

SOCIO-CULTURAL AND ENVIRONMENTAL BENEFITS FROM FAMILIAR ORCHARDS, IN SEMIRURAL LOCALITIES AT CENTRAL HIGHLANDS OF MEXICO

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Abstract

The aim of the study was to analyze the sociocultural and environmental perception of agro ecosystems with familiar orchard (AEFO) owners, in semirural localities at ecological transition zone of the State of Mexico. Methodology includes four steps: Geographic characterization of localities and AEFO; 2) Analysis of social benefits that orchards provide; and 3) Analysis of the

influence that AEFO has over familiar life quality. The investigation was realized at twelve localities in three municipalities of the State of Mexico, mean by structured and semi structured interviews, accomplished with on field direct observation. Familiar orchards provide to families multiple social, environmental, ecologic, economic and cultural benefits; they contribute to have medicinal, condiments, ornamental, even ceremonial plants; for familiar consumption, sales or exchanges. These spaces are also managed for small scale domestic animals nourishment, to obtain fuel material, raw material for construction and fences for protection. Therefore, familiar orchards are considered important agro ecosystems at semirural localities, that function mean by complex relations between all their components. The sociocultural and environmental benefits provided by these multifunctional productive agro systems, may become an important strategy of social cohesion and alimentary security for rural families, and at same time, one way to preserve the regional natural resources.

Introduction

The family orchards have been developed over hundreds of years by peasant and indigenous communities. They retain a wide variety of crops (FAO, 2005). They have trees, shrubs, vegetables, tubers and edible roots, grasses and herbs that provide food and condiments, medicines and building materials. They are a combination of edible, medicinal and aromatic plants and fruits useful for family consumption (GTZ, 2008; Rivas and Rodriguez, 2013) achieved through adaptation to the place, climate and cultivation techniques. They are sources of production and income throughout the year, even without using sophisticated agricultural inputs (FAO, 2005; GTZ, 2008). The composition and the use of crops vary according to life circumstances and needs of families in rural areas (GTZ, 2008). It is a sustainable agroecosystem developed by generations in ecological, agronomic, cultural, social and physical aspects, which are considered one type of agroforestry systems (Rivas, 2014).

However, these agroecosystems present problems in the environmental and socio-cultural areas, among them the presence of pests in trees, the lack of pest control, only few new trees and poor maintenance trees cause low productivity. Also the loss of traditional knowledge for the management of family orchards, the low participation of family members in the care of family orchards and the distribution of the land as an inheritance to the grown children threatens the continuity of family orchards. In addition to this, there is a lack of recognition of the benefits that the Agroecosystems with Family Orchards (AEFO) gives to families. Also the way of urban life exerts pressure to make these spaces disappear. For these reasons, families can begin a process of abandonment and the consequent loss of family orchards agroecological tradition.

The importance of this study is notable for documenting the perception of families about the socio-cultural and environmental benefits from family orchards. The hypothesis of this paper is that families have a positive perception about the benefits these systems can provide. The objective was to analyze the sociocultural and environmental perception of families who have family orchards in three municipalities, at the ecological transition zone of the State of Mexico, through field observation and application of semi-structured interviews with 180 heads of households. This work is part of a wider investigation. The overall objective is the

agroecological analysis of AEFO at the municipalities of Malinalco, Tenancingo and Villa Guerrero, State of Mexico.

Current family orchards are the result of the interaction between people, soil, water, animals and plants (Gaytan *et al.*, 2001; Juan, 2013). They represent an ethnological heritage of the first order with a traditional knowledge passed down from generation to generation. Its role has been, for centuries, to supply food to the family, but it currently features a playful and occupation paper, although the important role in the conservation of many species and varieties of cultivated plants *in situ* should not be forgotten. (Rigat *et al.*, 2009).

These traditional agroecosystems offer countless examples of sustainable agricultural practices: 1) They are based on poly-culture planting ; 2) They maximize the safety of crops using low levels of technology; 3) They have a limited environmental impact and adaptation to local conditions ; 4) They contain varying cultures and adapt to wild crops; 5) They do not depend as much on external inputs such as pesticides, fertilizers or artificial irrigation; 6) They make extensive use of renewable and locally available resources; 7) They have active recycling nutrients; 8) They conserve a biological diversity; 9) They use production to meet local needs; 10) They are relatively independent of external economic factors and 11) They are built on traditional knowledge and culture. (Gliessman, 2002; Gliessman *et al.*, 2007).

The appropriation of nature is an expression of the implementation of the strategy of multiple uses that responds to a rationality that is both ecological and economic. It is based on a local ecological knowledge; it is tradition that passes from one generation to another (García-Frapolli *et al.*, 2008). For Massieu and Chapela (2007) traditional knowledge is closely related to cosmogony and livelihoods of communities because its purpose is to strengthen the values of management of plants, seeds, animals and forms of organization. Therefore, this knowledge is essential to sustain and preserve the important environmental role of subsistence farming, which promotes diversity and accumulated knowledge about plants and living organisms interacting as part of the ecosystem.

According to Toledo (2005) traditional knowledge is a product of a network of relationships and practices that have developed over thousands of years of peasant and indigenous communities. It consists of beliefs (*cosmos*); knowledge that people keep in their minds, the structure or the elements of nature, the relationships established between them and their useful application (*corpus*), as well as the set of productive practices, which combine their knowledge system on their environment and about their development in daily life (*praxis*).

According to the FAO, 842 million people are chronically hungry because they cannot afford adequate food. Worldwide, 70% of people live in rural areas of developing countries (FAO, 2015). Production systems needed to meet food needs in these areas. One option is family farming, whose priority is labor force, with limited access to land, capital resources and use of multiple strategies of survival and income generation access (AFAC, 2011). This concept includes groups of farmers and farm families engaged in producing food for self-consumption, providing food and many other products on food supply. They are a starting point, like a recognition of traditional knowledge and ancestral wisdom of farm families (FAO, 2015). They combine tradition, innovation and science to promote the environment, fair relationships and a good quality of life. They also empower communities to take control of their food production

needs, providing systems that can be handled by them, sustainably and locally adapted. These small productive units are the key to food security. (AFAC, 2011).

For Vallejo *et al.* (2013) the socio-cultural perception is a subjective understanding of social action, understood as human behavior from meanings and motives that are generated in the individual's consciousness by attributing subjective meanings to their actions, generating experience and knowledge, called "common sense", which guides individual actions socially accepted.

Social perceptions of the environment are cognitive systems that recognize the presence of opinions, beliefs, values and norms on the environment, which determine the attitude for the conservation of nature. They are the product of a perception and social value shaped by emotional, cognitive and willingness of the inhabitants' components into the environment (Bertoni *et al.*, 2010). For Fernandez (2008) they are the relationships that occur between humans and nature, related to the management of natural resources, considering the cultural, ecological and climatic processes and their meaningful role in every society.

The analysis of attitudes identifies cultural, symbolic and cognitive components that support the patterns of interaction society (Bertoni *et al.*, 2010), oriented with nature. Cunha *et al.* (2010) mention the relationship between the physical environment and the reflection on the relations of the media with the subjectivity of each person, where the answers or demonstrations are a result of these perceptions from local knowledge.

Methods and material

The stages of this work are three, a) Geographical characterization of localities and AEFO, b) Analysis of social benefits offered by family orchards c) Analysis of the influence of AEFO on the quality of family life. The geographical characterization began to limit the study area. It was based on the political-administrative division of the State of Mexico and three municipalities were chosen. Through field observations 12 localities with family orchards were identified. For precise location, latitude, longitude and altitude of the localities were determined. From the location of physical characteristics such as physiography, topography, climate, geology, soil and vegetation were reviewed. To determine the socioeconomic characteristics, data from the XII Census of Population and Housing (INEGI, 2010) was processed, which allowed calculating the total population, the population structure by gender, education level, the economically active population (EAP) the economically inactive population (EIP), the population with access to health care and housing facilities.

Through direct observation and field work 15 family orchards of each locality were chosen and a semi-structured interview that yielded the perception of families about the benefits and the influence of AEFO on the quality of family life was applied. The analysis of social benefits offered by family orchards included three groups: Ethical-aesthetic that includes variables recreation and landscape, living and family relationships, family organization for the management and maintenance of the family orchards, the man-nature relationship in relation to new generations and community relations for the exchange of scientific-educational food in which traditional knowledge is discussed, environmental education in agroecosystems and

allows research on natural processes in these environments. Sustainability and food security strategy favored all these aspects.

For the analysis of the influence of family orchards on the quality of family life, the semi-structured interview was used, considering indicators of the UN to highlight the social importance, which are: food, housing, clothing, health, education, occupation and recreation, from income obtained from the sale of products that the AEFO have.

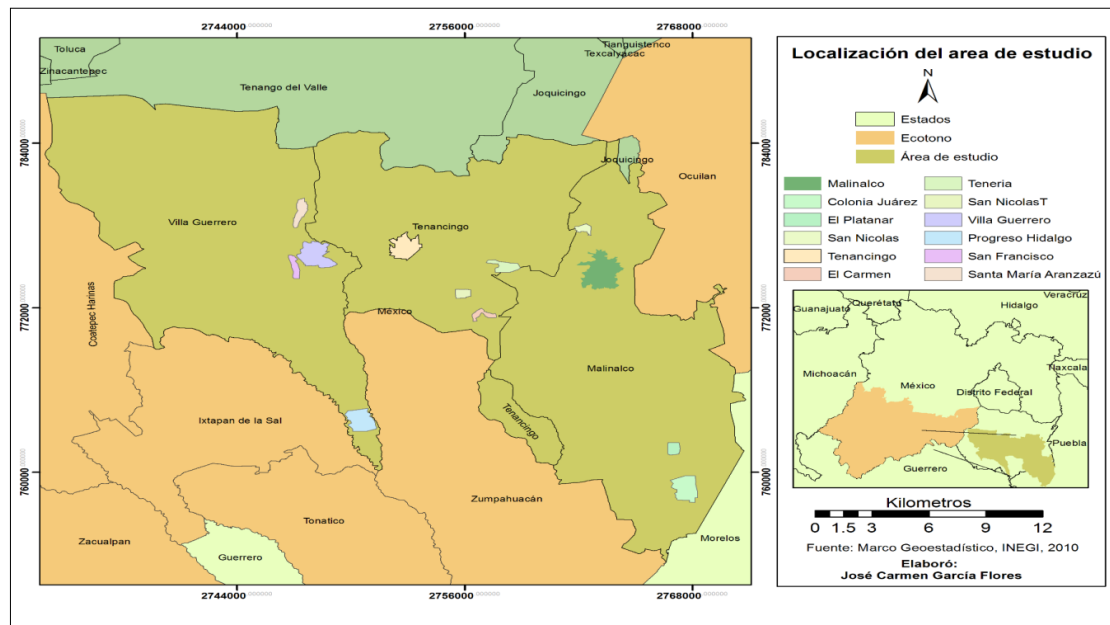
The study population were families with family orchards. The study area consisted of three rural villages and one urban locality by each municipality, 12 locations in total. The study was performed from January to March, 2015. The sample size was 180 householders from 20 to 85 years old. The surveys were conducted at the home of each of the respondents. The confidence level was 95% with a sampling error of 5%. The sampling method was "snowball", a technique allowed to form a network of informants through the application of a previously designed data collection questionnaire aimed primarily at households that have family orchards (Santana *et al.*, 2013) fifteen interviews were conducted in each locality.

The data collection was done by the family orchards on field work and two instruments were built, one was a questionnaire to analyze the agricultural ecosystem and the questions were closed. The other was a test to know the fate of agroecosystem products. Both were answered at the same time. Piloting instruments were made, allowing corrections, which were also checked with the relevant local civil authorities to carry out the study in each community.

The application time of the interviews was approximately 30 minutes in order to meet the socioeconomic conditions of the family, land characteristics, management practices and maintenance of family orchards, perception of social benefits by having the family orchards, as well as the economic benefits of family orchards, barnyard animal and vegetable area. For the analysis of the results, a Statistical Program for Social Sciences SPSS (version 22.0) was used. The study area is located in the Ecological Transition Zone (Ecotone) of the State of Mexico, Mexico, which comprises 24 municipalities in the state. Latitudinal and altitudinal derived gradients, representing a region of geographical, ecological and socio-economic importance, being a transition zone between the Nearctic and Neotropical biogeographic empires, shows plants and animals representative of both empires. In the tradition of the family orchards, there is an environmental, social and agroecological impact due to the association of herbs, and to the traditional ancestral knowledge put into practice, allowing rural families have a wide variety of trees and animals within the AEFO.

The localities analyzed belong to the municipalities of Malinalco, Tenancingo, Villa Guerrero and State of Mexico. They are located in the parallel 18° 48' 58" and 19° 57' 07" north latitude and 99° 38' 37" and 98° 35' 45" west longitude, with an approximate land area of 614.19 km² (Figure 1). The area has differences in altitude; the lowest points are presented in Malinalco with 1,580 meters, and the highest in Villa Guerrero with 3,760 meters (INEGI, 2009). The latitudinal and altitudinal location of the study area are important because they favor the presence of different climates, soil types and vegetation observed in these municipalities, conditions that favor the practice and tradition of the family orchards.

Figure 1. Localities studied on municipalities and state context.



Source. Prepared based on INEGI, 2010

The type of climate, soil and rock types prevalent in this region benefit people to develop agricultural activities achieving sociocultural adaptation and experimentation in family orchards with a vast agrobiodiversity of herbaceous plants, shrubs and trees. From 12 localities included in the study area, three of them are municipal capitals and nine are rural communities.

Results

Characteristics of the agroecosystems with family orchards

Table 1 shows the components of AEFO, the most common components of agroecosystems are housing, patio or deck and water sink, the fence and the yard, but the area of compost and vegetable observed are in less than one quarter of the AEFO.

Table 1. Components of agroecosystems with family orchards

Components	Number of orchards with different components
Home	179
Patio or broker	136
Water sink	134
Siege	96
Poultry breeding animals	75
Vegetable area	21
Composting area	18

Source: Prepared based on fieldwork, 2015

Based on field observations and interview information it is obvious that people do not devote space and time to make compost and have vegetable, perhaps because they have no knowledge or habit for recycling organic waste as composted. The most common practice observed was pulling the leaves, branches, fruit peels and kitchen waste directly into the base of the trees.

Only 21 people interviewed have the knowledge and habit of producing vegetables. As the surface of the family orchards, almost 40% of the family have a lower family orchard of 560m², whereas 40% between 561 and 1060m² surface, including various components of AEFO. Family orchards are generally between 500 and 1000 m².

According to ubieties of the family orchards, 52% are located in front of the house, 19% in the back, 16% and 13% left to the right. The distance between these components, in 81% of cases, is 2 to 7 meters. Both location and distance make easy monitoring and keeping. About the state in which there are family orchards was observed that 70% were maintained, and it is considered that 15% of the total AEFO is being lost.

Table 2 presents the various species of animals that are part of the agroecosystem. In most family orchards coexist chickens, pigs and to a lesser extent, horses, rabbits and sheep; species that provide various products and services, with limited space requirements, they can coexist in the family orchards. Regarding animals manure, half of the respondents said they left them outside, where the animals perform their droppings; almost a quarter of them place them directly into the trees and another quarter relocates them to their agricultural fields. This gives evidence generally unaware of the technique to transform it and use it to produce compost, but they use it directly as organic component of soil.

Table 2. Animals present in the agroecosystem^a

Animals	Number of orchards where they were present
Chickens	73
Hens	64
Pigs	30
Horses	19
Rabbits	18
Sheep	11
Turkeys	6
Cows	6
Ducks	5
Goats	2

^a In the same orchard can be present several animal species

Source: Prepared based on fieldwork, 2015

The AEHF featuring hedgerows are made with plants that are mostly fruit trees interspersed with other shrubs, wire or fence, as a way to take advantage of the space to have plants and

food. Just under a quarter of fences present plants with thorns, perhaps a little-used practice as a safety measure for children and animals, due to the proximity to housing.

Mothers are responsible for the family orchards because they stay longer in the house, so they spend part of their time taking care of the plants. Regarding the time devoted to this task, 79% of respondents spend between 2 and 8 hours a week, in which they perform maintenance activities. Only 1% employ more than 24 hours a week, which is understood as these agroecosystems do not require as much care as a purely ornamental and decorative garden.

On the other hand, in 108 family orchards men make pruning trees, as well as the work of making compost in 32 cases; weeding is a task that requires tearing or cutting herbs, done in 100 agroecosystems; for pest control, with either a chemical or natural preparations in 32 cases. 31 family orchards have trees and men paint the base of the plant, with a mixture made with prickly pear, lime and water to prevent insects and pests. This can be because the father has the knowledge to carry them out and it involves physical exertion (Table 3).

Table 3. Most commonly performed activities by father

In charge	Pruning	Natural fertilizers	Weeding	Pest control	Liming of trees
Father	108	32	100	32	31
Mother	23	13	26	10	4
Son	18	13	31	6	12
Daughter	1	0	5	0	1
Grandfather	4	1	0	0	1
Grandson	2	0	1	1	2
Total	156	59	163	49	51

Source: Prepared based on fieldwork, 2015

The activities attributed to the responsibility of the mother include planting trees, done in 32 cases; cleaning family orchards involves sweeping the dry leaves of trees in 132 family orchards; watering them is another activity registered in 104 occasions. In 87 cases women make harvest of family orchard, this is because the mother is responsible for feeding, therefore she chooses new trees to plant and decide which fruits can be used to supplement the family diet (Table 4).

Table 4. Most frequently activities performed by mother

In charge	Tree planting	Cleaning the home garden	Irrigation	Crop products
Mother	32	132	104	87
Father	24	34	42	52
Son	8	8	18	10
Daughter	3	8	8	6
Grandfather	2	0	0	1

Grandmother	1	4	4	0
Grandson	1	0	0	0
Total	71	186	176	156

Source: Prepared based on fieldwork, 2015

Weeding is done in 169 family orchards, manually, i.e. with machete, a hoe or tearing the grass by hand; 11 times equipment was used through a brush cutter; and in 4 cases they used herbicide. Hand weeding may be because it is a highly selective activity, because the complex association of particular species of these agroecosystems. To irrigate family orchards, people use different sources of water. At 134 family orchards they use water from municipal drinking water systems, and in 15 cases the water of domestic activities was reused, which can be attributed to water distribution for the various activities related to housing. The use of techniques for the most common irrigation was buckets, presented in 105 agroecosystems, perhaps because it is the mother who carries out this activity, consequently women both manages and provide water inside the house.

The frequency with which the owners of the studied family orchards produce compost is carried out in 41% of agroecosystems; the most frequent practice they do is letting decompose organic waste at the base of trees. The materials used are the leaves of trees, household waste, manure, grass and ashes. The compost is then reintegrated into the family orchards 52 times, while in 18 cases they lead it to the agricultural parcel. It is clear that in many family orchards composting was not carried out, probably because the owners are unaware of the benefits of composting techniques and do not invest time for processing. A strategy that families use to make organic waste products from the kitchen was found in 62 cases as a cheap strategy to maintain the animals. 54 respondents answered that wastes are deposited in the garbage truck.

Sociocultural and environmental benefits derived from family orchards

One of the questions that were asked to householders was why the family has orchards, in order to meet and emphasize the importance AEFO represents to them. Table 5 shows why people have and take care of their family orchards. The main reason is to meet the needs for food, this due to the number and variety of trees that there are in the family orchards by providing foods that complement their family's diet, because families make use of the products of these agroecosystems.

Table 5. Causes for having a family orchard

Reasons to have the garden	Replies
Cover food needs	105
Shadow	67
Nice weather	46
Source of income	8

Source: Prepared based on fieldwork, 2015

Food products that families consume from the AEFO were perceived in 177 times. The family orchards give them fruit, but also medicinal plants for health care, for condiments or for food preparation. Less often they take advantage of leaves, egg, milk, vegetables and stems, this show that it is a system from which a variety of food and medicinal products are obtained. The main use of the AEFO for the family is to provide food. However, space is used for other purposes such as carrying out recreational activities that are explained in Table 6. Both recreation and ornament highlight the importance of these systems for families to have recreation.

Table 6. Other uses for AEFO

Uses	Replies
Recreation	86
Ornament	78
Family reunion	42
Leisure time	12
Events	11

Source: Prepared based on fieldwork, 2015

Table 7 shows some of the social and cultural benefits and environmental services that people perceive to have from the family orchards, and the most frequently mentioned are the contribution of shade and as animal shelter, followed by maintaining moisture and food for animals. But people interviewed identified various uses that they apply in other activities, as functions related to different traditional ecological techniques that they have preserved and varied environmental services that promote productivity and quality of life.

Table 7. Sociocultural benefits and environmental services that owners and communities receive from family orchards

Goods and services	Number of people who consider the benefit
Shadow contribution	130
Animal shelter	124
Maintains humidity	88
Animal feed	71
Branches tutor	62
Provides sheets	60
Branches to close	38
Repel pests	30
Avoid grass grow	20
Prevents soil erosion	12

Source: Prepared based on fieldwork, 2015

Management that families make of the AEFO provides them with various socio-cultural benefits, such as: the provision of shade (130 people) with two main functions: creating a comfortable microclimate to the home and as a way to keep moisture in the agroecosystem, which is managed by intercalating trees, shrubs and herbaceous plants to maintain soil cover and to prevent fast evapotranspiration. As animal shelter (124 people), not only for wildlife, also for raising chickens, which at night are safeguarded and protected in the branches of trees to avoid being attacked by predators. The use of branches as support refers to the fact that family's plant, at the base of a tree, species of climbing vegetables such as squash (*Sechium edule Sw*) or pumpkin (*Cucurbita pepo L*), so that trees serve as a support for growth and production.

In these agroecosystems, the leaves of the trees are harvested for three uses, the first is to let them stay in the place where they fall, as ground cover to keep moisture; the second use is to feed small animals like rabbits and third use is composting. The branches in some family orchards are used to delimit the property limits. In a few family orchards owners perceive they have plants that can be useful to repel pests, such as the case of rue (*Ruta graveolens L*). Among other benefits they understand that from the accumulation of leaves and the presence of trees and shrubs the growth of grass and erosion can be prevented.

The perception of the holders of AEFO about the benefits they receive from their family orchards allowed 121 respondents state that they obtain products used for household consumption. 70 owners said they contribute to their health through consumption of healthy products, which are not produced with agrochemicals. Also they perceived the generation of clean air and medicinal plants, which helps them to attend sickness conditions and the presence of plants favors their family wellness. They highlight the economic benefits of the sale and exchange of products that complement the family diet in 15 cases. The reason why they are preserved because families are interested in keeping them because of the benefits.

Regarding environmental benefits, most villagers believe that the family orchards provide them with a pleasant climate and that by staying in the shade of trees can shelter from the heat and maintain a more uniform temperature throughout the day and humidity that favors a comfortable home environment. They also receive ethical-aesthetic benefits offered by the presence of birds and other wildlife animals that come to eat the fruits or sleep during the nights. This is part of recreational activity and for teaching their children to take care of nature. In 127 cases, the main reason why people are responsible for maintaining the family orchards is because they simply like it; 47 of them mentioned as motivation to get the food. Just over a quarter of respondents consider taking care of family orchards as a recreational activity.

Traditional knowledge that maintains and reproduces the families in the AEFO has led them to create a cultural tradition of management, which has been acquired through empirical practice of these activities. Continuous and systematic observation of the agroecosystem functioning is a natural process. Regarding the knowledge they possess to maintain the family orchards, 64% of respondents received it from their father, because it is a traditional practice passed from generation to generation, through father to son. The transmission of knowledge about maintenance is shared by 53% of holders. In 72 cases it is to children, in 12 times to grandchildren and in 9 times to neighbors. As expected 90% have not received technical assistance for the maintenance of agroecosystems, being a traditional knowledge in these

municipalities. However, 50% of families are interested in receiving training to improve the state of the family orchards.

Identifying social benefits have to do with family interactions and relationships with others outside the home. The family orchards allows to the owners to relate with other people; more than two thirds of the respondents believe that these agroecosystems foster coexistence with neighbors and family members themselves, it reiterates the importance of family orchards in family and social cohesion. The ways in which the family orchards allow people to relate, mostly is linked to the exchange of products, because it is a way in which families can supplement the family diet with other foods that do not produce in their own family orchards.

Conclusions

Through the management of family orchards, culture develops because are present customs; traditions and beliefs like the use of objects for protection of plants and the use of plants to attend diseases of respiratory, digestive and cultural affiliation diseases. At these agroecosystems people has been integrated adaptation and conservation of trees, shrubs and herbaceous species.

The AEFO redound in economic benefits for families as surplus products of orchards are sold or exchanged, contributing to family income in season when jobs are scarce, although the main destination for AEFO products is consumption. They are an alternative income generation for families derived from sale of surplus products and favor family household savings brought about by self-consumption.

Being a traditional practice were persons participate and are imitated ecosystems' natural processes it is possible to maintain biodiversity along the time, and ensure its preservation. This allows family integration mean by work distribution for AEFO management; and even to relate with other families through the products exchange such like fruit, seeds, leaves and plants.

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