Units of the community La Gloria Primera Sección, Chignahuapan, Puebla

*Source: Own elaboration with data obtained from the National Institute of Statistics and Geography and the National Commission for the Knowledge and Use of Biodiversity*

The following are the actions proposed for implementation as part of the CTO (see Table 7), these come from the problems detected, which are economic income and the importance of caring for the environment. In the execution of the projects, investment amounts ranging from \$5,000.00 to \$300,000.00 are estimated, depending on the project.

However, there are governmental agencies such as the presidency of the municipality, CONAFOR, SEMARNAT, SADER, private agencies, and the support of the groups in the community, from the community itself groups formed in the same community, from which they can get support to execute the projects.

In addition to the above, projects of social interest for the benefit of the community were detected, these are: the extension of the waste collection truck route and introduction of garbage containers, implementation of an internet network in the school, rehabilitation of the health center, improvement of the public transportation network and the extension of the drainage and electricity networks.

	Project
Short-term actions	Production of other forest species in the nursery.
	Rainwater harvesting and storage.
	Vegetable production in backyard gardens.
	Training in the diversification of dairy products.
	Backyard poultry management (chickens and turkeys).
	Technical training in crop production.
Medium-term actions	Establishment of forest plantation.
	Establishment of fruit plantation.
	Sheep fattening and marketing.
	Establishment of an area of influence along the river.
Long-term actions	Reforestation of wooded areas in the community.
	Restoration of degraded soils.

**Table 7** Land use planning model project in La Gloria First Section

Source: Own Elaboration with experimental data

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### Conclusions and recommendations

The methodology proposed in this study covers important areas that not only concern ejidos, but also communities where there is no natural resource management, degradation and loss of natural resources, and it is even more worrying because in recent years the overexploitation of resources has been increasing not only in Mexico but globally.

The general objective of this work, which was the elaboration of a CTO, was achieved. However, the execution of this work requires time to see the results; consequently, the community will have to follow up in subsequent years. According to the specific objectives of this research, they were fully met. Since the polygon of the community was delimited, interviews, surveys, visits and workshops were carried out; activities that gave way to the determination of the problems of the community in the social, economic and environmental fields, same that gave guideline to propose a plan of action that leads the community to a sustainable human development.

La Gloria Primera Sección is a marginalized community, the majority of the population is adults dedicated to agriculture with minimal income and the minors attend school, although there are some who also work. The school has three educational levels (kindergarten, primary and secondary) with 30 students and 3 teachers. Basic services are available (electricity, water and sewage), but they are deficient. Finally, the health center is not functioning.

The area is dominated by a natural pine-oak forest, where there is a diversity of flora and fauna species, including eleven families of trees and shrubs, and twenty-three families of birds, mammals, amphibians and reptiles.

The problems affecting the development of the community La Gloria Primera Sección were divided into two areas. The first is socioeconomic, which in general includes the deficiency of basic services, low income, lack of collective organization, lack of interest in activities that bring long-term benefits and lack of technical agricultural advice, limiting their ability to process some products. The second area is environmental, where the soil, water resources and the diversity of flora and fauna are affected.

Based on the diagnosis and identification of the problems, the Land Management Model (MOT) was detailed, in which the territory was zoned with Environmental Management Units (UGA's), and within each of them, short, medium and long term projects and/or activities were proposed, which should be carried out if the community decides to implement the OTC.



With this research work, it is possible to involve the population in decision making and/or actions that lead to a better quality of life in balance with an adequate use of natural resources. Finally, this work resulted in a CTO proposal that is not being implemented; however, the document was left in the hands of the community, who will have the final decision to apply it or not.

It is recommended that the community support the implementation of the CTO, form working groups within the community and establish a monitoring system for the CTO.

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