Biodiversity in family backyard systems of the municipality of Calpan, Puebla

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ABSTRACT

Objective: To determine the social usefulness of the backyard system biodiversity for rural families in the municipality of Calpan, Puebla.

Design/Methodology/Approach: One-hundred questionnaires were applied to informants of the selected families. The selection was based on a non-probability snowball sampling, using saturation to generate the maximum amount of data. The SPSS software was used to analyze data.

Results: Backyard systems have a great biodiversity, including vegetables, fruits, ornamental plants, medicinal plants, and animal species. Women carry out most of the work (65%), using biodiversity as a strategy to produce food, generate income and jobs, and preserve medicinal and other plants used for spiritual development.

Study Limitations/Implications: The lack of family backyard records hindered the accurate calculation of the sample size.

Findings/Conclusions: The collection and preservation of local biodiversity is the basis of backyard systems where vegetables, medicinal and ornamental plants, and animal species are produced as part of a family strategy.

Keywords: family agriculture, contributions, benefits.

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INTRODUCTION

The following proposals should be taken into account to achieve food security, nutrition improvement, and sustainable agriculture promotion: doubling agricultural production and productivity of small producers (Argueta and Toledo, 2023); maintaining the genetic diversity of seeds, crops, and farm animals; promoting the use of genetic resources and lore; and driving the operation of basic food product markets (Naciones Unidas and CEPAL, 2018). These characteristics are inherent in family agriculture, which has been managed by small producers and their families for centuries (Pérez, 2013). Consequently, the objective of this study was to determine the social usefulness of backyard systems biodiversity for rural families in Calpan, Puebla, Mexico.

MATERIALS AND METHODS

The research was conducted in the municipality of Calpan, located in central-western Puebla, at 19° 06' 36" and 19° 41' 12" N and 98° 23' 54" and 98° 32' 24" W. Calpan has an area of 66.9 km^2. Its territory is divided as follows: 71% is comprised of agricultural lands, 16% is a forest, and 13% is an urban area (INEGI, 2020). The climate is temperate subhumid with summer rains (85.11%) and semi-cold subhumid with summer rains (14.89%), with a 12-18 °C mean annual temperature (INEGI, 2020). The area has a wide biodiversity as a result of its varied soils: arenosol (38%), phaeozem (26%), leptosol (13%), cambisol (8%), andosol (8%), and luvisol (7%) (INEGI, 2020).

Research methods and techniques

A non-probability snowball sampling was used to identify informants and to generate data. This method was used given the lack of a census or register of families with backyard systems; only the total number of the local inhabited households (3,197) was available (INEGI, 2020). One hundred questionnaires were conducted in the following auxiliary boards: San Lucas Atzala (20), San Mateo Ozolco (10), San José Pueblo Nuevo (10), and San Andrés (60). The municipal seat of San Andrés was chosen because the highest number of backyard systems are located in its skirts. Male and female heads of families were interviewed. The interviews were arranged based on the following categories and number of questions: family characteristics (8), backyard system history (11), backyard system elements (22), benefits (10), environmental technology (7), global warming (10), and potential improvements (8). The results were registered and analyzed with the Statistical Package for the Social Sciences (SPPS) v. 22 software and Excel.

RESULTS AND DISCUSSION

Social characteristics of the families

The results of the interviews indicate that 65% of women and 35% of men work in backyard systems. The role of women was highlighted by the interviewees, because they spend more time in their homes than men and are usually in charge of backyard systems. In addition, women are fond of medicinal and ornamental plants inherited from their mothers, mothers-in-law, and grandmothers. The main activities of the interviewees included: housewives (58%), farmers (25%), laborers (7%), professionals (3%), taxi drivers (2%), shopkeepers (2%), students (2%), and pensioners (1%). Zamudio *et al.* (2004) pointed out that, besides housework, rural women manage and commercialize backyard products. They solve unexpected situations when their husbands are not around. These authors also mentioned that women work all year round, both in the house and in the backyard. The individuals in charge of the backyard systems were in average 52 years old (maximum: 95 years; minimum: 16 years). However, the age range of most of the interviewees was 40-70 years old. Youngsters are not interested anymore in backyard systems. All over the world, youngsters abandon family farms and migrate to urban areas (FAO, 2014).

Family use of backyard biodiversity

The interviewees had different opinions about the nature of backyard systems. However, they agreed that it is a place behind the house, used to grow plants and raise animals. Backyard systems are part of their identities: they love, respect, are grateful to, identify with, and value their backyards. Montañez-Escalante *et al.* (2012) mentioned that backyard systems have other names, such as plot, farmyard, orchard, parcel, and home. Backyard systems have an average of 225 m^2 (3.0-2,500 m^2 range). González (2013) recorded average areas of 601 m^2 (120-1,200 m^2 range). The oldest backyard system in the region is 85 years old, while the newest is one year old. Backyard systems have been preserved from generation to generation and only the newest are located in recently built houses. In Calpan, backyards preserve local agrobiodiversity and provide families with >50% of their daily food consumption. In addition, biodiversity creates, maintains, and develops culture, preserving the beauty of the landscapes and the environment (Van der Ploeg, 2014). In Central America, family agriculture is the main source of basic food for families. In addition, family agriculture is key to guarantee food security and to fight the degradation of ecosystems and landscapes resulting from climate change. Furthermore, it preserves natural resources and biodiversity (FAO, 2014).

Plant and animal diversity and medicinal plants

One-hundred-two plant species and nineteen animal species were recorded in this study. Table 1 shows the most important medicinal plants of the backyard systems in the study area, including: chamomile (90%), spearmint (85%), oregano (78%), epazote (66%), common rue (65%), arnica (60%), bougainvillea (55%), and prickly pear (52%). The most commonly grown plants are those used for mild diseases, such as stomach ache and headache. Poor people usually take home remedies before going to a doctor. The results of the interviews showed that 90% of the families grow medicinal plants: 97% grow plants for self-consumption and 3% sell the products of their backyards. Medicinal plants and vegetables are available all year round. Fifty-five percent of the people used them to prepare tea, 16% use them as spices, and 24% used them for both purposes. Common rue is used for limpias (purification rituals) (5%).

Fruit trees

Table 1 shows 14 types of fruit trees found in the area, including: peach, pear, walnut, avocado, *tejocote*, lemon, pomegranate, and fig. The area has optimal conditions (temperate weather) to plant this type of fruit trees. Tropical fruits were also found in the region, but they are grown to a lesser degree. These fruits include grape, mulberry, tangerine, banana, white sapote, and Barbados nut. Eighty-seven percent of the families use fruit trees for self-consumption, both as food and for medicinal purposes. Thirteen percent of the families sell their fruits in the main local markets: Huejotzingo, Cholula, and Calpan.

June, July, and August are the main harvesting months of peach, pear, nuts, pomegranate, capulín, fig, plum, guava, apple, quince, white sapote, and avocado. Meanwhile, tejocote, soursop, grape, mulberry, Barbados nut, tangerine, banana, and orange are harvested in October, November, and December.

Table 1. Uses of medicinal plants and fruit trees in the backyard systems of Calpan, Puebla, Mexico.

Common name Medicinal plants	Scientific name	Uses		Presence (%)
		Alimentary	Medicinal	
Chamomile	*Matricaria chamomilla*	x	x	90
Spearmint	*Mentha sativa*	x	x	85
Oregano	*Origanum vulgare*	x	x	78
Wormseed	*Chenopodium ambrosioides*	x	x	66
Rue	*Ruta graveolens*		x	65
Arnica	*Arnica montana* L.		x	60
Bougainvillea	*Bougainvillea glabra*		x	55
Prickly pear cactus	*Opuntia ficus*	x	x	52
Aloe	*Aloe vera*		x	45
Wormwood	*Artemisa absinthium*		x	40
Fruit				
Peach	*Prunus persica*	x		50
Pear	*Pyrus communis*	x		48
Walnut	*Juglans regia*	x		46
Avocado	*Persea americana*	x		45
Mexican hawthorn	*Crategus pubescens*	x	x	45
Lemon	*Citrus Lemon*	x	x	41
Pomegranate	*Punica granatum*	x		40
Fig	*Ficus carica*	x		40
Sweet lime	*Citrus aurantifolia*	x		32
Capulin cherry	*Prunus salicifolia*	x		30
Guava	*Psidium guajava*	x		30
Plum	*Prunus domestica*	x		25
Apricot	*Prunus armeniaca*	x		20
Apple	*Malus domestica*	x		20

Vegetables

A total of 6 vegetables are grown in the area. The most cultivated species include: chayote (*Sechium edule*; 46%), bean (*Phaseolus vulgaris*; 34%), zucchini (*Cucurbita* pepo; 30%), black seed squash (*Cucurbita ficifolia*; 28%), smooth pigweed (*Amaranthus hybridus*; 26%), and tomato (*Solanum lycopersicum*; 23%). Bean and broad bean are pulses included in the vegetable category. In addition, a lower percentage of other species were found in the area, including: strawberry (*Fragaria×ananassa*), cabbage (*Brassica oleracea* L.), carrot (*Daucus carota*), Swiss chard (*Beta vulgaris* L.), rocoto chili (*Capsicum pubescens*), poblano pepper (*Capsicum annuum* L.), and coriander (*Coriandrum sativum*). The seeds of these crops are not easily found in the local communities and, therefore, producers must buy them elsewhere. Ninety-two percent of the families use their produce for self-consumption, while the rest sells it in nearby markets. However, the main use of the backyard production is for self-consumption.

Ornamental plants

Table 2 shows the wide variety of the most frequently grown ornamental plants in the region, including: roses (*Rosa gallica*; 45%), calla lilies (*Zantedeschia aethiopica*; 26%), geraniums (*Pelargonium graveolens*; 25%), bougainvilleas (*Bougainvillea* spp.; 23%), lady's eardrops (*Fuchsia* spp.; 16%), and daisies (*Bellis perennis*; 6%). Ninety-eight percent of these colorful and aromatic plants are used for self-consumption. Flowers are also used to embellish gardens. Only 2% of the total ornamental flowers produced in the region are sold and their prices range from MXN$5.00 to MXN$10.00 per bunch. Ornamental flowers are sold among the neighbors all year round. These flowers are mainly used as decoration

Table 2. Ornamental plants found in the backyard systems of Calpan.

Common name	Scientific Name	Uses
Rose	*Gallic rose*	Adornment
Earring	*Fuchsia* sp.	Adornment
Geranium	*Pelargonium graveolens*	Adornment
Alcatraz	*Zantedeschia aethiopica*	Church
Bougainvillea	*Bougainvillea* spp.	Ornament, medicinal
Lily	*Iris germanica*	Adornment
Giant	*Tithonia tubiformis*	Adornment
Poinsettia	*Euphorbia pulcherrima*	Christmas
Gladiolus	*Gladiolus* spp.	Church, deceased
Common yarrow	*Achillea millefolium*	Adornment
Daisy	*Bellis perennis*	Adornment
Snapdragon	*Antirrhinum majus*	Ornament, sale
Heliconia	*Heliconia* spp.	Adornment
Elephant ear	*Xanthosoma robustum*	Adornment
Fern	*Pteridium aquilinum*	Ornament, floral arrangements
Violet	*Viola* spp.	Adornment
Tulip	*Tulipa* spp.	Adornment
Impatiens	*Impatiens walleriana*	Adornment
Asparagus	*Asparagus officinalis*	Adornment
Quaking grass	*Briza* spp.	Adornment
Hydrangea	*Hydrangea*	Adornment
Poinsettia	*Euphorbia pulcherrima*	Christmas
Carnation	*Dianthus caryophyllus*	Adornment
Common privet	*Ligustrum vulgare*	Adornment
Mourning bride	*Scabiosa atropurpurea*	Adornment
Angel Wing	*Begonia gracilis*	Adornment
Night blooming cestrum	*Cestrum nocturnum*	Adornment
Angel's trompet	*Brugmasia arborea*	Adornment
Lady's slipper orchid	*Cypripedium irapeanm*	Adornment
Lydia genista	*Genista lydia*	Adornment

Source: Table developed based on surveys conducted in 2014 and [17] Arredondo, Ávila, and Muñoz (2012). *Fact sheet of 52 ornamental plants*. INIFAP; [18] Marchesi, E. 1969. Ornamental plants.

(59%), but they are also used to embellish church altars (41%). In addition, some of these plants have medicinal uses. López *et al.* (2013) studied backyard systems in the San Nicolás de los Ranchos community in Puebla and found 12 ornamental plant species. These results closely match the findings of this study.

Animals

The most important animals in the backyard systems of the region were: chickens (*Gallus gallus domesticus*; 90%), pigs (*Sus scrofa domesticus*; 70%), sheep (*Ovis aries*; 45%), and cows (*Bos taurus*; 40%). The less frequent animals in the area included: tilapia (*Oreochromis niloticus*), doves (*Columba livia*), and bees (superfamily Anthophila). Chicken and eggs are the main source of food of the families. This species can be handled by children and elders and requires little infrastructure and management. These findings match the reports of Gutiérrez (2008), who pointed out that backyard livestock is a system characterized by raising a group of animals such as birds, cattle, pigs, goats, sheep, and horses. Out of the total of animals found in the region, 47% is sold and 53% is used for self-consumption. The most sold and consumed species is poultry. Debnath *et al.* (2011) mentioned that backyard chicken production is a subsistence strategy. In addition, Ahuja and Sen (2007) pointed out that poultry production improves food security and the nutrition of the poorest households. These findings match the results of this study. Rabbit is not widely produced, because the inhabitants of this area do not usually consume its meat.

Multiple correspondence analysis (MCA)

Multiple correspondence analysis (MCA) is a statistical technique used to analyze the relationship between several qualitative variables. This technique can be used to establish the interaction of variables with a complex interrelation. Codification can show qualitative variables as numerical variables. The analysis of the main components and correspondence is used to identify patterns and relationships between the variables. They are reduced to two dimensions to facilitate their visualization, through factor scores. The resulting observations and categories identify patterns or data clustering.

In this case, the aim was to determine the relationship between the characteristics of the family: age, gender, education, work, plant, vegetable, and fruit cultivation, and animal raising. Figure 1 shows that the activities of the production unit depended on gender. The local women that carry out these activities mainly attended elementary school, are in average between 40 and 51 years old, and are housewives that grow vegetables and raise animals. Meanwhile, local men are between 52 and 63 years old and they work as laborers and farmers. In addition, they spend less time growing vegetables and raising animals in their backyards than women. This phenomenon can be the result of their higher education level and jobs with better wages. Likewise, they go to other places to carry out their activities.

Backyard system benefits

The first benefit of backyard systems is food —chicken, pig, cow, and sheep meat and milk, eggs, and cheese. The second benefit are fruit trees and their by-products, such as

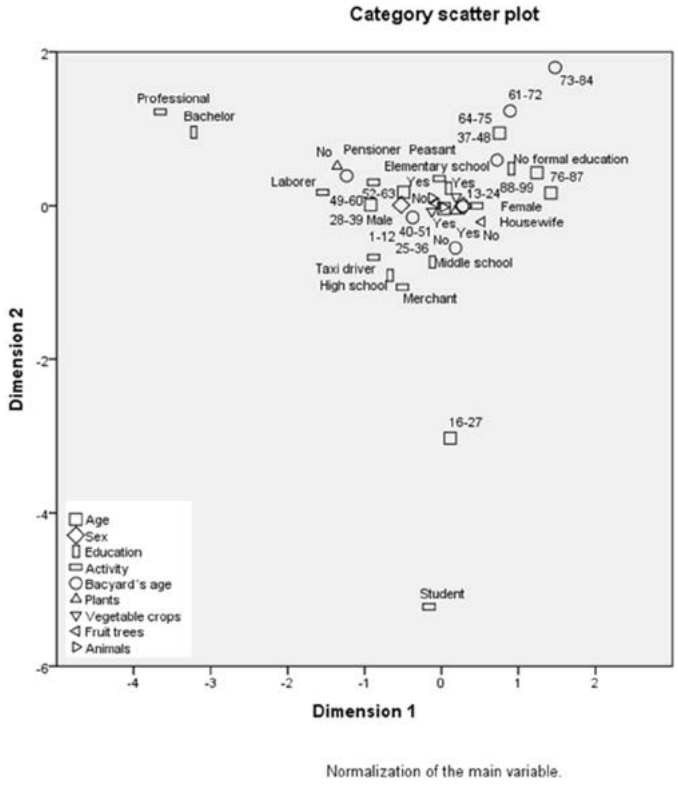

Figure 1. Multiple correspondence analysis of the characteristics of families and the biodiversity of their backyard systems.

marmalade, sweets, preserves, quince jelly, and liquors. The third benefit are the vegetables and medicinal and ornamental plants. Ornamental plants are mainly used to embellish churches, houses, and cemeteries. Most of the interviewees use backyard products for self-consumption and only a few sell them. Consequently, families save a significant amount of money, because they do not buy these products in markets. In this regard, López *et al.* (2013) pointed out that backyard systems are a survival strategy of farmers, because they complement family consumption and income in rough times. Backyard systems allow elders to help the family. Olvera *et al.* (2017) mentioned that backyard production helps to strengthen social relationships, as a result of barter (exchange of goods) that takes place in several communities of Calpan. The authors also mention that, as a sign of social commitment, some products are given away.

CONCLUSIONS

Backyard systems are important for the dynamics of family agriculture. They are mainly managed by women. Backyard products complement the diet and income of the families. Backyard systems provide food, medicinal products, and ornamental plants and promote the preservation of biodiversity. Consequently, they should be maintained and rescued. In addition, further research should be carried out to deepen the understanding of their operations.

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REFERENCES

Ahuja, V.; Sen, A. 2007. Scope and Space for Small Scale Poultry Production in Developing Countries. Paper presented at the International Conference "Poultry in the 21st Century: Avian Influenza and Beyond", Bangkok, November 5-7, 2007. W.P. No. 2007-12-02. 27pp.

Argueta, Q; Toledo, V. M. 2023.La Modernization Agroindustrial and the Emergence of Agroecology in Mexico (1920-1960). *HALAC.13*(3).76-106. http://dx.doi.org/10.32991/2237-2717.2023v13i3.p76-106

Debnath, M. K.; Majumder, D.; Das, P. K. 2011. Status of backyard and small scale poultry production to sustainable livelihood-a case study. *J. Crol Weed. 7*(2).113-15.

FAO, 2014. Towards a stronger family farming. Voices in the International Year of Family Farming, Rome, p. 31. content (fao.org)

González, F. 2013. Social, economic and ecological importance of backyard production, in the community of San Salvador Xiutetelco, Puebla. Master's thesis. Colegio de Postgraduados campus Puebla.

Gutiérrez, E. 2008. From theories of development to sustainable development. History of the construction of a multidisciplinary approach. *Engineering. 11*(39). 21-35.

INEGI (National Institute of Statistics, Geography and Informatics). 2020. Sociodemographic Panorama of Mexico 2020. Sociodemographic panorama of Puebla. Population and Housing Census 2020. Available online: https://www.inegi.org.mx/contenidos/productos/prod_serv/contenidos/espanol/bvinegi/productos/nueva_estruc/702825197940.pdf

López-González, J. L.; Damián-Huato, M. Á.; Álvarez-Gaxiola, F.; Zuluaga-Sánchez, G. P.; Parra-Inzunza, F.; Paredes-Sánchez, J. A. 2013. The backyard of corn producers: in San Nicolás de los ranchos, Puebla-Mexico. *Ra Ximhai. 9*(2).181-198.

United Nations and ECLAC. 2018. Sustainable Development Goals. 2030 Agenda and the Sustainable Development Goals. An opportunity for Latin America and the Caribbean. https://repositorio.cepal.org/server/api/core/bitstreams/cb30a4de-7d87-4e79-8e7a-ad5279038718/content

Olvera-Hernández, J.I.; Álvarez-Calderón, N.M.; Aceves-Ruiz, E.; Guerrero-Rodríguez, J. de D. 2017. Perspectives of the backyard and its importance in food security. *Agroproductivity.10*(7). 39-45.

Páramo, A. A. 2009. Ecotechniques and workshops. Ecotechniques Guide. Directorate of Concertation and Citizen Participation. Mexico City, 4 p.

Pérez, R. M. L. 2013. Efraín H. Xolocotzi. Contributions to the study of the Maya milpera families. *Ethnobiology. 11*(3). 14-27.

Van der Ploeg, J. D. 2014. Ten qualities of family farming. Foundation of rural studies. *LEISA journal of agroecology. 29*(4).6-8.

Zamudio, B. To; Alberti, M; Manzo, F; Sánchez, M. T. 2004. Women's Participation in Backyard Dairy Production Systems in Mexico City. *Cuadernos de Desarrollo Rural*. 51. 37-60.