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The backyard of Tlaxcala. An approach to its composition

El traspatio de Tlaxcala. Una aproximación a su composición

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SUMMARY

The backyard is an agroecosystem located near the home and fulfills several functions and provides various services; in addition, one third of the Rural Production Units in Tlaxcala have this agroecosystem. In the Mexican state of Tlaxcala, México, the primary sector is the one that contributes the least to the gross domestic product; it is divided into 60 municipalities and 66% of its territory is used for agricultural, livestock and forestry activities and little is known about this agroecosystem. The objective of the research was to make an approximation of its composition with respect to the plant and animal species found in the backyard. The Registry of Agricultural Producers of the State of Tlaxcala, Mexico, carried out by the National Institute of Statistics and Geography (INEGI) was used; as a member of the work team, a copy of the original database was obtained informally, which consisted of a total of 53 968 basic information cards; of that total, 17 236 reported backyard activities. The information was analyzed using frequency tables of data grouped and sorted into classes for both plant and animal species. Regarding the composition of the main vegetable species produced in the backyard, fruit trees such as peaches and corn stand out. Of the animal species produced, cattle and poultry are the most produced. On average, 91.15% of what is produced in the backyard is for self-consumption; the average area of the backyard was 215 m². The composition of the Tlaxcala backyard was determined in terms of plant and animal species of certain economic importance; the results reported here can be useful for other research that continues with the characterization of the structure, composition and functioning of the backyard in the state of Tlaxcala.

Index words: *animal production, farmers, pluriactivity, self-consumption, vegetable production.*

RESUMEN

El traspatio es un agroecosistema que se ubica cerca de la vivienda y cumple varias funciones y presta diversos servicios; además, una tercera parte de las Unidades de Producción Rural de Tlaxcala cuenta con este agroecosistema. En el estado mexicano de Tlaxcala el sector primario es el que menos aporta al producto interno bruto; está dividido en 60 municipios y 66% de su territorio se destina a actividades agrícolas, ganaderas y forestales y poco se conoce de este agroecosistema. El objetivo de la investigación fue realizar una aproximación a su composición con respecto a las especies vegetales y animales que se encuentran en el traspatio. Se utilizó el Registro de Productores Agropecuarios del Estado de Tlaxcala, México, realizado por el Instituto Nacional de Estadística y Geografía (INEGI); como miembro del equipo de trabajo, se obtuvo de manera informal una copia de la base de datos original, la cual consistió en un total de 53 968 cédulas de información básica; de ese total, 17 236 reportaron actividades de traspatio. La información se analizó mediante tablas de frecuencias de datos agrupados y ordenados en clases tanto de especies vegetales como animales. En cuanto a la composición de las principales especies vegetales producidas en el traspatio, destacan los frutales como el durazno y el maíz. De las especies animales producidas, el ganado y las aves de corral son las más producidas. En promedio, 91.15% de lo que se produce en el traspatio es para autoconsumo; la superficie promedio del traspatio fue de 215 m². Se determinó la composición del traspatio

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tlaxcalteca en cuanto a especies vegetales y animales de cierta importancia económica; los resultados aquí reportados pueden ser útiles para otras investigaciones que continúen con la caracterización de la estructura, composición y funcionamiento del traspatio en el estado de Tlaxcala.

Palabras clave: *producción animal, campesinos, pluriactividad, autoconsumo, producción vegetal.*

INTRODUCTION

Located in the central eastern part of the country, the state of Tlaxcala belongs to the region of the neovolcanic axis that crosses the central part of the country; its coordinates are 19° 44' and 19° 06' North Latitude and 97° 43' 08" - 98° 46' West Longitude. It has a temperate climate with a landscape of volcanic mountains of all types, more or less flat. It has an area of 3 991 km²; 96% of the Rural Production Units (RPU) have agricultural or forestry activity; 56.4% of them have an area of up to 2 hectares, indicating a serious smallholding problem (SAGARPA, 2018); 18.6% of the Economically Active Population performs agricultural activities (Fundación Produce Tlaxcala, 2011¹). Agricultural and livestock activities account for 4% of the state's Gross Domestic Product (CONACYT-Government of Tlaxcala, 2010). According to Damián *et al.* (2009), almost three quarters of the corn growers in the state of Tlaxcala were classified as pluriactive. Over the population, 78.2% live in urban areas and 21.8% in rural areas; the entity has a schooling of 8.8 years (INIFAP-SAGARPA, 2015). Poor rural families allocate on average 47.5% of their total expenditure to food consumption, while the urban poor allocate just over 42% (Chávez, Villarreal, Cantú, and González, 2009); for his part, Juárez (2015²) says that on average, 27% of rural households report food self-consumption from agricultural activities; in contrast, only 7% of urban households report self-consumption related to service activities, and only 2% report food self-consumption associated with agricultural activities. It is important to consider, in the backyard study environment, that

45.3 percent of the Tlaxcalan population cannot acquire the food basket with their labor income (labor poverty) in the first quarter of 2020, a rate that is 0.6 percentage points higher than the 44.7 percent in the fourth quarter of 2019 (Avendaño, 2020). From field visits in the entity, it is known that backyards have edible plant species such as corn, peach, pecan walnut, plum, pear, apple, etc., and that they raise animals such as goats, sheep, pigs, rabbits, poultry, bees, cows, donkeys, horses, etc.

There are few studies that describe the backyard in Tlaxcala State. The backyard that existed in Tlaxcala after the conquest of Mexico by the Spanish (500 years ago), is described by González (2006): usually located in the Franciscan Convents and cultivated with fruit trees, crops and condiment plants; she makes no mention of livestock activity in the orchards. The home garden present in Tlaxcala State, is characterized by the maguey, plum trees, apricots custard apple, peach, guava, fig, lime, lemon, apple, orange tree, walnut, pear, tejocote, some grape, xoconostle and plant species such as corn. González (2004) describes the backyard based on the investigations on basic ecological aspects that were carried out in four orchards in the community of Tepeyanco, south of Tlaxcala, which were carried out by Stephen R. Gliessman and his students from Agroecology Program, University of California at Santa Cruz, in the years 1981 and 1983; the existence of a total of 82 useful species and an average of 33 in a total area of 1.35 hectares was reported; too, bees, birds, donkeys, mules, pigs, cows, oxen are also reported. Chávez (2007³) describes in two different localities in Tlaxcala, the backyard with a study population of 180 people (53% men). The average age of the heads of families was 53.2 years and their level of schooling was 10.1 years of school; 40% of the heads of families are dedicated to agricultural activities. The average size of the backyards was 1 595 square meters. It is striking that only 20% use the entire backyard area for agricultural activities while 25% use half of the area. The backyard is used for the agricultural production of annual crops such as corn, some fruit trees, vegetables, flowers and medicinal plants, as well as for livestock

¹ Fundación Produce Tlaxcala. (2011). Agenda de Innovación Tecnológica. Tlaxcala, México.

² Juárez T., M. (2015). <https://www.banxico.org.mx/publications-and-press/banco-de-mexico-working-papers/%7B04AE64F6-9DAE-E817-37A4-EFD934A09152%7D.pdf>

³ Chávez Hernández, E. X. (2007). Transferencia y adopción de ecotecnias a nivel de traspatio en dos comunidades rurales de Tlaxcala. Tesis de Maestría. Colegio de Postgraduados, Montecillo, México. Discharged from February 18, 2020 http://colposdigital.colpos.mx:8080/jspui/bitstream/handle/10521/1457/Chavez_Hernandez_EX_MC_Desarrollo_Rural_2007.pdf?sequence=1&isAllowed=y

activities, mainly sheep, poultry, pigs and cattle. No more information was found on backyards in the state of Tlaxcala. The objective is to make an approximation of the composition of the backyard in Tlaxcala in terms of the plant and animal species produced and to describe some characteristics such as the size of the backyard area, and the percentages destined to self-consumption and sale of the production obtained, comparing these findings with those of other research on this agroecosystem. The results may be useful for the design of public policies to support rural inhabitants who manage these backyards, to reinforce their food security, referred by Lieffering, Newton, Vibart, and Li (quoted by Vargas-López *et al.*, 2017), regarding species richness have as a challenge to cope with the seasonality of food, with times of excess and scarcity, as well as for experiential tourism ventures.

MATERIALS AND METHODS

Database Used

Since very little published information was found related to backyards in Tlaxcala, it was decided to use El Padrón de Productores Agropecuarios del estado de Tlaxcala, carried out by the National Institute of Statistics and Geography (INEGI) in 2004 at the request of the State Government; its objective was to obtain basic information on the agricultural and forestry sector, as well as to generate sample frames through which specific studies could be carried out by having a state inventory of land (social, public and common use property) (INEGI, 2004), as is the case of this research; as a member of the work team, a copy of the original database was obtained informally, which consisted of a total of 53 968 basic information cards.

Data Used and Backyard

The data from the basic information questionnaires was obtained from ejidatarios, communal landholders, small landowners, representatives of agricultural or forestry production groups or any person responsible for land adjacent to the dwelling with agricultural or forestry activity. Given that the complete database consists of 53 967 census Rural Production Units (RPU), in order to analyze only those that corresponded to the backyard, we considered, first, the definition of Trabanino (2018), which states that "the family garden

in Mesoamerica is an agroforestry system with an antiquity of more than 11 000 years; it is located in the surroundings of the domestic unit, it facilitates the care and access to plants without having to travel to the most distant mountains" (p.87); then, from the section land of the responsible person's dwelling, the first question was taken into account that says: between February and August last year, in the land where this dwelling is located, did you have or plant fruit trees or did you plant any crop? Thus, only those RPUs that reported any fruit tree or crop in the area planted next to their dwelling were considered as backyard. This is because both plant and animal species of commercial value are mostly found in backyard conditions, for safety reasons.

Plant and Animal Species

The reagent applied to find out if the farmer had a backyard area is shown in Figure 1. It was assumed that if the respondent answered yes to P0010101 and P0010202, for example, then he (her) had one or two plant species in the field, respectively.

In the case of animal species, the item that indicated whether there were animal species in the backyard was: 7 Do you have or raise animals that sleep on the land where this dwelling is located? (P0070001), marking

LAND OF THE DOMICILE OF THE PERSON IN RESPONSIBILITY				
Mark with "x" the answer				
1. BETWEEN JANUARY AND AUGUST OF LAST YEAR, ON THE LAND WHERE THIS DWELLING IS LOCATED, DID YOU HAVE OR PLANT ANY FRUIT TREES OR CROPS? P0010001				
YES <input type="radio"/> 1 NO <input type="radio"/> 2				
1. WHAT CROPS, TREES OR FRUIT TREES OR PLANTATIONS DID YOU HAVE? Name	A. HOW MUCH AREA DID YOU PLANT OR DO YOU HAVE PLANTED? Amount Unit of measure		B. HOW MUCH DID YOU HARVEST? Amount Unit of measure	
P0010101	P0010102	P0010103	P0010104	P0010105
P0010201	P0010202	P0010203	P0010204	P0010205
P0010301	P0010302	P0010303	P0010304	P0010305
P0010401	P0010402	P0010403	P0010404	P0010405
P0010501	P0010502	P0010503	P0010504	P0010505

Figure 1. Reagent to know if you have backyard surface area. Source: INEGI (2004).

the answer with *yes* or *no*. As for other species, these were identified with item 18: On the land where this house is located, on January 31, did you have: 1. hens or chickens, 2. beehives, 3. other animals. This last item is important because working animals were found there.

Class Intervals

To calculate the class intervals, the recommendation of Gorgas, Cardiel, and Zamorano (2011) was followed, "when the number of different values taken by the statistical variable is very large or the variable is continuous... the data are grouped into intervals and a count is made of the number of observations that fall into each interval". The lower and upper limits of the class intervals are shown in hectares.

RESULTS AND DISCUSSION

Size of Agricultural Crop Production Units

According to the proposed methodology, 17 131 basic information forms (Rural Production Units, RPU) were used. In a first approximation of backyard size, class values were grouped from 1000 to 1000 m²; Table 1 shows that 93.6% have 1 to 10 000 m² of

backyard with crop production. This shows that more than 90% of the backyards in Tlaxcala are less than one hectare in size.

Taking into account that Góngora and Pastrana (quoted by Castañeda, Lope, and Ordóñez, 2018), stated that the size of the orchards analyzed in the literature ranges from 48 m² in Chemblas, Campeche, to 20 000 m² in Catmís, Tzucacab, Yucatán, as well as Olvera, Álvarez, Aceves, and Guerrero (2017) reported for three communities in Puebla a backyard size between 300 to 20 000 m², with an average of 2195 m², taking into account the results shown in Table 1, the surface between 1 and 1000 m² was analyzed with intervals of 100 to 100 m between classes.; the results are pointed out in Table 2.

It is observed in Table 2 that the backyard of up to 400 m² corresponds to 85.61% of the RPU, concerning 13 061 RPU out of 15 257 counted. When the average value of the range 0.0001 to 0.1000 hectares is obtained, the average area of the backyard is 0.0215 ha, it is, 215 m²; this is consistent with the 200 m² size reported by CEDRSSA (2018) for backyard livestock in Mexico.

Plant Species in Agricultural Crop Production Units

A total of 74 different plant species were detected in 17 131 backyards in Tlaxcala, when the responses referred to the first option. When they mentioned up to two different types of plants, or second option,

Table 1. Production units with backyard considering crop production.

Number	L. limit	U. limit	Observations	RPU	%
1	0.0001	0.1	905	12540	76.14
2	0.1001	0.2	358	805	4.89
3	0.2001	0.3	225	693	4.21
4	0.3001	0.4	79	145	0.88
5	0.4001	0.5	49	368	2.23
6	0.5001	0.6	133	162	0.98
7	0.6001	0.7	29	43	0.26
8	0.7001	0.8	76	266	1.62
9	0.8001	0.9	36	47	0.29
10	0.9001	1	19	350	2.13
11	1.001	150	420	1050	6.38
			Total RPU	16 469*	

RPU = rural production units. * With 769 missing or skipped data.

Table 2. Production units with backyard considering crop production between one and 1000 square meters.

Number	L. limit	U. limit	Observations	RPU	%
1	0.0001	0.01	99	5546	36.35
2	0.0101	0.02	100	1505	9.86
3	0.0201	0.03	100	2505	16.42
4	0.0301	0.04	100	3505	22.97
5	0.0401	0.05	95	633	4.15
6	0.0501	0.06	93	526	3.45
7	0.0601	0.07	92	322	2.11
8	0.0701	0.08	85	289	1.89
9	0.0801	0.09	76	195	1.28
10	0.0901	0.1	65	231	1.51
			Total RPU	15 257	100.00

RPU = rural production units.

10 484 backyards were counted, when there were three species this was in 6 498; when four species were 3404 backyards and up to five species of plants, it was in 1586 backyards; clearly it is observed that the greatest diversity of plants is found in the least amount of these production units. Nine were the most common species: corn, peach, plum, pear, pecan nut, apple, lemon, apricot and fig. Their relative importance is related to the number of species in the backyard. Thus, when only one species was mentioned, corn was the most reported plant (33.67%, followed by peach with 20.29%). When two, three or four types of plants were mentioned, the most important were plum and peach (19.52 and 17.85%, respectively); when up to five species were mentioned, the most important were again maize and peach (13.38 and 12.93%, respectively). However, this does not mean that medicinal and ritual plant species are not found in the backyards; there was just a lack of interest in recording them. It is also important to clarify that agricultural crops are mainly established in rainfed conditions, both in the main plots and in the backyards. Figure 2 shows the main plant species present in Tlaxcala's backyard.

Animal Species in Backyard Production Units in Tlaxcala

The main animal species that are produced in the backyard (mentioned as first option) are shown in Figure 3. It is observed that cattle and chickens, are the most produced, followed by sheep. It is important to mention that of 35 animal species, only 5 are not for human consumption (Figure 3). some species are companion such as dogs and birds. This result coincides with that reported by Castaños (quoted by López,

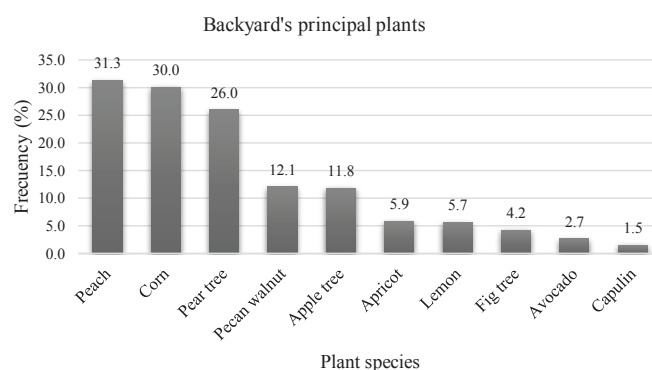


Figure 2. Plant species that are grown at tlaxcalteca backyard (%).

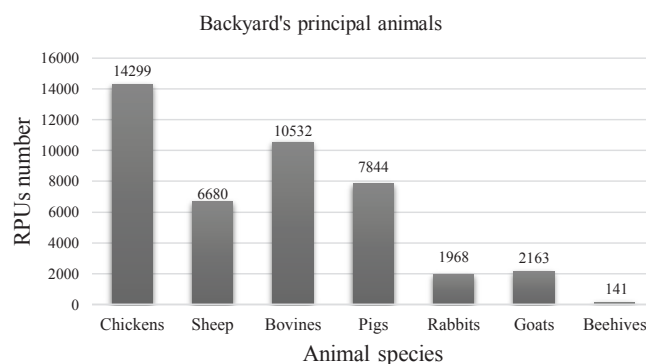


Figure 3. Animal species that are grown at tlaxcalteca backyard.

Damian, Álvarez, Parra, and Zuluaga, 2012), in which the most abundant animal in the backyard are chickens. Also, according to the OECD (2018), chicken meat is one of the main sources of protein for the Mexican population. Additionally, the average number of heads or units per Rural Production Unit for the main species were: 11.89, 4.31, 5.11, 13.01, 11.19, 19.22 and 16.62 for chickens, cattle, pigs, sheep, goats, rabbits and beehives, respectively, for the RPUs that had them.

Other animals also important in the backyard are working animals and the turkey (endemic species of Mesoamerica) and ducks; they are mentioned as second, third, fourth and fifth option (Table 3). Horses, donkeys and mules are work animals, while the other two are for human consumption. The percentage that is reported corresponds to the RPU that mention these animal species. Table 3 shows the importance of donkeys, standing out as the third, fourth and fifth option in the "other animals", despite the fact that it is a species at risk of extinction, as stated by Germán Flores (Velasco, 2018). As for the turkey (huexolotl), Pérez (2002) calls it the king of the Mexican orchard.

Table 3. Backyard's other animals (%).

Option	Turkey	Horse Cattle	Donkey	Mule	Duck
Second	32.97	30.00	19.09	13.88	1.53
Third	10.64	27.99	35.00	20.33	2.14
Quarter	13.81	20.59	36.06	20.84	3.96
Fifth	17.52	17.52	42.34	12.41	5.11
%	18.74	24.03	33.12	16.87	3.19

It is also noteworthy that the greatest number of animal species is observed in the smaller backyards, i.e., their number and diversity decreases as the surface area of these agroecosystems increases; this was observed for the animal species shown in Figure 3.

Self-Consumption-Sales

Vegetable crops. It was found that 16 574 RPU (95.23%) refused to sell the plant species or products produced, while 831 (4.77%) responded in the affirmative. This indicates, therefore, that approximately 5% of the RPU that have a backyard sell plant species or products. (Table 4). It was also observed that in a backyard area of up to 1000 m², 33.05% sell vegetable species or products, while 66.95% of those who sell have more than 1000 m². This indicates that the smaller the surface area, the greater the self-consumption of agricultural production.

Animal products or species. Table 5 shows the Rural Production Units that sell animal products or species. It is observed that of the RPU that indicated they have a backyard surface and that have or raise animals, 12.93% sell products or species of animal origin, while 87.07% use it for self-consumption. It can be observed that unlike the RPU that sell plant

products, the RPU that sell animal products are those with areas between 0.0001 and 0.1000 ha (73.7%). Note that 30.61% of Class 1 (0.0001 to 0.01 hectares) corresponds to 682 RPU out of a total of 2 228 RPU that sell products of animal origin. The low percentage of sales of vegetable and animal products, coincides with what was reported by Martínez and Juan (2005), López *et al.* (2012), Aznar and Carmona (2014), Covaleta, Paz, and Ranero (2016) and Suri (2020), in that backyard food production is mostly for self-consumption or survival.

Table 6 shows the animals or products of animal origin that are most commercialized from the backyard of Tlaxcala. It is observed that the highest percentage of what is sold (of the little that is sold) is related to cows, female pigs and sheep, showing the importance of these species in the backyard of Tlaxcala. Regarding the animal species produced in the backyard, the results found coincide with those of García and Guzmán (2014), who found two types of livestock production units (producers), those of self-consumption (91%) whose production is for family sustenance and who also see backyard animals as a savings bank, and commercial units (9%) that sell the production obtained.

Table 4. Rural production units (RPU) that sell vegetable products.

Class	L. Limit	U. Limit	Sell	Does not sell	Total RPU*	% Sell	% Does not sell	% Total RPU
1	0.0001	0.01	66	5480	5546	7.93	33.37	32.15
2	0.0101	0.02	36	3137	3173	4.33	19.10	18.39
3	0.0201	0.03	39	1479	1518	4.69	9.01	8.80
4	0.0301	0.04	35	828	863	4.21	5.04	5.00
5	0.0401	0.05	24	609	633	2.88	3.71	3.67
6	0.0501	0.06	20	506	526	2.40	3.08	3.05
7	0.0601	0.07	13	319	332	1.56	1.94	1.92
8	0.0701	0.08	13	276	289	1.56	1.68	1.68
9	0.0801	0.09	12	183	195	1.44	1.11	1.13
10	0.0901	0.1	17	214	231	2.04	1.30	1.34
11	0.10001	150	557	3390	3947	66.95	20.64	22.88
		Total	832	16421	17253	100.00	100.00	100.00

* RPU that do not report surface area in the backyard were omitted.

Table 5. Rural production units (RPU) who sell cattle.

Class	L. Limit	U. Limit	Sell	Does not sell	Total RPU	% Sell	% Does not sell	% Total RPU
1	0.0001	0.01	682	4864	5546	30.61	32.41	32.18
2	0.0101	0.02	419	2754	3173	18.81	18.35	18.41
3	0.0201	0.03	190	1328	1518	8.53	8.85	8.81
4	0.0301	0.04	103	760	863	4.62	5.06	5.01
5	0.0401	0.05	78	555	633	3.50	3.70	3.67
6	0.0501	0.06	63	463	526	2.83	3.09	3.05
7	0.0601	0.07	32	300	332	1.44	2.00	1.93
8	0.0701	0.08	23	266	289	1.03	1.77	1.68
9	0.0801	0.09	20	175	195	0.90	1.17	1.13
10	0.0901	0.10	31	200	231	1.39	1.33	1.34
11	0.1001	50.312	587	3343	3930	26.35	22.27	22.80
		Total	2228	15008	17236	100.00	100.00	100.00

Final Considerations

As Rivera *et al.* (2013) and Ayala, Gutiérrez, and Zapata (2016) said, climate change is one of the most urgent issues on the world agenda and can affect the productivity of plant and animal species, requiring countries to adopt public policies to mitigate its causes

and effects; the backyard is a useful strategy in this regard, by improving energy efficiency, reducing water consumption, planting many trees, reducing the use of gasoline-powered machinery, incorporating native species and incorporating organic waste from the home into the soil (National Wildlife Federation, n.d.).

CONCLUSIONS

The composition of the Tlaxcala backyard in terms of plant and animal species of some economic importance was determined. The characteristics of the size of the average backyard were described. It was also found that corn is the most important crop in this agroecosystem, only behind peaches; it was also found that cattle and chickens are the most important animals in the backyard, and that in both cases, only 8.8% of the backyards sell part of their production, which confirms their function of production for self-consumption, reported in most of the works on this agroecosystem. Given the current contingency due to the COVID-19 pandemic, the backyard agroecosystem or home garden should be stimulated to improve the diet and nutrition of the people of Tlaxcala. Additionally, the results reported here may be useful for other research that continues with the characterization of the structure, composition and functioning of the backyard in the state of Tlaxcala.

Table 6. Animals or animal products that are sold from the backyard of Tlaxcala.

Animal	RPU	%	Accumulated percentage
Cow milk	2165	36.33	36.33
Pig female	1056	17.72	54.05
Sheep cattle	752	12.62	66.67
Calf	471	7.9	74.57
Cattle	299	5.02	79.59
Turkey	223	3.74	83.33
Cows	211	3.54	86.87
Goat cattle	152	2.55	89.42
Rabbit	118	1.98	91.40
Chicken	79	1.33	92.73
Bull	74	1.24	93.97

* RPUs that do not report surface area in the backyard were omitted.

ETHICS STATEMENT

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

DATA AVAILABILITY

The data supporting the results of this study are available from INEGI, Tlaxcala, but there are restrictions on the availability of these data, which were used under license for this study and are therefore not publicly available. However, the data are available from the authors upon reasonable request and with the permission of INEGI, Tlaxcala.

CONFLICT OF INTERESTS

The author declare that he has no competing interests.

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