THE ORCHARD SYSTEM: AN INTERMEDIARY STAGE BETWEEN INTENSIVE PRODUCTION AND NATURAL PROTECTION AREAS

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Resumen / *Abstract* / *Résumé*

Se analiza el papel de los huertos en la biodiversidad y sustentabilidad. El trabajo es una revisión y discusión de la obra "Carpología Mexicana", que reporta las especies y variedades frutales en México, a finales del siglo XIX y constituye una fuente invaluable de información. El análisis reconoce la importancia de los huertos y proporciona bases teóricas para recuperarlos como unidades productivas. Los huertos son una oportunidad para el desarrollo rural y un mecanismo eficiente de conservación de biodiversidad útil. El análisis compara las características cualitativas y cuantitativas de la producción de frutales en cinco estados de México. Se estudian lugares de influencia franciscana (siglo XVI), lo que le da un carácter etnohistórico al trabajo. La órdenes religiosas funcionaron como centros de producción-aprendizaje e introdujeron prácticas agrícolas y especies, que influyeron en la economía y en las prácticas de manejo en América.

Palabras clave:
conventos
producción intensiva
sustentabilidad
biodiversidad útil

We analyze orchards' role in biodiversity and sustainable resource management. The study is a revision and discussion of a treatise called "Carpología Mexicana". This document reports fruit species and varieties in Mexico, during the end of XIX Century, and it is an invaluable source information. Data analysis, recognizes orchards' importance and give us a theoretical basis for their recovery as productive units. Orchards are an opportunity for rural development and an effective mechanism for "useful biodiversity" conservation. The study helps to compare qualitative and quantitative characteristics of fruit production in five Mexico's states. This paper is also an etnohistorical contribution, because, it focuses in towns or settlements where Franciscan convents existed during the XVI Century. Religious orders functioned as production and learning centers, that brought fruit species and agricultural practices, which influenced economy and management techniques in America.

Key words:
Convents
orchard intensive production
sustainability
useful biodiversity

Il s'analyse l'importance des plaines cultivés dans une biodiversité et dans la nourriture. Le résumé est une révision et discution de l'ouvre « Carpologia Mexicana ». Elle reporte la diversité des fruits au Mexique à la fin du XIX siècle et elle constitue une source pleine d'information. L'analyse connaît l'importance des plaines cultivées et donne la théorie pour les récupérer comme unités productives. Les plaines cultivées sont l'oportunité pour un développement rural et une mechanisme effciente et pour la conservation d'une biodiversité utile. L'analyse présente la diversité de la production des fruits pendant le XIX siècle et elle aide pour fair la comparaison entre la quantité et la qualité d'une production des fruits de cinq Mexique departements. Cette analyse insére les places d'une influence Francisçianne (XVI siècle), en donnat une charactère etnohistorique. Les réligions fonctionnent comme centres de production – apprentissage et elles introduitent des practiques agricoles et des espèces qui sont une influence à l'économie et aux practiques d'usage en Amérique.

Mots clefs:
couvent
production intensive
nourriture
biodiversité utile

Introduction

During the last twenty years, in spite of food production increases, modern agriculture has been hand in hand with high soil erosion rates and different degrees of water pollution in rural areas, caused by the use of pesticides and herbicides. It is also known that along environmental decay, social and cultural degradation occurs. Therefore, it is important to design and rescue ways to improve agricultural practices and use community knowledge to stop environmental and biodiversity loss; specially in countries like Mexico.

Mexico is known for its great geographical, ethnical, ecological, and cultural diversity. These characteristics make it an ideal country to preserve biodiversity and to recover information about traditional agricultural systems. For instance, Prehispanic cultures managed biodiversified productive units with multiple use species. When religious orders, such as the Franciscans, arrived in Mexico, agricultural practices combined, because they used local traditions and applied not only their own knowledge but Arabic horticulture concepts.

Religious orders were established all over the Mexican territory. First, they settled in the Mexican Central Plateau and later in Yucatan and Oaxaca states. Through their presence in different geographical locations of the country, religious orders, learned about the different cultural groups and experienced distinct ethnic practices in the use of resources, organic matter, soil, and water conservation (Abascal & Garcia, 1974; Armillas 1949). Therefore, agriculture syncretism had a powerful impact to develop highly productive and diverse orchards' systems.

Combination and syncretism of knowledge have made the orchard the most widely distributed production unit in Mexico. Nevertheless, there has not been extensive orchard research in our country, about orchards. The only advanced studies have been carried out in Yucatan. The Mayan orchards have been emphatically studied using an ethnobotanical perspective (Caballero, 1992). Etnobotanical studies show the need of knowing more about the orchards; specifically, about their role in natural resource conservation, sustainable management and as a food source.

Orchards' high number of species makes them complex and fragile ecological systems (Michon,1983). Their diversity reproduce a natural ecosystem accordingly to the geographical region. However, they are easy to maintain because they are self-sustained and have the potential to produce enough food for a concentrated population settlement, without environmental over-exploitation or deterioration of the system by itself (Michon,1983). Although, some intensive labor is needed during the crop season, there is a surplus of products which provide valuable cash income.

Why the Mexican Central Plateau?

The Mexican Central Plateau was chosen as a study area, because of its historical and biological importance to orchards. It comprises five states: "Estado de México, Hidalgo, Morelos, Puebla and Tlaxcala". Several authors have recognized the essential influence of this area in Mexican culture, among them, Armillas (1949) and Palerm & Wolf (1972), have pointed out the relevance of the Puebla and Tlaxcala Valley within the Mesoamerica intensive agrarian development.The agricultural and historical influence of this region has also been acknowledged by Abascal & Garcia (1974), and Garcia (1976). Specifically, Gonzalez-Jácome (1985) explains current orchards' diversity in Tlaxcala; and, Fowler (1968) and Paredes (1984) describe peculiarities and influence of management practices in Puebla.

The historical influence of the area is another reason to choose this region for the study. Central Mexico was first occupied by Spanish conquerors (1525), because of soil fertility and water availability resemblance to those in Castilla Region, Spain. The abundance of natural resources attracted religious orders to establish convents and develop agricultural practices. For instance, by 1550, Franciscans had already build five convents in central Mexico: Huejotzingo, Calpan, Huequechula, Colchihuapan and Tepeapa. Franciscans carried out a great number of economic, productive, and religious activities; and sustained large religious communities. An important activity, Franciscans developed in the con-

1 There are several terms that refer to an orchard, such as, homegarden, solar and backyard. In this paper we employ the term orchard.

vents, was agriculture and orchard management. Consequently, the influence of religious orders was determinant for orchard's proliferation.

Table 1 shows a list of Franciscans convents with information about localities, altitude, and foundation year. The majority of the convents in the Mexican Plateau were built in Puebla and Estado de México, 24 in each one. In Tlaxcala there are 12, in Hidalgo there are 11, and in Morelos there are 6 convents. Geographical and altitude data help to detect temperate ecosystems from those warmer and drier places. Then, convents distribution gives the pause to locate settlements, where orchards had an impact over populations' economy and agricultural practices, and to identify ecosystems' variations and diversity. For instance, the Acosta priest, in 1590, was impressed by the richness of Mexican flora. He explains in his work: "It is very difficult to describe all the fruits and trees from the Indias. To talk about the differences and shapes of so many wild trees is an impossible task" (Fondo de Cultura Económica 1940). So, the diversity of species in Mexico is conspicuous since colonial times. The idea of bioregions and altitude scales are also described in a document from 1895 called: "Carpología Mexicana", the central source of information for this paper.

TABLE 1. MEXICAN CENTRAL PLATEAU CONVENTS LOCATIONS IN THE STATES OF "ESTADO DE MEXICO, HIDALGO MORELOS, PUEBLA AND TLAXCALA" DURING THE XIV CENTURY

Locality	Altitude	Foundation Year	Locality	Altitude	Foundation Year
Estado de México					
Acambay	2500	1691-1696	Metepec	2600	Before 1569
Aculco	2309	1585-1640	Otumba		Before 1569
Amanalco	2300	1691-1696	Ozumba	2500	S. XVI
Atenco		1640-1696	Tecaxic		1651
Calimaya	2475	Before 1569	Temamatla		1603
Coalinchán		1569	Teotihuacán		1560
Cuautitlán	2252	Before 1569	Texcoco	2278	1525
Chalco	2350	Before 1569	Tlamanalco	2412	Before 1531/1569
Chiautla	2115	1569-1588	Tlanepantla	2278	Before 1569
Ecatepec		1569-1588	Tulantongo		1676
Huexotla		1560 / 1525	Toluca	2620	Before 1569
Huilotepec	2525	After 1529	Zinacatepec		1569
Hidalgo					
Alfafayucan	1989	1569-1585	Tepetitlán	2000	1569-1585
Apam	2493	Before 1569	Tepexi del Río		Before 1569
Huichapan	2102	Before 1560	Ula de Allende	2060	Before 1539
Tecozautla		1587-1614	Tulancingo	2222	Before 1560
Tepeapulco	2350	1530-1553	Tultitlán	2532	1569
Morelos					
Coatlán del Río		Before 1569	Mazatepec	990	Before 1569
Cuernavaca	542	1525	Tlalquiltenango	911	1540
Jiutepec	1350	Before 1569	Xochitepec	1115	1694
Puebla					
Acatzingo de Hidalgo	2160	1559			
Sto. Tomás de Acatzingo		1564-1585	Puebla de Zaragoza	2162	1539
Ahuacatlán	1330	Before 1640	Quecholac	2250	Before 1539
Amozoc de Mota	2331	1569-1585	Tecali de Herrera		Before 1569
Atlixco	881	Before 1569	Tecamacahlco	2055	Before 1569
San Andrés Calpan	2510	Before 1537	Tehuacan	1676	Before 1537
Cuatinchan		Before 1554	Tepeaca	2257	Before 1558
Chietla	1163	Before 1554	Tepexi Rodríguez	1746	Before 1566
Cholula de Rivaldavia	2150	Before 1537	Tlataluquitepec	1930	
Tochomilco	2070	Before 1566			
Huaquechula	1640	Before 1551	Totimehuacan	2110	Before 1569
Huejotzingo	2280	1524	Zacatlán	2000	Before 1564
Puebla					
Atlangatepec	2484	1569-1585	San Felipe Ixtlacuixtla	2192	Before 1569
Sta María Atlihuetzian		1555	San Francisco Tepeyanco	2213	1554
Calculalpan	2578	Before 1569	Sta. Ana Chautempan		1537-1569
Huemantla de Juárez	2553		Sta. María Texcalac		1587-1640
San. Idelfondohueyotlipan	2581	1569-1585	Tlaxcala de Xicotencatl	2252	1524
Sta. María Nativitas	2178	1569-1585	San Huan Tobalac	2208	1569-1585

Source: Vázquez, V.E., 1965. Distribución geográfica y organización de las órdenes religiosas de la Nueva España. S.XVI. Instituto de Geografía. Universidad Nacional Autónoma de México.

As we can see in Table 2, "Carpología Mexicana" offers data about fruit species and varieties, production localities, prices and period selling times. The fragment only shows the great variety of species available at that time in Mexico. Species distribution with relation to the altitude shows that different species can live within a very wide limits. Almost all kinds of fruits can be cultivated in all over the country with distinct cropping times.

TABLE 2. FRAGMENT OF "CARPOLOGÍA MEXICANA": RELATION BETWEEN ALTITUDE AND VARIETY OF FRUIT SPECIES

"As has already been said, the most varied productions within comparatively limited areas, presenting a mixture of plants which pertain to different zones, and generally speaking, their existence under favorable conditions of vegetation is possible within very wide limits of altitude. In order to give an idea of the character of these different zones of vegetation with respect to their altitude, we here present the following summary, which only specifies the most characteristic fruit threes which are cultivated".

Principal fruit trees of Mexico cultivated in different zones

Altitude	Commun Names of Species *
From sea level up to 500 m	Bonete, cabeza de negro, coconut, coyol, nanche, pineapple.
From sea level up to 1000 m	Ahuilote, arrayan, camichin, chicozapote, mamey, tamarind tempizque.
From sea level up to 1500 m	Alligator pear, anona, Mexican plum, chirimoya, pomegranate, guava, guamuchil, guamara, jocuistle, limes, lemons, mango, zapote melon, mezquite, mush melon, black mulberry, orange, chestnut, papayo, plantain, pitahaya, watermelon.
From 500 to 2000 m	Fig, apricot, peach, strawberry, sweet apple, quince, prickly pear, peñon, pear, sour apple, zapote prieto, zapote blanco.
From 1000 to 2500 m	Capulin, red currant, pingüica, tejocote, black berry.

* We transcribed exclusively common names used in the book, because in further research we will carry out an extensive revision of identification of current species.

The orchard as a unit of production and conservation

The orchard is and has been an experimental production unit for multiple plants' domestication (Gómez-Pompa, 1987). Orchards have different patterns of shade and sun, which creates distinct vertical and horizontal plants' distribution in small areas; consequently, each orchard represents a special study case. The spatial organization, complex structure, and species diversity make possible cultivated, semi-cultivated and wild species combination in the same place (Price, 1983). Then, orchards are a key to understand agricultural systems and practices in which a system's design and management does not need outside inputs; because we are able to reduce environmental impact of farming practices and make better sense of ecological and economical goals in the long term (Gleissman, 1988).

Orchards are considered as agrosystems that produce not only food but economical, social, cultural, recreational and landscape-aesthetic benefits. However, besides this notion of a multiple benefit system, we would like to introduce the concept of the orchard as an intermediary stage between the traditional productive system and a natural protection area. Orchards fulfill two primary requirements for conservation and management: 1) a unit of biodiversified production and 2) a unit of germplasm bank. Therefore, the orchard is a special agroecosystem system that combines the advantages of production and conservation.The availability of species in an orchard is an expression of the amount of germplasm stored in an space and the potential to use those species for food production.

During the last century, Natural Protection Areas have been the most conventional mechanism for conservation "in situ". Moreover, the botanical gardens and zoos have been the common response for conservation "ex situ". More recently, biotechnological advances, such as, tissue cultivation have been used for biological conservation. Nevertheless, this paper proposes the orchard as an alternative course for conservation because:

1) Orchards constitute an equilibrium point between management practices. They are also a middle stage between technological and natural processes for conservation.
2) Orchards provide the opportunity to integrate scientific and empirical or cultural knowledge.
3) Orchards combine social ancient learning and cultural processes for environmental integration.

On the one hand, orchards, at least, maintain three basic elements for achieving social and ecological sustainability: rescue of traditional systems, conservation of species and rescue, and improvement of

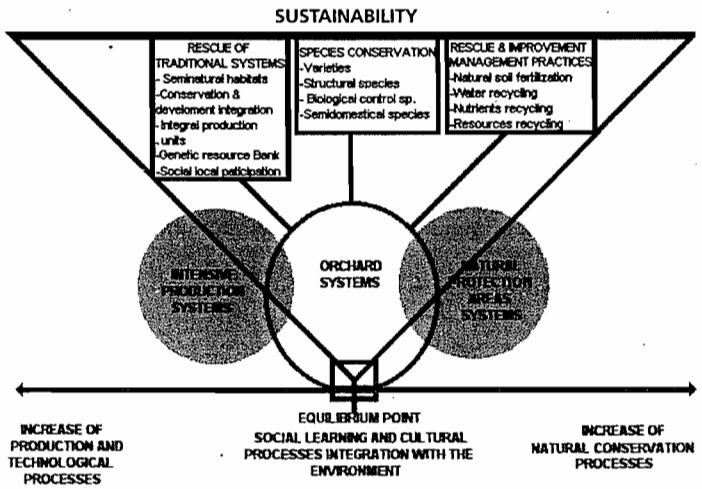
management practices. As we can see, a triangle where the base represents sustainability is shown in Figure 1. This means that to achieve sustainability, changes and management approaches develop from the apex to the base of the triangle. In other words, we should take food production in combination with responsible environmental practices, as a starting point, to reach sustainability. Under this view, orchards and other traditional systems excel typical conservation schemas (i.e., representative wild areas) and facilitate management and conservation "useful species". Orchards represents an important change in the conservation frame, because they give meaning to abstract concepts such as social learning and cultural processes. When we realize that there are abstract and complex processes involved in conservation, we also acknowledge the essential role of populations and community culture.

On the other hand, orchards as multiple management units, constitute a more pragmatic and effective approach to conservation and biodiversity maintenance. In the lower axis of Figure 1, we show the two opposite processes that characterize land use: intensive production systems and natural protection areas. If land use is directed to natural protection areas, conservation increases. However, if land use is focused to intensive production, technological processes would increase, and therefore conservation would disappear. So, the orchard system is the equilibrium point that integrates social learning and cultural processes to the environment. Then, conservation is a priority because of the existence of large biodiversity. Another advantage of promoting orchards is the use of biodiversity intensively, and, a faster track to achieve sustainability intrinsically related to local necessities. Finally, but more importantly, orchards provide social cohesion and integration to the environment, because they are part of heritage, traditions, customs and community rules.

Through the establishment of orchards and the use of traditional practices, we would found answers in how to make a transition, establishment, and maintenance of sustainable resource management. Besides, we could promote local economy in rural areas. Traditionally, countries like Mexico have only been raw material producers, however, it is time to search for alternatives and to establish productive chains in local communities. For instance, rural enterprises could add value to raw materials, and therefore encourage internal economy and regional development.

It is important to point out that environmental and Mexican agriculture policies have not addressed or even consider orchards as conservation and productive units. Mexican rural development programs have systematically devaluated and disregarded this community space. The main focus of agricultural practices and environmental-agricultural issues, if any, has been in intensive mono-crops. Therefore, there is a need to study and activate orchards as a mechanism for production and conservation. It is understood that orchard owner's and local communities have to recognize their advantages and be convinced of working in orchards; otherwise, efforts to activate such systems would be futile.

FIGURE 1. THE ORCHARD SYSTEM: AN INTERMEDIARY STAGE BETWEEN INTENSIVE PRODUCTION SYSTEMS AND NATURAL PROTECTION AREAS SYSTEMS



Methodology

The main goal of this paper is to show the relevance of fruit production during the XIX Century and the relationship with orchard management, where Franciscan convents existed in the XVI Century. We consider information from the XIX Century, based upon the revision of the "Carpología Mexicana" treatise, edited by the Secretaría de Fomento in 1895. This work is a database of 78 genus, 72 species and 108 varieties (258 taxa), production amounts, year time sales and production rates of fruits, in all municipalities or localities of Mexico during the last part of the XIX Century. By combining information from two historical periods (XVI and XIX Century) and showing the influence of Convents, which their orchards have an impact over the population surrounding as production centers, we recognize the essential role of history for establishing biodiversity loss or increase, when management practices are involved.

First, we identified localities where Franciscan Convents where built. Second, using the "Carpología Mexicana" document, we determined the municipalities corresponding to the places where Franciscans Convents had influence. Therefore, we chose our sample having as a criteria those localities with Convents and are in the Mexican Central Plateau. Then, we recorded fruit's production by localities, in order to determine the relationship between presence of a convent and species proliferation in each town. Available data in "Carpología Mexicana" is extensive. An example of such information is presented in Table 3, which records five varieties of pears in four of the five Mexican Central Plateau states and 20 localities. A more detailed example, is the case of the Bergamota pear that is located in the Mexican Plateau.

TABLE 3. EXAMPLE OF AVAILABLE INFORMATION IN "CARPOLOGÍA MEXICANA" (1895). PEAR VARIETIES AND LOCALITIES OF MEXICO

Scientific Name [2]	Common Name	Varieties
Pyrus communis (Lin).	Pear	Black pear, Milky pear, San Juan's pear, Bergamota pear and Cristal pear.

States	Localities
Estado de México	Chalco, Ecatepec, Ozumba, Tlalmanalco, Tlanepantala.
Hidalgo	Tepeapulco
Puebla	Atlixco, Cholula, Huaquechula, Huejotzingo, Puebla, Quecholac Tehuacan, Tochimilco, Zacatán
Tlaxcala	Chautempan, Huamantla, Nativitas, Tepeyanco, Tlaxcala

The information in "Carpología Mexicana" comprises a great number of species and varieties. Consequently, it describes the enormous fruits biodiversity that existed in our country. We made a synthesis of the data because of information richness. We report only the species and varieties in the Mexican Central Plateau (Estado de México, Hidalgo, Morelos, Puebla and Tlaxcala states).

Discussion and Conclusions

Table 4 shows the enormous number of taxa [3] in the XIX Century, in the Mexican Central Plateau, conditioned to the presence of Franciscan Convents. It is noticeable the large fruit production diversity and the large number of localities where they are grown. Another important issue, is the fact, that the sample is characterized by tempered ecosystems, although tropical microclimates are present in Morelos and Puebla, as a result of altitude differences in the country. For example, Coatlán del Río in Morelos has 33 fruit species because of its tropical microclimate.

Using the "Carpología Mexicana" and under an ecological criterion, diversity is expressed by the number of the genus, species and varieties. We found that in the Mexican Central Plateau there are 73

2 Scientific names are reported as they were used in the XIX Century.
3 Taxonomic groups from the XIX could vary from today's classification.

genus, 67 species and 105 varieties of fruits in 604 localities. A relevant case is Opuntia spp, which constitutes a whole taxonomic group by itself. However, in "Carpología Mexicana", this group is reported as 8 varieties of Opuntia, which in reality must comprise much more species and varieties.

The state that has the larger number (76) of fruit varieties is Puebla. The second state is Morelos with 60 varieties. It follows, Tlaxcala with 58 and with less varieties are the states of Morelos (30) and Hidalgo (26). These data agree with the importance of the Mexican Central Plateau mentioned by Armillas (1949) and, Palerm & Wolf (1972), as a center of an intensive agrarian center in Mesoamerica.

TABLE 4. SPECIES AND VARIETIES PRODUCED DURING THE XIX CENTURY IN THE MEXICAN CENTRAL PLATEAU

Scientific name	Common name in Spanish	Common name in English	States
1 *Achras sapota. D.C.*	Chico zapote	Zapota sweet	3
2 *Acrocomia mexicana*	Coyol	Cohune palm	4
3 *Amigdalus persica. Lin.*	Prisco	Peach	1
	Melocotón	Peach	2,3,4,5
4 *Annona cherimola*	Chirimoya	Anona	2,3,4,5
5 *Annona glabra. Lin.*	Anona	Anona	3,4
6 *Annona squamosa*	Llama	Llama	3
7 *Anona sp.*	Anona	Wild anona	4
8 *Arachis hypogea. Lin.*	Cacahuate	Peanut	3,4
9 *Arbutus jalapeusis*	Garambuyo	Garambuyo	2,3
10 *Carica nana. L.*	Bonete	Bonete	3,4
11 *Carica papaya. Lin.*	Melón zapote	Papayo	3,4
12 *Carya oliveformis. Nutt.*	Nuez	Walnut	2,4,5
13 *Casimiroa edulis. L.*	Zapote blanco	White Zapota	2,3,4,5
14 *Cerasus caproniana. D.C.*	Guinda	Sour cherry	4
15 *Cereus pitahaya. Jacq*	Pitahaya común	Pitahaya	3,4,5
16 *Cereus trigonus*	Pitahaya	Pitahaya	5
17 *Citrullus vulgaris. Schrad.*	Sandía	Watermelon	2,3,4
18 *Citrus aurantium. Risso.*	Naranja dulce	Sweet orange	3,4
19 *Citrus vulgaris Risso.*	Naranja agria	Sour orange	4,5
20 *Citrus limeta. Risso.*	Chica	Small lime	1
	Grande	Big lime	2
	Chichona	Chichona lime	3,4,5
21 *Citrus limonium. Risso.*	Agrio	Sour lemon	1,2,3,4,5
	Dulce	Sweet lemon	
	Real	Royal lemon	
22 *Citrus medica. Risso.*	Cidra	Citron	3,4
23 *Citrus medica rugosa. Rind.*	Rugosa	Grapefruit	3
24 *Cratagus mexicanus. Lin.*	Tejocote	Tejocote (wild apple)	2,3,4,5
25 *Cocus nucifera. Lin.*	Coco	Coconut	3
26 *Cucumis melo. Lin.*	Melón	Melon	3,4
27 *Cucumis sativus. Lin.*	Pepino	Cucumber	4
28 *Cydonia vulgaris. Pers.*	Membrillo	Quince	1,3,4,5
29 *Cyrtocarpa proeera. H.B.K.*	Copalcojote	Cherry	3,4
30 *Charatas Plumieri*	Jocuistle o timbiriche		3
31 *Diospyros nigra. D.C.*	Zapote prieto	Black zapota	3,4,5
32 *Elaeis guineensis*	Palma del coco	Coquito palm	3
33 *Ficus carica L.*	Higo	Early fig.	4,5
34 *Ficus carica. L.*	Higo negro	Higo Blanco	1,2,4,5
35 *Ficus padifolia. H. B.*	Small fig	Tlaxcala	5
36 *Fragaria vesca. Lin.*	Fresa	Strawberry	1
37 *Inga*	Jinicuil	Jinicuil	3,4
38 *Juglans regia. Lin.*	Nuez china	Chinese walnut	1,4,5
39 *Lucuma bomplandi*	Mamey	Mamey	3,4
40 *Lucuma salicifolia. H. B.*	Zapote borracho	Drunk zapota	2
	Zapote amarillo	Yellow zapota	3,4
41 *Malphigia faginea. Swartz*	Nanche	Nanche	4
42 *Mangifera indica. Lin*	Manila	Manila Mango	3
	Mango común	Common Mango	4
43 *Monstera deliciosa*	Piña anona	Pinnaple	3,4

**Tempizque. Wild Fruit Puebla 1 locality. Edo. de México=1; Hidalgo=2; Morelos=3; Puebla=4; Tlaxcala=5.

Scientific name	Common name in Spanish	Common name in English	States
44 *Morus nigra*	Mora negra	Black berry	2,4,5
45 *Musa s.p.p.*	Plátano chico	Small banana	3
	Plátano grande	Big banana	1
	Plátano guinea	Guinea banana	1
	Plátano costa rica	Costa Rican banana	1,4
	Plátano manzano	Manzano Banana	1
46 *Myrtus arrayan*	Mirto	Myrthe	3
47 *Opuntia.spp*	Tuna Cardona	Cardona Indian fig	1,5
	Tuna Chavena	Chavena Indian fig	5
	Tuna Joconostle	Joconostle Indian fig	1,4,5
	Tuna Mansa	Mansa Indian fig	1,2,4,5
	Tuna Tapona	Tapona Indian fig	1,2,4,5
	Tuna Chica	Small Indian fig	1,2,4,5
	Tuna Amarilla	Yellow Indian fig	2,4,5
	Tuna Silvestre	Wild Indian fig	2,4,5
48 *Passiflora coerulea. Lin.*	Granada China	Pasion flower fruit	3,4
49 *Pereskia portulacoefolia. Han.*	Pitayita de agua	Fruit of cactus	3,4
50 *Persea grattissima. Gaert.*	Aguacate Chico	Small Avocado	1,2,3,4,5
	Aguacate Grande	Big Avocado	1,2,3,4,5
51 *Phitecelobium dulce. Pent.*	Guamuchil	Guamuchil	3,4
52 *Phoenix dactyllfera. Lin.*	Dátil	Date	3,4
53 *Pinus cembroides. Zuce.*	Piñon	Pinion	5
54 *Prosopis juliflora*	Mezquite	Mezquite	2,3
55 *Prunus armeniaca. Lin*	Chabacano	Apricot	1,4,5
56 *Prunus capolli Lin.*	Capulín	Capolli	1,2,4,5
57 *Prunus domestica. Lin.*	Ciruela	Foreign prune	3
58 *Psidium pyriferum. Lin.*	Guayaba china	Chinese guava	1
	Guayaba peruana	Peruvian guava	2
	Guayaba roja	Red guava.	3,4
59 *Psidium pomiferum. Lin.*	Guayaba agria	Acid guava	3,4
60 *Punica granatum. Lin.*	Granada común	Grenade	1,4,5
61 *Pyrus communis. Lin.*	Pera negra	Black pear	1,2,3,5
	Pera lechera	Milky pear	1,2,3
	Pera San Juan	San Juan pear	1,2,3,4
	Pera bergamota	Bergamota pear	1,2,3,4
	Pera cristal	Cristal Pear	1,2,3,4
62 *Pyrus malus. Lin*	Manzana camuesa	Camuesa apple	5
	Manzana chata	Chata apple	5
	Manzana dulce	Sweet apple	5
	Manzana panochera	Panochera apple	5
63 *Pyrus malus. Lin.*	Perón	Var: commun, cristal	1,3,4,5
64 *Rubus fructicorus.Lin.*	Mora	Black berry	3,5
65 *Sechium edule. Lin.*	Chayote	Chayote	1,2,3,4,5
66 *Solanum melangena. L.*	Berenjena	Egg-plant	3
67 *Spondias lutea. Lin.*	Ciruela amarilla or Jobo	Wild yellow prune	3
68 *Spondias purpurea. Lin.*	Ciruela Roja	Red prune	3
69 No Classified	Tempizque	Tempizque (wild fruit)	3
70 *Tamarindus occidentalis.*	Tamarindo	Tamarind	3
71 *Vitex mollis. H.B.*	Ahuilote	Black wild cherry	3
72 *Vitis caribea D.C.*	Uva silvestre	Wild Grape	3,4
73 *Vitis vinifera*	Uva	White Grape	2,5
		Black Grape	5

Fuente: *Carpología Mexicana*.1985. Directorio General sobre la producción de frutos en las municipalidades del país. Metereológico Central. Secretaría de Fomento. 512p.

**Tempizque. Wild Fruit Puebla 1 locality. Edo. de México=1; Hidalgo=2; Morelos=3; Puebla=4; Tlaxcala=5.

At first glance, the historical information of fruit production in the XIX Century indicates the great biodiversity of species managed, used and sold. The data also provides secondary information about the diverse ecological and geographical conditions of fruit's production. Furthermore, the analysis reveals that Franciscan Convents' management practices, through orchards, still remained in the XIX Century. By identifying locations where convents existed, we recognize orchards as relevant units of food production and agriculture intensive management.

The historical records and traditional management lead us to propose orchards as an intermediary stage between an intensive productive system and a natural protection area, as it was previously summarized in Figure 1. Orchards not only conserve biological diversity, but they are also management units that support a large number of fruits varieties, because of the diverse microclimate conditions in their structure.

This paper is an invitation to recover orchards as a feasible agroforestry system approach to improve

the rural areas in Mexico. Given the fruit diversity found in the Mexican Central Plateau, it is necessary to continue research in this knowledge area. Research should focus on comparing information at distinct historical periods with present fruit's production, with the purpose of defining biodiversity loss and/or increase. Attention must be paid to regions with traditional orchard management. We should be especially interested in varieties that, even though, are no longer produced in large amounts, are still in demand and fulfill specific ecological functions.

Information in "Carpología Mexicana" reveals the importance to conserve productive and useful biodiversity, and makes us to consider local populations as the main promoters for diversified production and conservation activities. In this case, orchards are feasible paths for ecological restoration that incorporate populations needs. As it is known, there are several authors, who argue that peasants are the ones who make the real conservation (Oldfield & Alcorn, 1987; Altieri & Merrick 1987, 1988; del Amo 2000). Peasants select, manage and use cultivated and associated species. Therefore, peasants and rural communities play an essential role in conservation. Moreover, these agriculture practices have sustained and fulfill basic needs for populations around the world.

In Mexico, due to social and economical constrains and to poor public policies, there is a great deal of poverty. Public strategies focuses more into services rather than into basic food production. As a consequence, orchards and other traditional agroecosystems are underused. Therefore, it is necessary to use orchards for food production and to reactivate internal economies. It is understood, that food production should be directed to add value to raw materials, such fruits, and to manage useful biodiversity.

Studying orchards under ecological, social and economical criteria would be a major contribution to rural development in temperate, tropical and subtropical areas, in Mexico and Latin America. There are several questions that emerge from looking at the orchard's systems. These questions need to be answered by doing a deeper analysis of the relation among etnohistorical, ethnobotanical, ethnographic, economical, ecological, social and cultural perspectives. The main questions are:

- What is the role of orchards in biodiversity maintenance to reach sustainability?
- What is the total number of fruit's species and varieties lost in the last Century? What fruits species are endangered?
- Which species are native to Mesoamerica and how many of them were introduced during Colonial times and the XX Century?
- Which fruits species and management practices, according to the geographical region, would be relevant for food production?
- What is the role of the household in the orchard maintenance?
- What is the impact of urbanization in the orchard production?

Finally, a last inquiry implying biodiversity and orchards systems, remains: What have we done, what are we doing, and, what would we do about the enormous biodiversity and richness, we as human beings, are in charge? Would we have the capacity to use biodiversity in a sustainable way?, Would we be able to combine conservation and production? Or, are we going to continue wasting our natural resources, with the additional effect of losing useful biodiversity? Management of useful biodiversity is a pragmatic answer to fight poverty and undernourishment in our country. In other words, useful biodiversity is the intrinsic richness of rural local communities that could and should be the foundation for their development.

Acknoledgement

This work was supported by Comision Nacional para la Conservación y Uso de la Biodiversidad (CONABIO, Project No. QO7)

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