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Influence of Land-Use Changes (1993 and 2013) in the Distribution of Wild Edible Fruits From Veracruz (Mexico)

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Abstract

Wild edible fruits are a complement to the diet, generate income, and contain cultural values for local populations. In Mexico, their presence is threatened mainly by deforestation. The purpose of this work was to evaluate the distribution of 106 wild edible fruits from Veracruz state in several vegetation types and consider the effect of land-use changes on species distribution between 1993 and 2013. Seven species with the least number of herbarium specimens were chosen in order to estimate the current and potential distribution using Maxent models. The types of vegetation with the largest number of wild edible fruit species were the evergreen tropical rainforest with 64, deciduous tropical forest with 51, and the mountain cloud forest with 33. The largest loss between 1993 and 2013 was in secondary vegetation (0.19%) and evergreen tropical rainforest (0.11%). The main causes are the increment in human settlements and pasture, and grazing land (originally populated by tropical forests)—both factors that could put at risk, in the near future, most of the species studied. All of the species with restricted distribution in Veracruz showed a tendency to shrink in area, particularly the piñón (*Pinus cembroides*) and nuez de castilla (*Juglans pyriformis*), both of economic importance. In the face of land-use changes, conservation strategies must be designed in accordance with rational use and public policies that promote a sustainable management of wild edible fruits and the forests in which they grow.

Keyword

biodiversity, forests, land-use changes, non-timber forest products

Introduction

Ecosystems and their biodiversity are constantly threatened (Hughes, 2017; Kideghesho, 2015; Sandewall & Gebrehiwot, 2015), land-use change (LUC) being the main driver of the loss (Millennium Ecosystem Assessment, 2005). Deforestation, carried out mainly for expansion of cattle and agricultural land (Ferguson, Morales, & Rojas, 2009), is the most important form of LUC (Kideghesho, 2015), and consequently, the greatest threat to wild edible fruits (WEF) populations in forestlands (both managed and wild) and in specialized production systems.

Native vegetation is a valuable biodiversity store and its permanence maintains productive systems (Mooney, Ehrlich, & Daily, 1997), which form part of food chains (including for humans) and in some cases contribute to food security (Bharucha & Pretty, 2010; Godfray et al., 2010; Toledo & Burlingame, 2006). Similarly, wild food resources can be found in remnant vegetation under some

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anthropogenic impact regimes (e.g., *acahuales*) and in intensively managed systems: agroforestry, agrosilvopastoral, family gardens, among others (Bharucha & Pretty, 2010; Wiersum, 1997).

Fruits, nuts, and edible leaves of high nutritional value and of wild origin contribute to the sustenance and the economy of more than one billion low-income people (Byron & Arnold, 1999; Delang, 2006; Food and Agriculture Organization, 2011). WEFs are an ecosystem service and represent enormous importance to many people around the tropics; they are known as *Cinderella* species (Leakey & Newton, 1993). Among other reasons, this is due to the lack of information describing wild fruits' natural history and population dynamics and associated biotic and abiotic variables, along with the lack of a detailed cartography on its distribution and consumption (Schulp, Thuiller, & Verburg, 2014). Anta-Fonseca et al. (2008) stated that, in Mexico, official statistics on nontimber forest products only record those that are industrialized and exclude those that are commercialized locally. Therefore, there is scarce information on the diversity of uses, amounts extracted, collection processes, production, and commercialization, which limits the possibilities for acknowledging the social, cultural, and economic role of these products in the development of rural communities. However, in Mexico, the database of useful plants of Mexico is relevant (Instituto de Biología—Universidad Nacional Autónoma de México, 2017).

It is necessary to carry out studies that link LUC at different spatial scales and wild fruits with food demand (Aide et al., 2013), which can generate data for conservation and food provision, geared toward food security along with the preservation of genetic diversity in forests and in productive agricultural systems, that are reservoirs for wild edible species or in the process of domestication (Caballero & Cortés, 2001). It is important to note that uncultivated foods can help increase food security, but only if protected by public policies for their conservation and management (Bharucha & Pretty, 2010; Jamnadass et al., 2015; Sunderland, Powell, Ickowitz, & Foli, 2013; Turner et al., 2011). The action of various public policies has blocked the development and application of community use rules appropriate to local conditions (Merino-Pérez, 2004). To be able to achieve these goals, it is necessary to establish a baseline knowledge. WEF are collected in temperate and tropical forests and sometimes are cultivated in orchards, some are transplanted along the edges of agricultural fields and living fences (Bharucha & Pretty, 2010). Also on arid and semiarid areas, xerophilous scrub is established, vegetation where we do not register any WEF. Particularly in the dry tropics, traditional silvopastoral systems are related to woody species that are used as a source of fodder for livestock. To date, most of the studies that record WEF were made in Africa and Asia (Akinnifesi et al., 2006; Tincani, 2009). In Mexico, over 200 species have been documented (Mapes & Basurto, 2016), although, due to environmental heterogeneity and management types, it is possible that there are more species. However, studies on WEF in this country are still rare. In Veracruz state, 120 species have been recorded (Lascurain-Rangel, Avendaño, del Amo, & Niembro, 2010), which represent 60% of those cited for the country as a whole; however, the WEF record is currently considered very likely to be incomplete.

In Veracruz, the threat of deforestation (0.19% between 1993 and 2000) not only extends to the preserved forest cover but also to traditional agroforestry systems; secondary forests constitute an important component of tree vegetation (Ellis & Martínez Bello, 2010). The disappearance of temperate forests and their associated biodiversity directly impacts the environments where WEF grow, with consequences such as the possible diminishing of social well-being of the inhabitants and the loss of cultural capital in the impacted regions. We do not have enough data of the extraction intensity of WEF, but there is a long traditional history of their use (Lascurain-Rangel et al., 2010). In this context, the main goal of this article is to evaluate the state of vegetation in different vegetation types and consider the effect of LUCs in WEF species distribution between 1993 and 2013.

Methods

Study Area

The state of Veracruz is located in the eastern region of Mexico, between the latitudes 22°20′19" to the north and 17°08′02" to the south and between the longitudes 93°36′28" to the east and 98°40′58" to the west (Figure 1). According to the National Geostatistical Framework of the Republic of México (INEGI, 2017), the continental surface of Veracruz covers 7,020,363 ha, which represents 3.7% of the national territory, making it the 11th largest state. This state has a high environmental heterogeneity and includes 10 vegetation types (Rzedowski, 2006), which makes it the third most biodiverse state in the country.

LUC and Vegetation

Based on Lascurain-Rangel et al. (2010), 106 species of WEFs, each with backing herbarium material deposited in the Herbarium XAL (Instituto de Ecología, A. C.), were selected to generate a map of the density of collections. Based on the change of vegetation cover for two decades (1993–2013), a matrix of LUC was developed in order to infer the future availability of the WEF in Veracruz. Vector layers of vegetation were used for the Series IV (INEGI, 1993) and V (INEGI, 2013) at

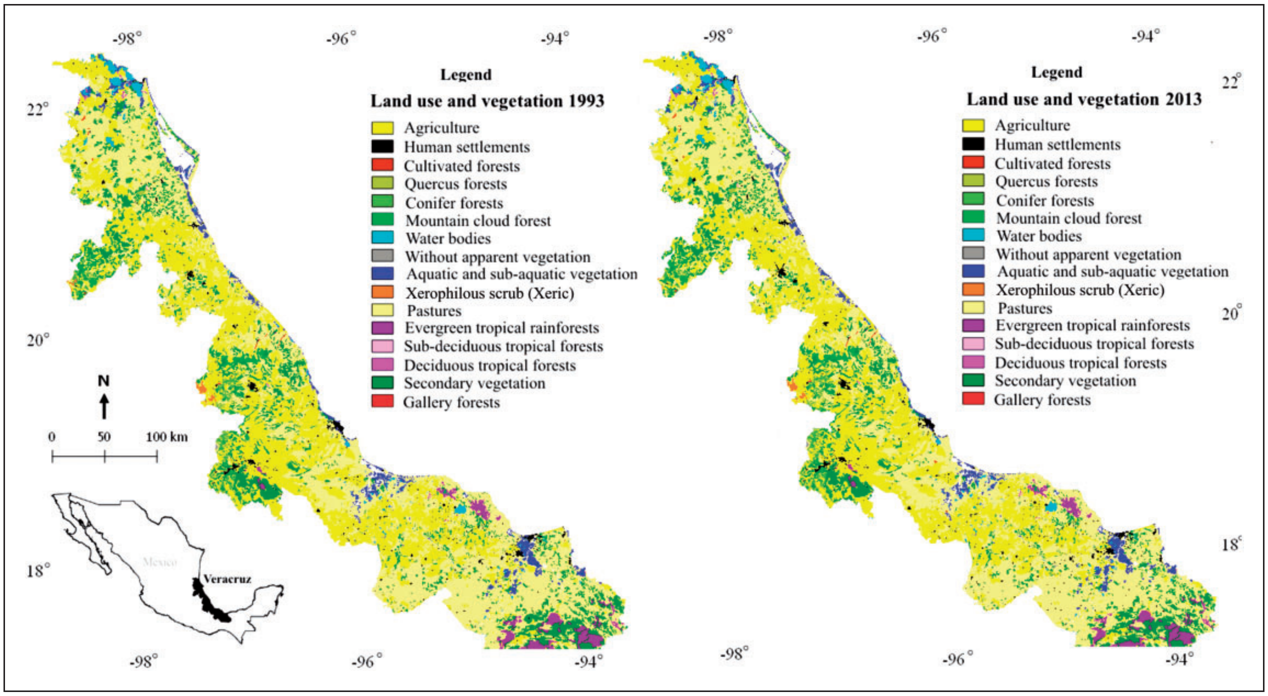

Figure 1. Localization of Veracruz state, Mexico. Vegetation and land-use change between 1993 and 2013.
Source: Vector data from land-use and vegetation scale 1: 250,000 (INEGI, 1993, 2013).

1: 250,000 scale. The latter were reclassified according to the guide to cartographic interpretation of use of soil and vegetation of the Series V (INEGI, 2013) and the types of vegetation per Rzedowski (2006). Reclassified polygons from Series IV and V were turned into raster format with a pixel size of 100×100 m. Finally, 1993 and 2013 raster layers were analyzed by LUC modules and simulation from QGIS 2.2 (NextGIS, 2017). The 10 types of vegetation selected correspond to the locations of WEF species in Veracruz. With some exceptions, certain species were grouped together in the pasture and savanna lands; aquatic and subaquatic vegetation were grouped in mangrove, popal, and tular; and finally, halophilic pasture land was included in the dunes category.

Potential Distribution

Database. To understand how WEF species would be affected by LUC, seven species of economic and cultural importance, with restricted distribution in Veracruz, according to records of the XAL Herbarium, and from the data from the Global Biodiversity Information Facility (2017), were selected: piñón (*Pinus cembroides*), palo de fraile (*Couepia polyandra*), zapote negro (*Diospyros conzattii*), nuez de castilla (*Juglans pyriformis*), guayabillo (*Myrciaria floribunda*), jagua (*Genipa americana*), and anayo (*Beilschmiedia anay*). The species selected to estimate their current and potential distribution are provided in the Supplementary Material. The localities of occurrence were validated through discussion with specialists from 2010 to 2015 in the state (Figure 2). To reduce spatial autocorrelation, only one occurrence point per grid cell (i.e., $1 \text{ km} \times 1 \text{ km}$) was considered, following Maria and Udo (2017).

Modeling. The Maxent model v.3.4.1 (Phillips, Anderson, & Schapire, 2006) was used to estimate the actual and potential geographic distribution of each selected species. This model is based on a statistical approximation called maximum entropy, which formulates predictions using incomplete information, in this case, data on the presence of the species to estimate its potential distribution (Phillips et al., 2006); 6,000 pseudo-absence points were generated, following Maria and Udo (2017). Spatial data used for the Maxent model included 19 bioclimatic data variables from the database of CHELSA v.1.2 at a resolution of 30 arc seconds (Karger et al., 2016). CHELSA bioclimatic variables have proved to be the more suitable variables in mountainous and tropical areas (Maria and Udo, 2017).

For each species, the climate data set was checked for multicollinearity among the variables using Spearman's rank correlation, since high collinearity might lead to low model performance and wrong interpretations (Maria and Udo, 2017). We calculated pairwise Spermans's correlations, resulting in a small set of predictor variables ($r_s \leq 0.7$). The R package "niche-tool-box" (Osorio-Olvera, Barve, Barve, & Soberón, 2016) was used to clean up the occurrence database and to obtain the main predictor variables. Finally, AUC values were

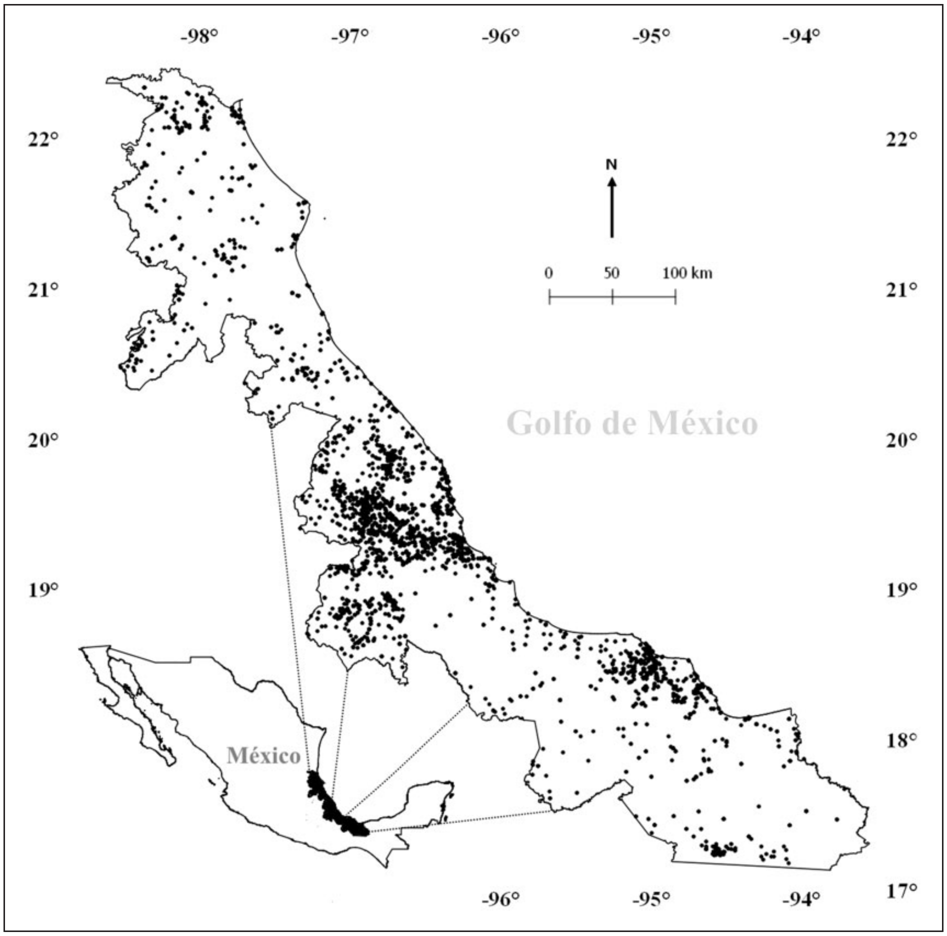

Figure 2. Distribution of collection points of the wild edible fruits in Veracruz.

calculated to describe the model performance or predictive accuracy. In this study, all statistical analyses were performed using the programming language R v.3.4 (R Core Team, 2017) and all maps were created using ArcGIS v.10.4.1 (Environmental Systems Research Institute, 2016).

Results

Current Vegetation and LUCs Between 1993 and 2013

In 1993, vegetation covered 4,493,499 ha in Veracruz (64.0%) while in 2013, it covered 4,479,577 ha (63.8%), which meant a decrease of 13,922 ha that includes cultivated forest, *Quercus* forest, conifer forest, mountain cloud forest, aquatic and subaquatic vegetation, xerophilous scrub, evergreen tropical forest, subdeciduous tropical forest, deciduous tropical forest, pastures, secondary vegetation, and gallery forest. The changes are shown in Figure 1 and are analyzed from data shown on Tables 1 and 2.

LUC Matrix and Transition

In the LUC matrix (Table 1), the changes that have occurred from 1993 to 2013 in Veracruz can be seen. The greatest loss corresponds to secondary vegetation (−13,160 ha), followed by the evergreen tropical forest (−7,746 ha) and the xeric category (−1,585 ha). The largest increases are in human settlements (11,669 ha) and pastures (4,130 ha). The matrix of transition (Appendix 1) shows that human settlements increased mostly in areas that were covered by pastures (0.003) and secondary vegetation (0.001), in tropical deciduous forest, gallery forests, and near bodies of water; settlements were identified on the margins of the rivers and on bodies of water covered. Pastures mainly replaced secondary vegetation (0.004), aquatic and subaquatic vegetation (0.003), as well as coniferous forest, evergreen tropical and mountain cloud forests, among others (all values > 0.017). Although agriculture decreased, its surface area changed in distribution, occupying areas of pasture lands (0.008) and secondary vegetation (0.002).

Table 1. Land-Use Change Matrix and Loss of Vegetation Cover Between 1993 and 2013 in Veracruz.

Vegetation type and land-use	Area, ha		Change	Change
	1993	2013	ha	%
Agriculture	2,360,917	2,360,293	−624	−0.01
Human settlements	83,896	95,565	11,669	0.16
Cultivated forests	2,440	3,190	750	0.02
Quercus forests	14,065	13,606	−459	−0.01
Conifer forests	73,647	73,688	41	<0.01
Mountain cloud forest	56,304	56,024	−280	<0.01
Water bodies	76,101	78,874	2,773	0.04
Without apparent vegetation	5,950	6,054	104	<0.01
Aquatic and subaquatic vegetation	174,262	178,913	4,651	0.07
Xerophilous scrub (Xeric)	12,747	11,162	−1,585	−0.02
Pastures	3,138,811	3,142,941	4,130	0.06
Evergreen tropical rainforests	132,537	124,791	−7,746	−0.11
Subdeciduous tropical forests	551	550	−1	<0.01
Deciduous tropical forests	6,096	5,832	−264	−0.01
Secondary vegetation	880,273	867,113	−13,160	−0.19
Gallery forests	1,766	1,767	−1	<0.01
Total	7,020,363	7,020,363		

Table 2. Extract of the Transition Matrix of Land-Use and Vegetation Cover Loss 1993 and 2013 in Veracruz.

	Agr	HS	PS	SV	Number of species	Unique
ETR	<0.01	<0.01	0.02	0.05	64	1
DTF	0.02	0.03	0.01	<0.01	51	6
MCF	<0.01	<0.01	<0.01	<0.01	33	1
QF	0.04	<0.01	0.01	0.01	25	s/r
CF	<0.01	<0.01	<0.01	<0.01	13	1
SDF	<0.01	<0.01	<0.01	<0.01	10	1
GF	<0.01	<0.01	<0.01	<0.01	1	2
XS	<0.01	<0.01	<0.01	0.12	0	s/r

Note. Vector data from INEGI, 1993 and 2013. Agr = Agriculture; HS = Human settlements; QF = *Quercus* forest; CF = Conifer forest; MCF = Mountain cloud forest; XS = Xerophilous scrub (xeric); PS = Pasture; ETR = Evergreen tropical rainforest; SDF = Subdeciduous tropical forest; DTF = Deciduous tropical forest; SV = Secondary vegetation; GF = Gallery forest. The full matrix is available in Appendix 1.

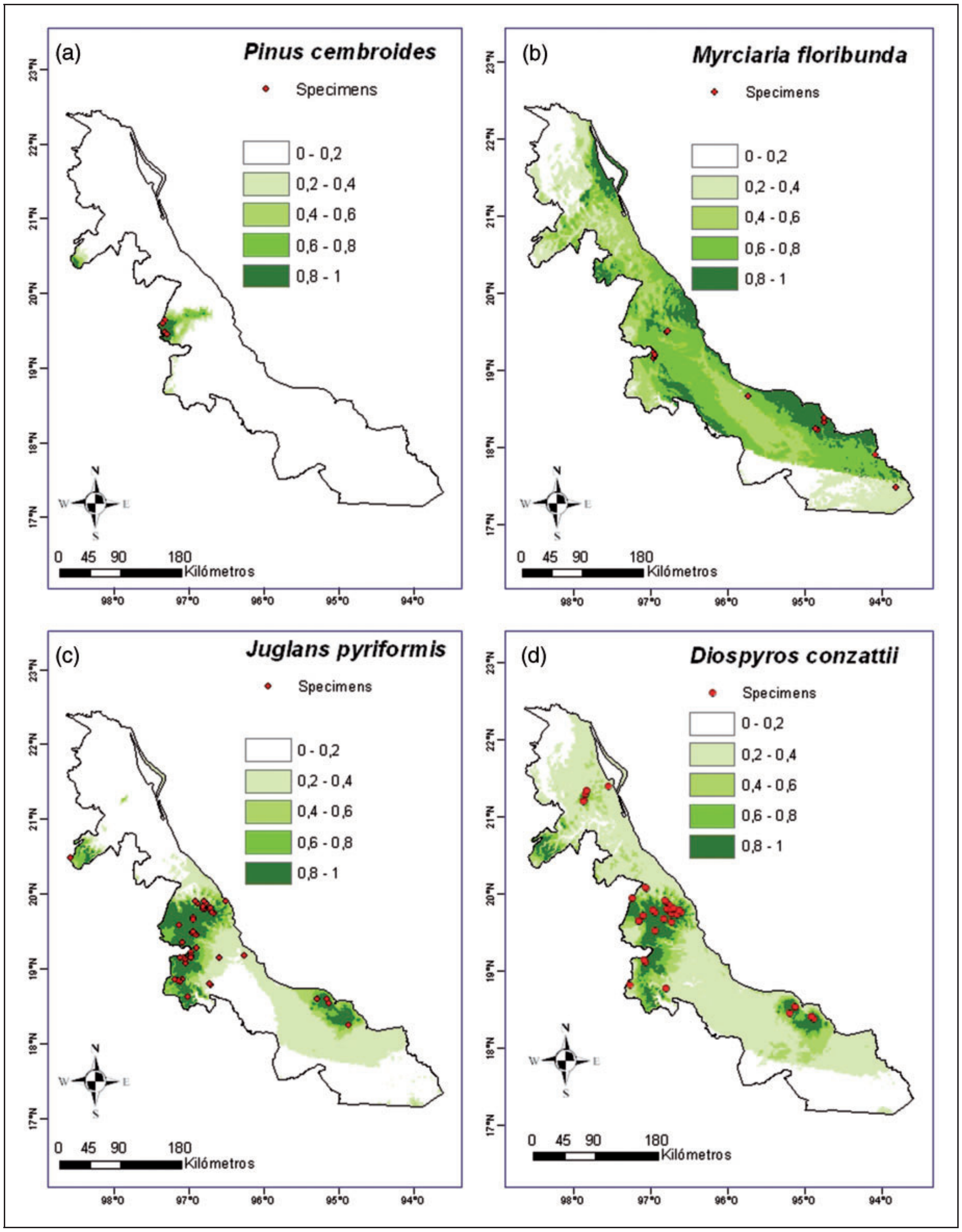

Figure 3. Potential distribution model of some edible species in Veracruz, Mexico: (a) *Pinus cembroides*, (b) *Myrciaria floribunda*, (c) *Juglans pyriformis*, and (d) *Diospyros conzattii*. The probability of presence as predicted by the Maxent models (0–1) is shown. The red points show the collection sites.

WEF Species per Vegetation Types and Current and Potential Distribution

Collections of WEF species are mainly distributed in the following types of vegetation: Evergreen tropical rainforest with 64 species, which means 60% of the total species recorded in our study (106) with potential edible fruits, tropical deciduous forest with 51 (48%), mountain cloud forest with 33 (31%), *Quercus* forest with 25 (23%), and subdeciduous tropical forest with 10 (9%). The greatest number of wild edible species fruits are concentrated in the center and southeast of the state, coinciding with forest types with the greatest richness, such as the evergreen tropical, deciduous, and cloud mountain forests (Figure 2).

The seven focused species were mostly distributed in the montane areas in an altitudinal range of 1,300 m to

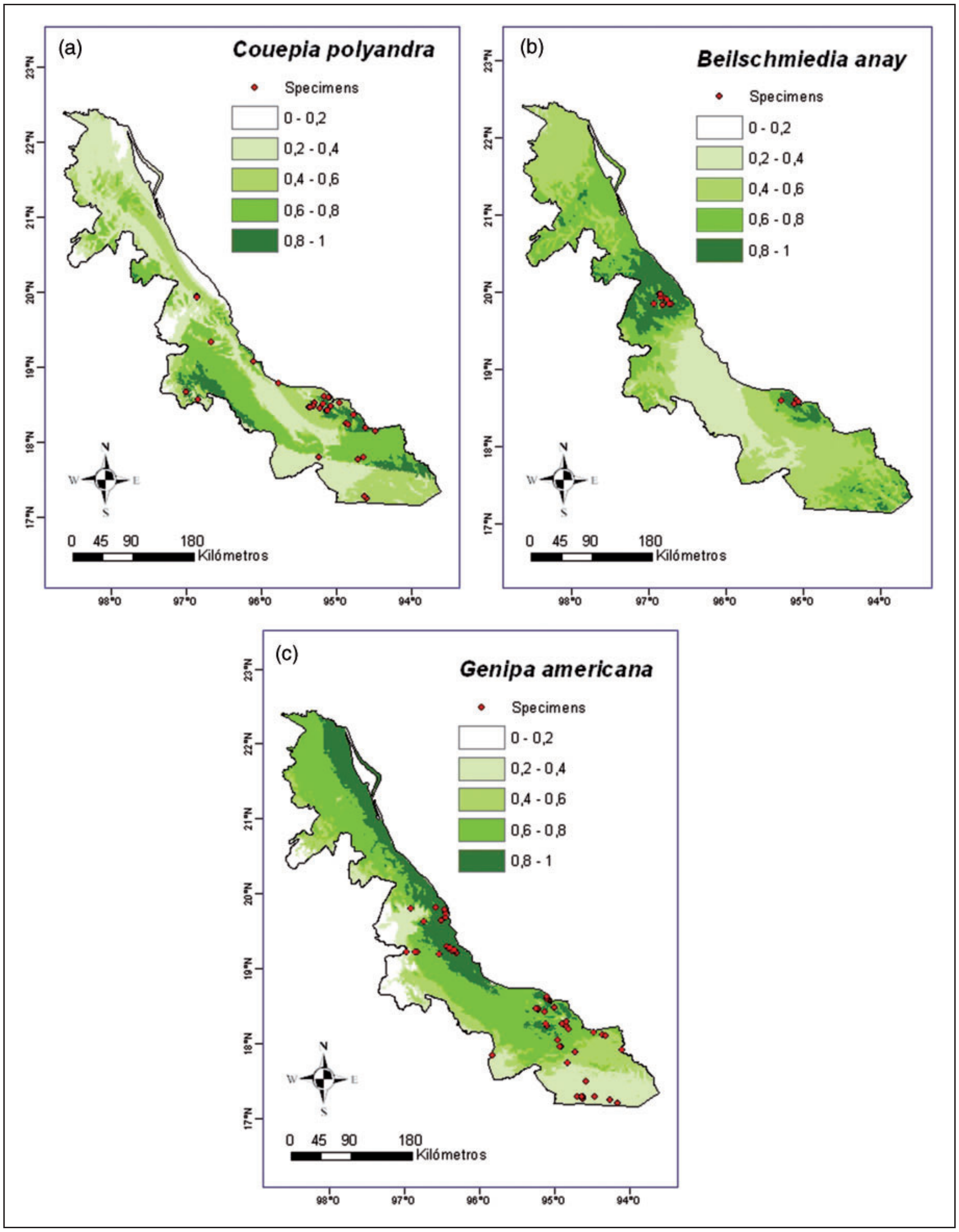

Figure 4. Potential distribution model of some edible species in Veracruz, Mexico: (a) *Couepia polyandra*, (b) *Beilschmiedia anay*, and (c) *Genipa americana*. The probability of presence as predicted by the Maxent models (0–1) is shown. The red points show the collection sites.

2,500 m, mainly in humid montane forests, but also in tropical humid, oak, and pine-oak forests (Figures 3 and 4). The predictive accuracy of the models generated for all the species was high, with area under the values ranging between 0.78 and 0.966 (Table 3). The three variables that best explain the presence of most of the species were isothermality, annual mean temperature, and mean diurnal range with some exceptions: *M. floribunda* and *J. pyriformis* for which the temperature seasonality was more important (Table 3).

Discussion

The largest loss between 1993 and 2013 was in secondary vegetation (0.19%) and evergreen tropical rainforest (0.11%). The main causes are the increment in human settlements and pasture, and grazing land (originally populated by tropical forests)—both factors that could put at risk, in the near future, most of the species studied. Of the seven species, six could be susceptible to undergo surface losses in Veracruz, due to its reduced distribution

Table 3. Summary of the Main Predictor Variables Climatic (Percent of Contribution), the Area Under the Curve (AUC) Values, Distributional Area (ha), and Percentage of the State's Distribution Surface (%) for Seven Edible Species in Veracruz, Mexico.

Species	Predictor variables (% model contribution)	AUC	Area	%
Pinus cembroides	Max Temperature of Warmest Month (41.9%), Isothermality (25.6%), Annual Precipitation (15.1%), Annual Mean Temperature (13%), Precipitation Seasonality (3.7%), and Mean Diurnal Range (0.8%)	0.93	47309	0.7
Myrciaria floribunda	Temperature Seasonality (61.8%), Mean Diurnal Range (22%), Annual Precipitation (8.5%), Precipitation of Warmest Quarter (6.3%), and Isothermality (1.4%)	0.82	84034	1.2
Couepia polyandra	Mean Diurnal Range (50.5%), Isothermality (24%), Annual Mean Temperature (16.9%), and Precipitation of Warmest Quarter (8.6%)	0.87	157547	2.2
Genipa americana	Annual Mean Temperature (31.5%), Annual Precipitation (30.1%), Isothermality (26.1%), Mean Diurnal Range (5.7%), Precipitation of Warmest Quarter (3.6%), and Precipitation of Driest Month (3.1%)	0.78	161763	2.3
Juglans pyriformis	Temperature Seasonality (64.5%), Precipitation of Warmest Quarter (18.3%), Annual Mean Temperature (13.4%), and Isothermality (3.8%)	0.92	186215	2.7
Diospyros conzattii	Annual Mean Temperature (30.5%), Mean Diurnal Range (22.5%), Precipitation of Warmest Quarter (18%), Isothermality (15 %), Annual Precipitation (13%), and Precipitation of Driest Month (0.8%)	0.91	187138	2.7
Beilschmiedia anay	Precipitation of Driest Month (74.9%), Isothermality (16%), and Annual Mean Temperature (9.1%)	0.83	314867	4.5

area along the sample sites and the pressure on its associated vegetation (Supplementary Material), in particular, *P. cembroides* (0.7%) and *M. floribunda* (1.2%). There are two species considered under conservation: *P. cembroides,* endemic and subject to special protection and *J. pyriformis*, nonendemic and threatened (NOM-059-SEMARNAT-2010; SEMARNAT, 2010); however, this species can be abundant in other regions or geographical scales (Eguiluz, 1982). In the context of this work, these two species deserve attention because of their economic importance (Supplementary Material).

The seven species inhabit mainly in tropical evergreen (Figures 3 and 4), deciduous forests, cloud mountain forests, and coastal lowlands. These areas show a higher probability of occurrence based on environmental characteristics ($p > 0.8$) present in forested areas. The difference between current and potential areas could be explained due to the impact of human activities (e.g., cattle pastures) and the loss of forest cover (secondary vegetation and ever green tropical rainforest). The types of vegetation that are changing and that are important habitat for the WEF with scarce herbarium records are as follows:

Forests tropical evergreen and deciduous: These types of vegetation occupy approximately 130,633 ha (2013). However, nowadays they are only found in the northern part of the Sierra de Los Tuxtlas and the Valley of Uxpanapa, with only 16% of the original cover (Ellis, Martínez-Bello, & Monroy-Ibarra, 2011). Currently, Veracruz is occupied by a mosaic of remnants of original vegetation mixed with pastures for livestock.

Pine and pine-oak forest: Several species have a distribution at the slopes of Cofre de Perote and Pico de Orizaba mountains. Similar tendencies were found in other studies that show between 3.8% and 4.8% (pine and pine-oak, respectively) of loss of natural vegetation in areas that were deforested (Armenta-Montero, Carvajal-Hernández, Ellis, & Krömer, 2015).

Humid montane forests: These forests are highly threatened by human population growth in Veracruz, with greater threat intensity in the central montane region (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, 2010). The seven edible species were also found in conservation hotspots in the state based on vegetation cover loss and anthropogenic pressures (Ellis et al., 2011).

The current state of the vegetation in Veracruz is the result of the policies of economic development driven for decades, aimed at promoting the preponderant agricultural and livestock activity. Temperate and tropical forests were not incorporated as productive areas to the regional economy, which generated a culture of illegal removal or replacement by other land uses (Gerez-Fernández & Pineda-López, 2011).

In terms of the context of managed systems, the agroforestry systems evolved both in the fields of cultivation outside the villages and in the orchards established next to the houses; these have been recognized for their high potential to reconcile the productive purposes with the conservation of biodiversity and ecosystem functions of great importance (Vallejo, Casas, Moreno Calles, & Blancas, 2016). Although, in this work, it was not possible to identify it in particular systems, relatively high levels of conservation of native forest species have been documented within the orchards through management. The agricultural and agroforestry systems integrate crops and wild species from the forest. It is recognized that they have remarkable benefits in terms of resource provision and functional ecosystems services, these systems integrate the management of water, soil, crops, vegetation, and animals (Moreno-Calles, Casas, Toledo, & Vallejo Ramos, 2016).

Implications for Conservation

The largest number of WEF species is recorded in the center and south of Veracruz in evergreen and deciduous tropical forests that also recorded the largest loss of surface in the studied period, and are being replaced mainly by pastures. One potential path for conservation of these species is to maintain the secondary forest that derived from original vegetation, and these areas could have a store of WEF as long as they do not turn into pastures.

Our results allow us to suggest that some conservation strategies should be addressed and reviewed to promote cross-sectoral measures to halt deforestation, and also address the design and promotion of reforestation and restoration programs, especially the species with restricted distribution, as is the case of the piñón (*P. cembroides*), whose seeds are of great commercial and nutritional value by the high content of fat and protein; this applies too to nuez de castilla (*J. pyriformis*), which is important for its edible fruit and its wood quality.

In this study, we have shown that many of the areas of vegetation that may be key to develop food security are threatened by the loss of forestland and should be protected through public policies. Planning for use of WEF should include strategies for rational use and conservation, promoting their sustainable management and that of the forests that host them, in the face of LUCs.

Appendix 1

Transition matrix of land-use and vegetation cover loss between 1993 and 2013 in Veracruz

Source: Vector data from INEGI, 1993 and 2013. Symbols (from their Spanish acronyms): Agriculture (Agr), Human settlements (HS), Cultivated forest (CuF), *Quercus* forest (QF), Conifer forest (CF), Mountain cloud forest (MCF), Water bodies (WB), Without apparent vegetation (WAV), Aquatic and subaquatic vegetation (ASV), Xerophilous scrub (xeric) (XS), Pasture (PS), Evergreen tropical rainforest (ETR), Subdeciduous tropical forest (SDF), Deciduous tropical forest (DTF), Secondary vegetation (SV), and Gallery forest (GF).

In the matrix, the numbers of rows represent the probability of occupation of vegetation types and land uses in Time 1 (t^1), in this case 1993, and columns, vegetation types and uses of the map at the Time 2 (t^2), in this case 2013. Areas unchanged, that is, unchanged areas between t^1 and t^2, are presented in the diagonal of the matrix; outside the diagonal numbers, correspond to the probability of transitions between the types t^1 and t^2.

	Agr	HS	CuF	QF	CF	MCF	WB	WAV	ASV	XS	PS	ETR	SDF	DTF	SV	GF
Agr	**0.986**	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.000	0.003	0.000
HS	0.004	**0.991**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.001	0.000
CuF	0.000	0.000	**0.998**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000
QF	0.038	0.000	0.000	**0.944**	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.012	0.000
CF	0.002	0.000	0.000	0.000	**0.996**	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000
MCF	0.003	0.000	0.000	0.000	0.000	**0.990**	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.001	0.000
WB	0.001	0.000	0.000	0.000	0.000	0.000	**0.976**	0.000	0.016	0.000	0.005	0.000	0.000	0.000	0.000	0.000
WAV	0.000	0.000	0.000	0.000	0.000	0.000	0.048	**0.934**	0.003	0.000	0.011	0.000	0.000	0.000	0.003	0.000
ASV	0.006	0.001	0.000	0.000	0.000	0.000	0.015	0.000	**0.966**	0.000	0.011	0.000	0.000	0.000	0.001	0.000
XS	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.873**	0.001	0.000	0.000	0.000	0.123	0.000
PS	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	**0.984**	0.000	0.000	0.000	0.004	0.000
ETR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.017	**0.936**	0.000	0.000	0.046	0.000
SDF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	**0.993**	0.000	0.004	0.000
DTF	0.015	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	**0.948**	0.000	0.000
SV	0.010	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.035	0.000	0.000	0.000	**0.953**	0.000
GF	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	**0.997**

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