Agricultura, Sociedad y Desarrollo

SOCIOECONOMIC CHARACTERISTICS OF FAMILIES AND THEIR USE OF FOREST RESOURCES IN THREE COMMUNITIES OF CINTALAPA, CHIAPAS, MEXICO

Cristhian Adolfo **Velázquez- Muñoz**[1], Benito **Ramírez-Valverde**[2*], José Pedro **Juárez-Sánchez**[2], Gustavo **Ramírez-Valverde**[3], José Pablo **Prado-Córdova**[4]

[1]Programa en Estrategias para el Desarrollo Agrícola Regional, Colegio de Postgraduados, Campus, Puebla, México.
[2]Colegio de Postgraduados Campus Puebla, México. [3]Colegio de Postgraduados Campus Montecillo, México.
[4]Facultad de Agronomía, Universidad de San Carlos de Guatemala, Guatemala.
*Corresponding author: bramirez@colpos.mx

Citation: Velázquez-Muñoz CA, Ramírez-Valverde B, Juárez-Sánchez JP, Ramírez-Valverde G, Prado-Córdova JP. 2023. Socioeconomic characteristics of families and their use of forest resources in three communities of Cintalapa, Chiapas, Mexico. Agricultura, Sociedad y Desarrollo https://doi.org/10.22231/asyd.v20i4.1615

ASyD 20(4): 533-548

Editor in Chief:
Dr. Benito Ramírez Valverde

Received: May 19, 2023.
Approved: July 3, 2023.

Estimated publication date:
September 28, 2023.

ABSTRACT

This research intended to define the socioeconomic characteristics of families and their use of forest resources in three rural communities in the municipality of Cintalapa Chiapas, Mexico. 80 "ejidatarios"; heads of families who possess land areas were interviewed. Evidently, 57.1% of "ejidatarios" are farmers and 30% are cattle ranchers. The weekly family income is $780.60 and 75% considered this to signify poverty. 83% of "ejidatarios" in Venustiano Carranza have food supply problems; in Francisco I. Madero this is 51.4% and in Triunfo de Madero 51.5%. 100% of families live in overcrowded homes. The main crop is maize with yields of 2.5 t/ha and the most important livestock activity is cattle ranching with an average of 20 head of cattle per producer. The species with the highest value in the Cultural Importance Index are the cattle kept in ranches. All the backyards grow species that complement food consumption, mainly fruit. 48.7% of "ejidatarios" obtain part of their food from the forest by hunting and gathering. In these rural communities, more than 80% receive some type of government support.

Keywords: food, housing, natural resources, poverty.

INTRODUCTION

In 2022, it was estimated that between 691 and 783 million people worldwide suffered from hunger. This is partly due to the increase in food prices, agricultural inputs and energy, intensified by the impact of the war in Ukraine, which prevented recovery in employment and thus affected the income of the most vulnerable people, hampering reduction in hunger (Food and Agriculture Organization of the United Nations-FAO, International Fund for Agricultural Development-IFAD, United Nations Children's Fund-UNICEF, World Food Program-WFP and World Health Organization-WHO. 2023).

In Latin America, rural poverty increased from 46.7% to 48.6% between 2014 and 2016, while extreme rural poverty increased from 20% to 22.5% (Food and Agriculture Organization of the United Nations- FAO, 2018). In Mexico in 2018, poverty in rural areas affected 55.3% of the total population, that is, 17 million people, and in this type of context, the main deficiencies included: access to social security (77.7%), access to basic services in the home (52.2%), educational backwardness (28.2%) and access to food (25.8%). To a lesser extent it referred to access to health services (13.8%) and

access to quality housing spaces (18.7%) (National Council for the Evaluation of Social Development Policy, S/A).

In other words, this population suffers from multidimensional poverty, reflected in the deficient provision of basic social services, because poverty is not only defined in terms of income, but should be assessed in terms of other non-monetary variables to measure deprivation (health, education, mortality, employment, etc.) that are complementary to income. In this context, it is apparent that the poorest population is located in agricultural regions and depends on agriculture to survive (FAO, IFAD, UNICEF, WFP and WHO. 2023). Their production units are usually smallholdings.

In 2020, forested areas on a global scale were estimated at 4,060 million hectares, representing 31% of the land surface and these are located mainly in the Russian Federation (815,312 thousand hectares), Brazil (496,620) and Canada (346,928; together accounting for 41% of the world surface. Mexico has a forested area of 65,692 thousand hectares (FAO, 2021) ranked twelfth in the world, of this, 49.9% corresponds to primary forestry and the remaining percentage to secondary vegetation (National Forestry Commission-CONAFOR, 2022).

Regarding production, approximately 1,150 million ha (30%) of the forests are mainly managed to produce timber and non-timber forest products. Besides this, 749 million hectares are designated for multiple uses, which often include production (FAO, 2021). Production of timber from forests in 2021 equaled 9.3 million m^3 of round wood, of which 8.1 million m^3 constituted native forest and 1.2 million m^3 commercial forest areas (CONAFOR, 2022). Non-timber forest production amounted to 396,660 tons, which includes the non-wood contribution from the vegetation of a forest ecosystem, such as lichens, mosses, fungi and resin (CONAFOR, 2022).

The objective of the research was to identify the socioeconomic characteristics of families in three rural communities, located in the municipality of Cintalapa, Chiapas, Mexico. This considers the productive activities they carry out in the region, as well as the management and use of forest species, which complement the basic needs of households. We assessed the opinions of "ejidatarios" concerning the current conditions of their forests in the face of climate change and anthropogenic activities.

THEORETICAL FRAMEWORK

It is important to recognize that the neoliberal agricultural policy that was implemented in rural areas has caused an unprecedented crisis. This is reflected in economic and social problems such as population growth that results in the subdivision of agricultural plots, low prices for agricultural products, migration and lack of jobs in rural areas. In this context, the production of food in diversified landscapes and with multiple capacities to satisfy their dietary needs becomes relevant. In this context, agricultural production must be combined with environmental conservation, taking advantage of the fact that agricultural production in diversified landscapes has been the predominant form of small-scale agricultural exploitation (Padoch and Sunderland, 2023).

Forests specifically, contribute to soil formation and provide a habitat for wild pollinators and predators of agricultural pests; they provide access to food in the form of available edible plants and animals and the income generated from forest products can be used to buy food. They also provide a diversity of medicinal plants (Mohamed and Smith, 201B). Byproducts include a variety of foods such as fruit, nuts and vegetables that contribute to more varied diets.

The diversity of productive activities, characteristic of these systems, is well adapted to the multiple environmental, demographic, social, political, and economic changes that are taking place in most of the less developed world.

In Mexico, rural communities make use of forest resources, when they exist; to satisfy their immediate needs, such as food, materials, services, housing, etc. López and Chan (2016) mention that "a natural resource is any element of the environment that can be used, extracted and managed, resulting in useful products and goods for society, throughout the different ecosystems, their species and all processes ecological, from an anthropocentric perspective, natural resources are defined according to human requirements with an economic aspect". From a bio-centrist perspective, a resource refers to any natural element that is either beneficial or not so (Tapia, 2012). For his part, Carabias (2009) mentions that there is no way to distinguish between management and sustainable management; we apply the term ecological management, meaning the use of a resource in a limited area. Therefore according to Arce and Armijo (2011), this implies access to a resource and the rights to its management, which are determined by the type of property where it is found. Studies on resource management have been implemented in "ejidos" in Mexico, mainly focusing on species use and the recognition of community strategies for conservation, such as that of Martínez and Arellano (2010), carried out in an "ejido" in the state of Jalisco, Mexico. Lazos *et al*. (2016) studied the management of trees and their cultural importance index, finding anthropogenic activities that cause deforestation and loss of resources such as agricultural and cattle grazing activities. Barrera *et al*. (2016) studied the Yucatan peninsula, where they found significant impact on forests related to the ecological management carried out by the Maya. Guevara *et al*. (2015) study the perception of users of natural resources in Puebla, Mexico; as well as the ways of life, uses and customs, ways of working the land and how the natural resources in their environment have been used.

Lazos *et al*. (2013) consider that a more active and educated rural population is required that recognizes its resources based on greater knowledge, in order to make decisions and help shape the policies that regulate its territory, thus conserving their forests, knowledge and ecosystems. Álvarez (2006) affirms that most of the best conserved resources are found in the social sector (on "ejidal" and "communal" property). As rural areas are those manifesting greatest poverty in the country, it is necessary to carry out an assessment of the social (Toledo *et al*., 1990) and economic conditions of those who use these resources, as well as the activities they carry out within from the forest to supplement and satisfy their immediate needs for food, materials and services.

METHODOLOGY

Study area

The municipality of Cintalapa, Chiapas, Mexico is located between the geographic coordinates 16º 39' N and 93º 44' W, at an altitude of 540 meters above sea level, a territorial extension of 2,436.2 km2, representing 19% of the territory of the Central region and 3.18% of the state surface INAFED (National Institute for Federal and Municipal Development, 2010). It has a population of 78,114 inhabitants, of which 39,239 are men; 4,247 speak Tzotzil and 347 speak Tzeltal (National Institute of Statistics and Geography-INEGI, 2010). The communities where the investigation was carried out consisted of the Triunfo de Madero, Francisco I. Madero and Venustiano Carranza "ejidos".

Statistical sampling was used as a way of obtaining information. The sampling scheme used was qualitative with maximum variance. To calculate sample size, the following equation was applied:

$$n = \frac{NZ^2_{\alpha/2}(0.25)}{Nd^2 + NZ^2_{\alpha/2}(0.25)}$$

Where *n*: sample size; *N*: Size of population; $Z_{\alpha/2}$: *Z* value (normal standard distribution); *d*: accuracy.

The sampling frame was obtained from the "ejidatario" register for the "ejido" assembly, provided by the commissioner for each "ejido"; with overall (N) of 457 "ejidatarios", and a reliability of 95% ($Z_{\alpha/2}$=1.96).

Sample size consisted of 80 "ejidatarios". For the Francisco I. Madero "Ejido", 35 "ejidatarios" were surveyed, in Triunfo de Madero 33 and in the Ejido Venustiano Carranza 12 "ejidatarios". Only "ejidatarios" were interviewed, as they represent the people who possess the land and have greater knowledge of resource management over time, as indicated by Davis *et al*. (2010).

Cultural Importance Index for Species

The Cultural Importance Index (CII) for each species z (CIIz) was calculated with the modifications proposed by Ávila *et al*. (2011) and simplified as follows:

$$IIC_z = \frac{iu_z + fm_z + vut_z}{3}$$

Where use intensity of species z (ui_z) was calculated by applying the equation:

$$iu_z = \frac{\text{Number of uses of sp. z}}{\text{Total number of uses for all spp.}}$$

Frequency of mention of species z (fm_z) by applying the equation:

$$fm_z = \frac{\text{Number of mentions of sp. z for all uses}}{\text{Total number of mentions of all spp. for all uses}}$$

The value of the species z for the use α ($vu_{z\alpha}$), by applying the equation:

$$fm_z = \frac{\text{Number of mentions of sp. z for use } \alpha}{\text{Total number of mentions of all spp. for use } \alpha}$$

The total use value for the species z (vut_z) by applying the equation:

$$vut_z = \sum_{\alpha}^{n} -1uv_{z\alpha}$$

This index objectively quantifies the importance of each timber species used by "ejidatarios", taking into account intensity, frequency and use value, associated with their recognition, reputation and lexical score in terms of mentions and uses. Parametric and non-parametric statistics were used for data analysis.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the interviewees

100% of the interviewees from the Venustiano Carranza "Ejido" speak Tzotzil as their mother tongue and speak Spanish where necessary, so it is considered an indigenous community (Brascoupé, 1992); people who speak an autochthonous language are also considered natives, as indicated by the National Commission for the Development of Indigenous Peoples-CDI-United Nations Development Program-UNDP (2006). Likewise, all the interviewees refer to themselves as indigenous, which is another factor that should be taken into account if they are to be considered as such (Snipp, 1989). In the Triunfo de Madero and Francisco I. Madero, "ejidos", only Spanish is spoken.

Evidently, in the Francisco I. Madero "Ejido", 100% of the interviewees are men, with an average age of 59 years, 5.7% are single, 88.6% are married and 5.7% live in civil partnership. The highest education level is secondary (11.4%), 54.3% finished primary school and 34.3% did not attend school. In the Triunfo de Madero "ejido", 97% of interviewees are men; with an average age of "ejidatarios" of 59.6 years; 81.8% are married and 9.1% are single, 6.1% live in civil partnership and 3% are widowed; 36.4% did not attend school, 36.4% went to primary school and 27.3% went to secondary school. In the Venustiano Carranza "ejido", the average age of the interviewees is 45.5 years; 75% are men; 58.3% are married, 33.3% live in civil partnership and 8.3% are single; 58.3% attended primary school, 16.7% secondary school and 25% never studied. No significant statistical difference between the three "ejidos" was found in terms of schooling, according to Fisher's exact statistic (p=0.405).

Family size and living conditions

In the Francisco I. Madero "ejido", the size of the nuclear family averages 3.5 members; and the extended family consists of 4 individuals. For the Triunfo de Madero "ejido", the size of the nuclear family is 3.3 and the extended family is 4 members. In the Venustiano Carranza "ejido", the size of the nuclear family is 4 and the extended family is 2.6 individuals. The extended families of the communities average 7 members, on average the homes have 2.5 rooms or rooms that are shared among the members of the family. This means that the homes of the communities being studied are overcrowded.

97% of homes have a kitchen, of which more than 58% are inside the home. In the communities, household construction size averages 91.2 m^2 and the patio areas are 685.5 m^2; 69.6% of the floors of homes are made of cement, 16.5% are mud, 12.7 of mud-cement, 1.3% of brick. Regarding the walls of homes, 60.8% are adobe, 20.3% block, 11.4 brick, 3.8% wood and 3.8 block and partition. All homes have bathrooms, 46.2% are located inside the house and 53.8% outside. 67.9% of bathrooms do not have showers and 93.8% have a septic tank and 6.3% latrines.

All the homes have electric light; 72.5% have drinking water, 16.3% consume water from wells or water tanks and 11.3% from streams or springs. 75.9% use firewood as their principal fuel and 24.1% gas. 93.8% of homes have a septic tank and 6.3% latrines. Due to its characteristics and services, the region is considered to be of medium to high marginalization (National Population Council-CONAPO, 2015).

Family diet

Family diet was analyzed with respect to the quantities of products that they consume during the week. The main product was processed maize in the form of a tortilla of which they consume 12.4 kg/family weekly; beans 2.8 kg/family; bread 0.8 kg/family; rice 1.3 kg/family; tomato 2.3 kg/family; fruit 2 kg/family; pork 1.2 kg; chicken 1.5 kg; cheese 0.8 kg, egg 1.1 kg; chili 0.7kg; fish 1.1kg; and beef 1.2 kg.

Food consumption is limited, due to restricted access and high prices; according to interviewees, 3.8% receive financial support for food and 80% receive financial support from the PROSPERA program, which does not provide food. 56.3% stated that they have food supply problems, because of cost, all mentioned that their economic income is insufficient to ensure a good diet. This result reflects that found in an indigenous municipality in the state of Puebla by Apadaca-González *et al.* (2020), who mention that due to their low income, residents do not have access to sufficient food. In the Venustiano Carranza "ejido", 83.3% of families suffer from food and supply problems, in Francisco I. Madero 51.4% and in Triunfo 51.5% (Table 1). Venustiano Carranza is a community inhabited entirely by Tzotzil residents and they reside further away from the city which provides food, meaning that many basic products are not sold in the area.

Table 1. Food supply in the communities.

Location	Do problems for food storage exist? (%)	
	Yes	No
Francisco I. Madero	51.4	48.6
Triunfo de Madero	51.5	48.5
Venustiano Carranza	83.3	16.7
Total	56.2	43.8

Source: self elaborated based on field data.

Opinion concerning conditions of poverty in rural communities

On average, the "ejidatarios" work a daily shift of 7.3 hours and the interviewees in the three "ejidos" receive a weekly income of $780.62. In Francisco I Madero income was $735.7 per week, in Triunfo de Madero this was $851.5 and Venustiano Carranza $716.7. Applying an analysis of variance, no statistical difference was found between the communities (F=1.288; p=0.282). The results show that the income of the "ejidatarios" is low and due to this situation, conditions of poverty persist.

75% of those interviewed spend their money on food; 13.8% on health; 8.8% on education; 2.5% on housing. The Inger coefficient is calculated based on the percentage of expenditure dedicated to food. In the three study communities, the Engel coefficient was 0.75, which coincides with that shown by Vezares-Zúñiga (2023) in the community of General Cárdenas located in the same municipality, where the coefficient reached a value of 0.77. These data provide information concerning the level of poverty in the municipality of Cintalapa.

Expenses per community are presented in Table 2. Therefore, 71.3% consider themselves poor within their community and 58.2% are poor compared to other neighboring communities.

When Fisher's exact test was applied, no significant difference was found (Fisher's exact statistic=9.871; p=0.070) and notably, like all poor families, most of their income goes to buy food. These results reveal the difficult socioeconomic conditions in which families in the study region find themselves.

Table 2. Family expenses from weekly income**.**

Location	Principle expenses from overall income (%)			
	Food	Home	Education	Health
Francisco I. Madero	60.0	2.9	17.1	20.0
Triunfo de Madero	87.9	0.0	3.0	9.1
Venustiano Carranza	83.3	8.3	0.0	8.3
Total	75.0	2.5	8.8	13.8

Source: self elaborated based on field data.

65.8% received financial support from the government from the Prospera program; 15% of families have a relative who has migrated; principally it is the children of "ejidatarios" who migrate. Of this percentage, 45.5% migrated to another state; 27.3% to another municipality; 18.2% to the United States; 9.1% to another community. Regarding non-agricultural rural employment, 45.5% said that they are workers; 27.3% day laborers.

Economic activities in the communities

The main economic activities of the interviewees were agriculture and cattle ranching. 57.5% of "ejidatarios" are dedicated to agriculture, 30% to livestock, 5% said they were involved in business, 3.8% day laborers and 2.8% other activities. "Ejidos" with the highest percentage of farmers were Francisco I. Madero (80%) and Venustiano Carranza (50%). Livestock activity predominates in the "Ejidos", Triunfo de Madero (42.4%) and Venustiano Carranza (41.7%). This means that agriculture is the main economic activity of the "ejidos" and the one that occupies the largest area. (Table 3).

By community, it was found that in the "ejido" Francisco I. Madero, 44.9% of the surface is dedicated to agriculture, of this area, 66.7% was for communal use, 44.9% "ejido" and 33.3% private property; on average each producer dedicates 3.2 hectares to this activity. In Triunfo de Madero, 39.7% of their territory was devoted to agriculture; 40.6% of cultivated land consists of "ejidos"; 33.3% communal and 26.1% private and on average farmers have 2.8 ha to cultivate. In Venustiano Carranza, 15.4% of the surface is dedicated to agriculture and they have an average of 3.8 hectares for farming. The above data placed the interviewees among "ejidatarios" (52%) at the national level, who have up to 5 ha of land, CEDERSA (Study Center for Sustainable Rural Development and Food Sovereignty) 2014.

The main crops produced in the study communities were maize, beans, peanuts, coffee, sorghum and squash. It was found that the producers cultivate four endemic maize varieties and in recent years they have been using hybrids. 35.2% of the producers sowed the Tuxpeño variety, 22.5% from Veracruz and 19.7% are introducing hybrids (Table 4). 88.9% of maize production was sold locally and 11.1% regionally, at market prices established by intermediaries in the region. The yields for the "ejido" Francisco I Madero were 2.6 t/ha with an average income value of 11,777.7 pesos/hectare; in Triunfo de Madero they achieved an average yield of 2.5 t/ha and an income of $10,961.29 per hectare; in

Table 3. Main activity of the interviewee (%).

Location	Farmer	Day worker	Businessman	Builder	Cattle rancher	Other activities
Francisco I. Madero	80	2.9	2.9	0	14.3	0
Triunfo de Madero	36.4	6.1	9.1	3	42.4	3
Venustiano Carranza	50	0	0	0	41.7	8.3
Total	57.5	3.8	5	1.3	30.0	2.5

Source: self elaborated based on field data.

Table 4. Percentage of producers who grow various maize types.

Location	Name of white maize variety						
	Veracruzano	Palomero	Blanco	Olotillo	Tuxpeño	Crema	Hybrid
Francisco I. Madero	32.3	0	0	6.5	38.7	0	22.6
Triunfo de Madero	17.9	3.6	3.6	14.3	35.7	0	25
Venustiano Carranza	8.3	0	25	25	25	16.7	0

Source: Self elaborated based on field data.

Venustiano Carranza the yield was 1.8 t/ha and their income was $9,571.4 per ha. The producers interviewed do not have an exact tally of the production costs they incurred to produce maize per hectare. Here, intermediate and small cities play a fundamental role in providing input and output marketing opportunities for rural populations (FAO, IFAD, UNICEF, WFP and WHO. 2023).

Bean crops in the area average yields of 0.89 t/ha and generate an income of $2956.5 per hectare; peanuts are only produced in Francisco I. Madero and Triunfo de Madero with yields of 2.4 t/ha, generating an average income of $11,500.0 per ha; squash was produced for cattle consumption and generated an income of $1,300.0 per hectare; in Francisco I. Madero and Venustiano Carranza they produce Robusta type coffee with a yield of 0.650 t/ha of robust type, providing an income of $1,500.0 per ha.

Livestock activity is practiced in the three "ejidos", with backyard livestock (pigs, sheep, poultry, horses and donkeys) predominating over grazing livestock (cattle). The first of these is produced for consumption and the second, 53.3% sold it in local markets and the remaining percentage was sold regionally. Ranchers have access to an average surface area of 15.4 ha for grazing and the predominant form of land ownership is the "ejido".

Ranchers in the region who have an average of 20 head of cattle generating income of $9,500.0 per head in one year; of pigs 3.5 heads with an income of $1,966.7 per animal for sale; they sell 20.6 chickens at an average cost of $150.0 per animal; 5.3 turkeys with a value of $550.0 per animal. There is only one sheep producer in the Triunfo de Madero "ejido" with 10 animals that he sells live in the community. The sale of animals is only undertaken to cover immediate expenses or if the breeding process has reached its point of sale.

In the case of draft animals such as oxen, donkeys and horses, these are not assigned commercial value; these animals are discarded once their work cycle ends or due to old age and prices are calculated according to the discretion of the intermediary (Table 5).

Activities within the forest

The communities undertake activities in woodlands to complement their need for food, fuel, construction material and recreation. Forested areas are mainly "ejidal" (84.1%) followed by private (13.6%) and communal (2.3%). Regarding the type of activities they

Table 5. Income from sale of animals from the family farm.

Location	Income in pesos ($)					
	Pigs	Chickens	Cows	Oxen	Sheep	Turkeys
Francisco I. Madero	2,200	218.182	9,500	8,000	0	0
Triunfo de Madero	1,500	156.25	9,625	0	1,200	0
Venustiano Carranza	0	197.5	8,750	0	0	550
Total	3,700	571.932	27,875	8,000	1,200	550

Source: self elaborated based on field data.

carry out in the forest, 51.1% of the "ejidatarios" of Francisco I. Madero hunt, collect firewood and wood; 46.7% of the "ejidatarios" of Triunfo de Madero said they used the forest for extracting timber and posts; in Venustiano Carranza, 35% were involved in hunting and wood extraction.

The Cultural Importance Index (CII) shows the most significant species for "ejidatarios" in the communities, at the time of the interview. Thus the trees most appreciated by "ejidatarios" could be identified; however, evidently the species with a greatest value did not necessarily correspond to those most used for livestock activity (Lazos *et al*., 2016). When calculating the CII, the species that are unique for particular use earn a very high score, the total value of use (vutz) shoots up compared to the other two parameters (intensity of use and frequency of mention). As proposed by Lazos *et al*. (2016), species use was taken to calculate the cultural importance index.

Of the 11 timber species mentioned by the interviewees, apparently the most important tree for the "ejidatarios" is the oak with ten different uses and a CII value=0.28; as from this species they obtain firewood, wood for the construction of houses, furniture, poles; in some cases it is ornamental due to its foliage, it provides a habitat for wild animals and is important for livestock activity. This is followed by pine trees with five different uses and a CII value of =0.17. Here, it should be noted that the rural poor in developing countries depend on biomass for cooking (Mohamed and Smith, 2013).

These two species have been the most affected by change in land use in the last 19 years, according to the calculation of the Annual Modification Rate (AMR) that was carried out in this investigation. The ceiba is a tree that fulfills cultural needs for conservation, is ornamental and provides shade for livestock, with a high CII value=0.17; despite having few uses, it obtains many mentions. Guanacaste is a tree appreciated by ranchers as it provides fodder, shade, ornamentation and wood, with a CII value=0.16 (Table 6).

In the backyards, there are edible species and those used for timber as they are traditionally planted in the patios of houses and provide seasonal fruit, including mango, anona, soursop, tamarind and citrus fruits, esepcially orange and lime. Once the trees grow too large and the branches can easily be damaged, they are pruned and used for firewood or poles. Evidently, women are in charge of the garden, with support from the rest of the family for

Table 6. Main timber trees of cultural importance in rural communities.

Scientific name	Common name	No. of mentions	Use*s	Parts used	CII
Quercus sp.	Oak	45	A,C,D,E,H, K,L,M, N,O	Trunk, branches	0.286
Pinus sp.	Pine	34	A,C,D,E,N	Trunk, branches, roots	0.173
Acacia farnesiana L. Willd	Huizache	15	A,H,J	Trunk, branches	0.089
Uncaria tomentosa	Uña de gato	12	A,H,J	Trunk, branches	0.081
Gliricidia sepium (*Jacq.*) *Kunth ex Walp.*	Maricacao	25	F, I, j, L	Trunk, leaves, branches	0.133
Leucaena leucocephala (*Lam.*) *de Wit*	Guaje	31	A,C,H,J	Leaves, Trunk, branches	0.149
Ceiba aesculifolia (*Kunth*) *Britten & Baker f.*	Ceiba	47	K,L,O	All	0.174
Mimosa tenuiflora L. Willd	Tepezcohuite	18	A,G,H	Trunk, bark	0.097
Tabebuia rosea (*Bertol.*) *DC.*	Matilijuate	30	A,E,H,N	Trunk	0.146
Enterolobium cyclocarpum (*Jacq.*) *Griseb.*	Guanacaste	35	J,K, L,N	Trunk	0.166
Cedrela odorata	Red cedar	15	E,N	Trunk	0.111

*Uses: A-firewood; B-utensils; C-house construction; D–house rooves; E-furniture; F-food; G-medicine; H-posts or shelves; I-Live fence; J-cattle; K-ornamental; L-shade; M-wild life; N-wood; O-conservation; P-crafts; Q-ritual; R-wind break; S-others.
Source: self elaborated based on field data.

maintenance. In this sense, Stloukal *et al*. (2013) comment that men are more interested in exploiting trees for commercial purposes, whereas women opt for multipurpose tree species that provide subsistence. In the study area, 20 species with nutritional importance were found, mainly providing fresh fruit that complements the diet of rural families, as well as providing firewood (Table 7).

In the study area, 76.3% of "ejidatarios" use forest products, and are mainly involved in activities to extract firewood, timber, and hunting. Hunting is an important activity in the region, to supplement meat deficiencies in their diets, as they do not have easy access to chicken, beef and pork for food. In the "ejido" of Venustiano Carranza, all "ejidatarios" hunt and fish, in Francisco I. Madero 33.3% and in Triunfo de Madero 31.3%.

12 species of fauna of nutritional importance were found in the study area, only half the number of species found in the work by Toledo *et al*. (2008), where he documented 24 species of importance in the Mayan region of Yucatán. The main species hunted in the region are white-tailed deer, which is consumed in Venustiano Carranza by 25% of hunters; Francisco I. Madero (13%) and Triunfo de Madero (10%); this is due to the fact that because of the invasion of livestock and agriculture, the species has dispersed towards higher areas, where numbers have increased. Another species that is hunted is the iguana, which is only consumed in low-lying areas of the study; in Francisco I. Madero, 18% hunted black iguanas and 10% green iguanas, in Triunfo de Madero 15% black iguanas and 12% green iguanas. The tepescuincle is one of the most abundant animals in times

Table 7. Important species growing in the backyards of rural families in the communities studied.

Species	Common name	Use
Mangifera indica	Mango	Fresh fruit, firewood and posts
Annona reticulata	Anona	Consumption of fresh fruit
Citrus sinensis	Orange	Fresh fruit, leaves for making tea medicinal
Citrus aurantium	Lime	Fresh fruit, leaves for making tea
Spondias purpurea	Jocote or plum	Fresh fruit
Annona muricata	Soursop	Fresh fruit, firewood
Persea americana	Avocado	Consumption of fresh fruit and firewood
Tamarindus indica	Tamarind	Consumption of fresh fruit and firewood
Psidium guajava	Guayaba	Fruit, wood for pitchforks and posts
Citrus nobilis	Mandarin	Fresh fruit
Byrsonima crassifolia	Nance	Fresh fruit, wood for posts and firewood
Talisia olivaeformis	Guaya	Fresh fruit and firewood
Bixa orellana	Achiote	Seasoning for food
Aloe vera	Aloe vera	Medicinal
Musa paradisiaca	Small	Fresh fruit
Manilkara zapota	Banana zapote	Fresh fruit and firewood
Acrocomia aculeata (*Jacq.*) *Lodd. ex Mart.*	Coyol	Fruit, flowers
Dysphania ambrosioides (*L.*) *Mosyakin & Clemants*	Epazote	Seasoning for food
Sechium edule	Chayote	Fresh vegetable

Source: Self elaborated based on field data.

of maize harvest and is present in the three "ejidos". Birds such as chachalacas and doves are abundant in the study area, but they are only hunted when meat is urgently required. (Table 8).

Perception of weather conditions and forest cover

It is important to comprehend the opinion of forest users concerning the conditions and causes that affect the regeneration of the forest and its resources. Thus, "ejidatarios" were asked whether they perceived any change in the climate and to provide an approximate date. 100% of the interviewees considered that the climate in the region has changed; 23.8% observed that from the year 2000; 16.3% in 2008; 25% in the year 2010; 7.5% in the year 2013; 27.4% did not give a date, but believe that there have been changes in weather conditions. Of the interviewees who observed changes in the climate, 29.1% affirmed that there are now prolonged droughts; 25.3% changes in the rainfall regime; 19% feel that it is hotter; 11.4% noted temperature changes; 11.4% loss of water bodies; 3.8% the presence of pests and diseases (Table 9). Here the concept of food resilience becomes relevant; defined as the capacity of ecosystems to sustain food production and this also refers to the ability of people to produce, harvest and buy food in difficult times, as well as environmental, economic and social stress (Mohamed and Smith, 2013).

Table 8. Use of the main species related to hunting and fishing**.**

Scientific name	Common name	Percentage of *ejidatarios* who hunt		
		Francisco I. Madero	Triunfo de Madero	Venustiano Carranza
Dasypus novemcinctus Linnaeus	Armadillo	13	11	19
Ctenosaura pectinata	Black iguana	18	15	0
I. iguana	Green iguana	10	12	0
Tayassu pecari Link	Wild boar	0	0	12
Odocoileus virginianus Zimmerman	Deer	13	10	25
Cuniculus paca Linnaeus	Tepescuintle	12	21	15
Claravis pretiosa Ferrari-Perez	Dove	11	9	21
Sciurus aureogaster F. Cuvier	Squirrel	5	2	0
Procyon lotor Linnaeus	Raccoon	3	4	0
Ortalis vetula Wagler	Chachalaca	5	6	8
Dorosoma anale Meek, D. petenense Günthe	Sardine	5	5	0
Undetermined	Snail	5	5	0
	Total	100	100	100

Source: self elaborated based on field data.

42.5% of the producers considered that the increase in cattle is the main factor contributing to forest loss; 35% wood extraction; 11.3% agricultural expansion; 8.8% urban growth; 2.5% demographic factors (Table 10).

CONAFOR (2022) states that during the period 2001-2019, 73.8% of deforestation was due to the conversion of forest land to pasture; specifically redefining land use for extensive livestock; 22% for conversion to agricultural land and 4.2% was deforested to provide space for urban expansion, tourist developments and infrastructure, among other uses.

Opinions concerning reasons for forest loss over the last 5 years were considered; 66.3% observed that coverage had decreased; 23.8% believe that it has remained the same; 10%

Table 9. Climate systems as observed by the *ejidatarios*.

Locations	Observed phenomenon (%)					
	Changes in temperature	Higher temperatures and less rainfall	Change in rainfall patterns	Prolonged droughts	More plagues and diseases	Loss of water bodies
Francisco I. Madero	11.4	28.6	28.6	28.6	0.0	2.9
Triunfo de Madero	12.5	9.4	25.0	25.0	0.0	25.0
Venustiano Carranza	8.3	16.7	16.7	41.7	16.7	0.0
Total	11.4	19.0	25.3	29.1	3.8	11.4

Source: self elaborated based on field data.

Table 10. Factors that cause forest loss

Locations	Opinion of *ejidatarios*				
	Agricultural expansion	Cattle expansion	Demographic factors	Wood extraction	Urban growth
Francisco I. Madero	17.1	40.0	0.0	31.4	11.4
Triunfo de Madero	3.0	42.4	3.0	42.4	9.0
Venustiano Carranza	16.7	50.0	8.3	25.0	0.0
Total	11.3	42.5	2.5	35.0	8.8

Source: self elaborated based on field data.

think it increased. Regarding productivity in the last 5 years, 75% consider that it has decreased; 23.8% that it remains the same as 5 years ago; 1.3% consider that production has increased.

CONCLUSIONS

Results from a socioeconomic analysis, indicated that the homes of "ejidatarios" have minimum services in terms of light, water and drainage; for the construction of their homes they use resistant materials from the region, such as wood, gravel, earth and sand. It is considered that the quality of their homes has improved with materials such as block and cement floors. The size of the extended family exceeds the capacity of the homes, which is why they are considered to have overcrowding problems.

The diet is inadequate as they consume minimal amounts of the components of the basic food basket. In the "Ejido" of Venustiano Carranza there are food supply problems, because it is located in a highly marginalized area and resources take time to arrive; in Francisco I. Madero and Triunfo de Madero, the "ejidatarios" do not have food supply problems, but their economic income is not sufficient to fulfill their food needs.

A little over fifty percent of "ejidatarios" considered themselves poor with respect to their community and other communities. The income they earn weekly is spent mainly on food and health; they receive government financial support, but this is insufficient to cover their various needs.

Agricultural activity and livestock are the main sources of income in the region; trade for their products is at a local and regional level, so they do not receive high prices for the sale of their products; production costs are not considered, so the real values of benefits are unknown.

Regarding forest resources, it was found that the use value is associated with the agroecological needs of the species and their environment, rather than their commercial value. According to CII calculation, the most important timber species for the "ejidatarios" are those used for livestock activities, whether for fence posts, construction of infrastructure to protect animals, or soil and water conservation.

Species found in family backyards are those that are used to supplement the family diet, in the form of fruits and spices for consumption. To complement the consumption of

meat among families, "ejidatarios" pursue hunting activities in the forest, managing these species and generating knowledge concerning favorable times for this activity.

Finally, concerning climate change it is considered that the processes affecting quality of life in the region have worsened in recent years. 100% of "ejidatarios" consider that a change in climatic conditions is taking place, which directly affects the productivity of the forest.

REFERENCES

Álvarez P. 2006. Los recursos de uso común en México: un acercamiento conceptual. Gaceta Ecológica. Instituto Nacional de Ecología, México 79. 5-17.

Apodaca C, Juárez JP, Ramírez B, Díaz R, Rodríguez FJ, Vázquez V. 2020. La alimentación familiar de pequeños productores de café y variabilidad climática en Huehuetla, Puebla, México. Agricultura, Sociedad y Desarrollo, 17(2). 375–396. https://doi.org/10.22231/asyd.v17i2.1350.

Ávila D, Rosas O, Tarango L, Martínez J, Santoyo E. 2011. Conocimiento, uso y valor cultural de seis presas del jaguar (Panthera onca) y su relación con éste, en San Nicolás de los Montes, San Luis Potosí, México. Revista Mexicana de Biodiversidad 82(3). 1020-1028.

Arce IAN, Armijo CN. 2011. Uso y manejo de los recursos naturales. Capítulo 3. *In*: Pozo C, Armijo C N, Calmé S. Riqueza Biológica de Quintana Roo. Un análisis para su conservación. Tomo 1. CONABIO, ECOSUR, Gobierno del Estado de Quintana Roo. Quintana Roo, México. pp: 112-115.

Barrera A, Gómez A, Vázquez C. 1977. El Manejo de las Selvas por los Mayas: sus implicaciones Silvícolas y Agrícolas. Biótica 2(2). 47-61.

Brauscupé S. 1992. Indigenous perspective on international development, Akwe: Kon Journal. 60 p.

Carabias J. 2009. Manejo de recursos naturales y calidad de vida. *In*: Chediack, S.E., (comp), Monitoreo de biodiversidad y recursos naturales: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. México, D.F. pp: 29-37.

CEDERSA (Centro de Estudios para el Desarrollo Rural Sustentable y la Soberanía Alimentaria). 2014. El minifundismo: una realidad del siglo XXI. CEDERSA. 20 p.

CDI-PNUD. 2006. Regiones indígenas de México. ISBN 970-753-064-2. 147 p. consultado:10/08/2018. http://www.cdi.gob.mx/regiones/regiones_indigenas_cdi.pdf

CONAPO. 2015. Índice de marginación por entidad federativa y municipio 2015. Fecha de consulta 11/08/2018. https://www.gob.mx/conapo/documentos/indice-de-marginacion-por-entidad-federativa-y-municipio-2015.

CONAFOR (Comisión Nacional Forestal). 2022. Estado que guarda el Sector Forestal en México. Comisión Nacional Forestal, México. 459 p.

Consejo Nacional de Evaluación de la Política de Desarrollo social. S/A. La pobreza rural en México. CONEVAL, Pág. Web: https://www.coneval.org.mx/Medicion/MP/Documents/PATP/Pobreza_rural.pdf

Davis C, Gallardo H, Lachlan K. 2010. Talking straight about communication research methods. Kendall Hunt Publishing Co. Dubuque. 448 p.

FAO, IFAD, UNICEF, WFP and WHO. 2023. The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum. Rome, FAO. 283 p. https://doi.org/10.4060/cc3017en.

FAO. 2021. Evaluación de los recursos forestales mundiales 2020. Informe principal. Organización de las Naciones Unidas para la Alimentación y la Agricultura. 170 p. Roma. https://doi.org/10.4060/ca9825es

FAO. 2018. Panorama de la pobreza rural en América Latina y el Caribe 2018. Santiago de Chile, 112p.

Guevara ML, Téllez MB, Flores M. 2015. Aprovechamiento sustentable de los recursos naturales desde la visión de las comunidades indígenas: Sierra Norte del Estado de Puebla. Nova Scientia. Universidad De La Salle Bajío León, Guanajuato, México. 7(14). 511-537.

INAFED. 2010. Instituto Nacional para el Federalismo y el Desarrollo Municipal. Sistema Nacional de Información Municipal. Consulta 11/08/2018. http://www.snim.rami.gob.mx/

INEGI. 2010. Censo de Población y Vivienda 2010. Fecha de consulta 02/08/2018. http://www.beta.inegi.org.mx/proyectos/ccpv/2010/default.html?init=2

Lazos RA, Moreno CP, Guevara S, Gallardo C, Galante E. 2016. El uso de los árboles en Jamapa, tradiciones

en un territorio deforestado. Madera y Bosques 22(1). 17-36.
Lazos RA, Moreno CP, Galante E. 2013. Empresa Rural Verde: desarrollando criterios de sustentabilidad con la comunidad rural. Revista Forum de Sostenibilidad (6). 3-16.
López LN, Chan JG. 2016. Marco conceptual del manejo de recursos naturales. Revista Latinoamericana de Recursos Naturales 12(1). 27-35.
Martínez JA, Arellano RE. 2010. Uso comunitario de los recursos naturales en el Ejido Lagunillas, Jalisco, México. Ambiente y Desarrollo, Bogotá, Colombia. 16(26). 96-109.
Mohamed-Katerere JC, Smith M. 2013. La función de los ecosistemas en la seguridad alimentaria. Unasylva, 241(64). 14-22.
Padoch C, Sunderland T. 2013. La ordenación del paisaje, vía para el logro de una mayor seguridad alimentaria y mejores medios de subsistencia. Unasylva 241(64). 4-13.
Snipp M. 1989. Americans Indians: The first of this land. Rusell Sage Fundation. New York USA. pp: 107.
Stloukal L, Holding C, Kaaria S, Guarascio F, Gunewardena N. 2013. Los bosques, la seguridad alimentaria y el género.
Tapia LA. 2012. Recurso natural, sustentabilidad, conservación, preservación: conceptos-jurídico ambientales en las políticas públicas mexicanas. Derecho Ambiental y Ecología, 49. 71-78.
Toledo VM, Barrera-Bassols N, García E, Alarcón P. 2008. Uso múltiple y biodiversidad entre los mayas yucatecos (México). Interciencia 33(5). 345-352.
Toledo VM. 1990. El proceso de ganaderización y la destrucción ecológica de México. *In*: Medio ambiente y desarrollo en México. Leff E, coord. UNAM-CIIH-Porrúa. México, D.F. pp: 191-22.
Vesarez-Zúñiga VF. 2022. Pobreza rural y canasta básica alimentaria en la comunidad General Cárdenas, municipio de Cintalapa, Chiapas. Estudios Sociales. Revista de Alimentación Contemporánea y Desarrollo Regional, 32(59). 1-32. https://doi.org/10.24836/es.v32i59.1200