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Sampling-event and checklist datasets of non-timber forest products and associated vascular flora from ejidos in Zacatecas, Mexico, within the Chihuahuan Desert Ecoregion (2020-2026)

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Abstract

Background

The Chihuahuan Desert in northern Mexico is notable for its rich vascular plant diversity and the significance of non-timber forest products (NTFPs) to local ejido communities. Despite their importance, standardized, accessible biodiversity data from community-managed forests remain limited.

New information

Here we present a comprehensive, open-access sampling-event and checklist datasets derived from standardized forest inventories conducted between 2020 and 2026 across twelve ejidos in Zacatecas, Mexico. The datasets encompass **2,629** sampling events, **21,451** occurrence records, and **50,167** measurements covering **129** vascular plant species, including **12** NTFP species. Rigorous spatial and taxonomic validation ensured data quality. These datasets provide a valuable baseline for monitoring biodiversity, informing sustainable community forest management, and supporting ecological research in arid and semi-arid environments of the Chihuahuan Desert.

The dataset distinguishes between focal NTFP taxa, measured in detail for forest-management purposes, and associated vascular flora, recorded as complementary

presence information either at the plot level or, in some ejidos, as study-level species-richness lists. Harvesting practices in these semi-arid systems generally involve removing specific plant parts rather than entire individuals. Commercially valuable parts include the buds of *Agave lechuguilla* Torr., cladodes of *Opuntia rastrera* F.A.C.Weber, branches of *Larrea tridentata* (DC.) Coville and *Flourensia cernua* DC., partial aerial biomass of *Euphorbia antisyphilitica* Zucc., and juvenile agave offshoots for reforestation projects. Because management is not exclusively extractive, this selective harvesting approach may increase the dataset's utility for future management, biodiversity, or ecological analyses.

Keywords

Chihuahuan Desert, non-timber forest products, community forest management, vascular flora, biodiversity monitoring

Introduction

In Mexico, many forested and semi-arid landscapes are managed under communal tenure by ejidos and agrarian communities (Morett-Sánchez and Cosío-Ruiz 2017). These institutions play a central role in community-based forest management and have been linked to important conservation outcomes (de la Mora et al. 2021, Morett-Sánchez and Cosío-Ruiz 2017). More than half of Mexico's territory is under communal tenure, comprising over 33,000 ejidos and agrarian communities where non-timber forest products (NTFPs) are vital for rural livelihoods and cultural practices (Delgado et al. 2016). In northern Mexico, the Chihuahuan Desert is recognized for its high floristic diversity and the importance of NTFPs to local communities (Villarreal-Quintanilla et al. 2017; Sosa et al. 2020). To legally use these NTFPs, ejido members must comply with regulations that require forest resource assessments through formal surveys (Delgado et al. 2016, de Mello et al. 2020). Although these forestry surveys generate valuable biodiversity data for management plans, such information is rarely made available as interoperable datasets (GBIF Secretariat and IAIA 2020). To address this gap, we compiled a standardized dataset from twelve ejidos in Zacatecas to document economically important NTFPs and associated flora within a regional framework.

Forest inventories are systematic efforts to measure and describe forest resources within a defined area. They provide essential information on the condition and composition of vegetation, which is needed for planning, management, and evaluation of forest resources (Villavicencio-Gutiérrez et al. 2021). Beyond their immediate purpose, inventory data provide a valuable basis for ecological analysis and biodiversity monitoring (Martínez Salvador et al. 2019).

In this context, we present a dataset derived from forest inventory activities conducted in twelve agrarian communities in northern Zacatecas. These include Morelos and Las Huertas in the municipality of Concepción del Oro, and El Berrendo, Camacho, Cuitláhuac, Presa del Junco, Sabana Grande, San Antonio del Portezuelo, San Francisco de los Quijano, San José de Carbonerillas, San Juan de los Charcos, and Santa Rosa in the municipality of Mazapil. All of these communities are located within the Mexican portion of the Chihuahuan Desert, where arid and semi-arid vegetation types, non-timber forest products, and local resource-use practices strongly influence forest management and conservation strategies (Villarreal-Quintanilla et al. 2017, Sosa et al. 2020, Delgado et al. 2016, Villavicencio-Gutiérrez et al. 2021, Fig. 1).

General description

Purpose: We aim to provide open access to a standardized compilation of sampling events and associated vascular plant records from a regional, ejido-based framework in the Chihuahuan Desert Ecoregion, thereby generating a reusable sampling-event dataset and increasing access to biodiversity data generated in the context of ejido-based forest management. This information can be used to effectively assess forest management over time, since every authorization for the extraction of plants or their derivatives is valid for only 5 years (SEMARNAT 2020) and can subsequently be renewed (while presenting a new inventory and analysis). It can also be used for biodiversity or ecological studies. This relevance is further underscored by the recent establishment of the Semidesierto Zacatecano Natural Protected Area (SEMARNAT 2024 , Suppl. material 4) which was designated as a Flora and Fauna Protection Area (CONANP 2026).

Project description

Title: Biodiversity Data from Forest Inventories in Zacatecas, Mexico

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Study area description: The study area covers social land tenure throughout Zacatecas, Mexico. Across Zacatecas, there are xerophytic shrublands, desert and semi-desert grasslands, temperate forests, tropical dry forests, gallery vegetation, and secondary vegetation. Depending on the dataset, samples may come from a variety of plant communities, including microphyllous (small-leaved) or rosetophyllous (rosette-forming) desert scrub, crassicaule (succulent-stemmed) scrub, natural or managed grasslands, oak and pine forests, mixed pine-oak forests, juniper woodlands, riparian areas, and other plant communities (Rzedowski 2006), found in communal and rural areas. Each dataset includes metadata detailing the exact geographic area (e.g., municipalities, ejidos, or communities), coordinates, vegetation types, field dates, and methods used to collect the records.

Design description: The project compiles field evidence from applied forestry activities, where biological records are collected to inform forest management and support local decision-making. The project design reflects the applied nature of the source studies. Fieldwork is conducted in community-managed landscapes and is organized according to the objectives of each forestry assessment. Records in the datasets originate from various types of surveys, including inventories focused on different resources or vegetation types. These field activities generate data on species presence, abundance, habitat, vegetation structure, useful plant resources, and measurable attributes of selected taxa. Following fieldwork and technical reporting, the collected records are reviewed, validated, standardized, harmonized, and mapped to Darwin Core terms.

Funding: The forest inventories from which data were derived were funded by the National Forestry Commission (CONAFOR) through the Sustainable Forest Development Support Program. Financial support was provided directly to the beneficiary ejidos. Depending on the study, work was conducted by Gestión para el Desarrollo Social y Ambiental (GDSA) and the Centro de Investigación, Divulgación y Asesoría Técnica Forestal y Agropecuaria (CIDYATFA), in accordance with the objectives, scope, contractual arrangements, and local conditions of each ejido. These studies generated primary field information on vegetation, forest resources, non-timber forest products, and associated biodiversity in community-managed landscapes of Zacatecas.

Sampling methods

Description: Field sampling was conducted across the twelve ejidos described above, forming a regional study extent within the Chihuahuan Desert (Fig. 2).

Sampling description: Field sampling was conducted between 2020–2026 across twelve ejidos in northern Zacatecas. The study areas in each ejido were defined with the ejidatarios and local inhabitants, according to their harvesting practices, economic activities, and the location of the targeted NTFP species (Suppl. material 2). Sampling was made using circular plots of 500 m² (radius = 12.61 m), the WKT representation of each sampling plot was obtained using the sf package (Pebesma 2018, Pebesma and Bivand 2023) on R Studio. The study design considered a 95% confidence level, a 10% sampling error, and a sampling intensity of ~0.25%. A total of 2,617 georeferenced sampling plots were generated within the management polygons (Suppl. material 3) using QGIS and the Processing algorithm “Random points in extent” (QGIS.org 2026). The procedure was applied during the 2020–2026 field campaigns to establish pre-sampling sites and, after the minimum number of plots required for each target species had been estimated according to the allowed sampling error and precision of the forest-inventory design, to generate additional candidate sites until the required sampling effort was reached. A minimum distance of 50 m between points was used to avoid spatial clustering.

Sampling plot sites were established in the field at their original locations whenever possible; when access was unsafe or impracticable due to steep terrain, loose gravel, high stoniness or dense vegetation cover, plots were relocated to the nearest accessible position. All final plot locations were established on slopes below 45°, relocations remained within 100 m of the original candidate point, and relocated plots were checked to avoid overlap with any other sampling point. Thus, plot placement should be interpreted as random allocation within the forestry-inventory sampling frame and management polygons.

Plots were georeferenced with Garmin eTrex 65s GPS equipment; boundaries were marked at cardinal points. Associated vascular flora was recorded either at the plot level or across the ejido-level sampling campaign (Fig. 3), depending on the field protocol applied in each locality, as indicated in Table 1, which summarizes the sampling effort implemented, temporal coverage and criteria used to record associated vascular flora. Within each plot, target NTFP species were measured according to taxon-specific protocols. The reference thresholds used to interpret plant-size and harvestability measurements for focal NTFP taxa are provided in Table 2.

In the published Darwin Core Archive, these plot-level records were organized within a hierarchical sampling-event structure that includes 12 additional parent events representing ejido-level sampling campaigns, resulting in a total of 2,629 event records in the Event Core. Best practice guidelines were used to support estimates of the evaluated forest resources (CONABIO 2022, López-Serrano et al. 2021a, López-Serrano et al. 2021b, López-Serrano et al. 2021c, López-Serrano et al. 2021d, López-Serrano et al. 2021e, López-Serrano et al. 2021f, López-Serrano et al. 2021g, Solís et al. 1989).

Quality control: Spatial quality control involved manual comparison of field forms against digitized coordinates to identify inconsistencies. When GPS waypoint files were available, coordinates were validated against field records. When unavailable, records were reviewed based on sampling design and study area boundaries, with attention to records located outside expected areas or showing atypical spatial positions.

Prior to integration into the final dataset, species records underwent taxonomic validation (Suppl. material 5). This process improved nomenclatural consistency and record accuracy, which facilitates compatibility with global biodiversity databases. These measures supported data quality and reproducibility (Grenié et al. 2023, Berendsohn et al. 2026).

Taxonomic validation was conducted using R version 4.5.3 (R Core Team 2026) in RStudio, employing the rgbif package (Chamberlain et al. 2026), which provides access to the GBIF Backbone Taxonomy (GBIF Secretariat 2023). To improve matching accuracy, each record was evaluated in both its original form (including authorship) and a simplified form (genus and specific epithet only). The most consistent result was selected based on match quality and confidence metrics. This approach is consistent with recommendations for taxonomic name harmonization, which endorse the use of multiple name representations to maximize matching success and minimize assignment errors (Grenié et al. 2023).

Scientific names flagged during validation as requiring nomenclatural changes were manually reviewed. These names were cross-checked against specialized taxonomic databases, including Plants of the World Online (Royal Botanic Gardens, Kew 2026) and the Taxonomic Catalog of Biota in México (CONABIO 2026) for taxonomic status and the International Plant Names Index (The Royal Botanic Gardens, Kew et al. 2026) for nomenclature. Out of the 22 flagged species, 19 were changed to their exact match outcome and 3 species were assigned scientific names that differed from those provided by rgbif: *Larrea tridentata* (DC.) Coult. was changed to *Larrea tridentata* (DC.) Coville; *Neltuma laevigata* (Humb. & Bonpl. ex Willd.) Britton & Rose was retained instead of *Prosopis laevigata* (Humb. & Bonpl. ex Willd.) M. C. Johnst; and *Ferocactus hamatacanthus* (Muehlenpf.) Britton & Rose was retained instead of *Bisnaga hamatacantha* subsp. hamatacantha.

To enhance spatial data quality, occurrence coordinates were screened using the CoordinateCleaner package (Zizka et al. 2019). The assessment did not identify spatial inconsistencies or records requiring correction.

Step description: Field data compilation: Vascular plant records were compiled from field observations within the study area. Locality information, sampling events, taxonomic identifications, and associated field notes for each record were reviewed and organized into a standardized tabular format following Darwin Core terms.

Data quality control: Quality control procedures involved verifying the consistency of identifiers, dates, coordinates, locality names, taxonomic fields, and required Darwin Core terms. Taxonomic validation and spatial screening were implemented as detailed in the Quality Control section.

Final data processing: Following taxonomic and structural validation, the final datasets were prepared for publication via the IPT as a Darwin Core Archive. The dataset is provided as a sampling-event resource, including occurrence records and associated measurements or facts.

Geographic coverage

Description: Mazapil and Concepción del Oro, Zacatecas, México.

Coordinates: 24.081 and 25.004 Latitude; -102.615 and -101.086 Longitude.

Taxonomic coverage

Description: The checklist comprises 306 accepted taxonomic entries of vascular plants within the kingdom Plantae and phylum Tracheophyta. These entries represent 5 classes, 23 orders, 42 families, 105 genera, 128 species, and 1 subspecies. At taxon level, the checklist includes 129 taxa (Fig. 4): 128 species and 1 subspecies. The families Cactaceae, Asteraceae, Asparagaceae, Fabaceae, and Verbenaceae are the most represented (Fig. 5 & Fig. 6). Phylogenetic trees at species and family levels illustrate evolutionary relationships among recorded taxa; family-level richness is visualized by circle size and color on divergence-time-scaled trees.

The dataset considers two categories of records: NTFP taxa and associated vascular flora. NTFP taxa are the productive species examined in detail for forest management, and the focal set was defined by the productive activities, management interests, and decisions of each ejido. Twelve species were treated as focal NTFP taxa: *A. asperrima*, *A. lechuguilla*, *A. salmiana*, *D. cedrosanum*, *E. antisyphilitica*, *F. cernua*, *J. dioica*, *L. tridentata*, *Lippia origanoides*, *N. cespitifera*, *O. rastrera*, and *P. cembroides*. These taxa account for 14,910 of the 21,451 records in the Occurrence extension (69.51%), and associated vascular flora accounts for the remaining 6,541 records (30.49%).

Associated vascular flora is documented as complementary biodiversity information, and its completeness varies across ejidos. In some ejidos, this flora was compiled as a study-level richness list and is represented in the Occurrence extension by a single occurrence per species. In others, it was registered at the plot level, denoting presence within individual sampling plots. Abundance was not estimated for these taxa, so the records should be interpreted as presence data only.

We report 21,451 records, of which 21,094 records (98.34%) were resolved to species or subspecies level. Only 357 records (1.66%) were retained above species level: 248 records (1.16%) were genus-only identifications across 21 genera and 109 records (0.51%) were family-only identifications across six families. All genus-only and family-only records were recorded during the dry season, mainly in January, November and December, and were concentrated in three ejidos. These unresolved identifications correspond to Cactaceae (229 records; 64.15% of unresolved records), followed by herbaceous groups, mainly Asteraceae and Poaceae (73 records; 20.45%) and woody shrubs or broader woody groups (55 records; 15.41%). During taxonomic harmonization, these records were not forced to species-level names; they were retained at the highest reliable taxonomic rank to avoid unsupported species-level determinations.

The phylogeny was generated in R (R Core Team 2026) using the V.PhyloMaker2 package (Jin and Qian 2022), with the GBOTB.extended.WP megatree and associated nodes.info.1.WP node-age file implemented in the package (Suppl. material 6) . The GBOTB.extended.WP backbone is based on the GBOTB see-plant phylogeny of Smith and Brown (2018), extended with pteridophyte lineages from Zanne et al. 2014 and divergence-time estimates from Smith et al. 2018. The input table contained the three columns required by phylo.maker: species, genus, ans family. Phylogenetic reconstruction was performed using phylo.maker(sp.list = species_list, tree = GBOTB.extended.WP, nodes = nodes.info.1.WP, scenarios = "S3"). All 128 binomial terminals used as input were retained in the resulting scenario S3 phylogeny, and no taxa were dropped. Taxa not directly represented in the backbone were placed according to the S3 procedure implemented in V.PhyloMaker2. The input list included two fern taxa in Polypodiopsida and Pteridaceae, both of which were retained in the resulting phylogeny; therefore, non-seed vascular plants were included in the dated tree rather than excluded. The family-level tree was generated by pruning the species-level tree to one representative terminal per family among taxa retained in the phylogeny. Phylogenetic manipulation, tree pruning, and topology processing were performed using the ape package (Paradis and Schliep 2018). Tree visualization was conducted with ggtree (Yu et al. 2016) and ggplot2 (Wickham 2016) in RStudio version 2026.05.0+218 (Posit team 2026).

Taxa included:

Rank	Scientific Name	Common Name
kingdom	Plantae	
phylum	Tracheophyta	
class	Gnetopsida	
class	Liliopsida	
class	Magnoliopsida	
class	Pinopsida	
class	Polypodiopsida	
order	Asparagales Link	
order	Asterales Link	
order	Boraginales Juss. ex Bercht. & J. Presl	
order	Brassicales Bromhead	
order	Caryophyllales Juss. ex Bercht. & J. Presl	
order	Celastrales Link	
order	Ephedrales Dumort.	
order	Ericales Bercht. & J. Presl	
order	Fabales Bromhead	
order	Fagales Engl.	
order	Gentianales Juss. ex Bercht. & J. Presl	
order	Lamiales Bromhead	
order	Malpighiales Juss. ex Bercht. & J. Presl	
order	Malvales Juss. ex Bercht. & J. Presl	
order	Pinales Gorozh.	
order	Poales Small	
order	Polypodiales Link	
order	Ranunculales Juss. ex Bercht. & J. Presl	

order	Rosales Bercht. & J. Presl	
order	Sapindales Juss. ex Bercht. & J. Presl	
order	Saxifragales Bercht. & J. Presl	
order	Solanales Juss. ex Bercht. & J. Presl	
order	Zygophyllales Link	
family	Amaranthaceae Juss.	
family	Anacampserotaceae Eggli & Nyffeler	
family	Anacardiaceae R. Br.	
family	Apocynaceae Juss.	
family	Asparagaceae Juss.	
family	Asphodelaceae Juss.	
family	Asteraceae Bercht. & J. Presl	
family	Berberidaceae Juss.	
family	Bignoniaceae Juss.	
family	Brassicaceae Burnett	
family	Bromeliaceae Juss.	
family	Burseraceae Kunth	
family	Cactaceae Juss.	
family	Celastraceae R. Br.	
family	Convolvulaceae Juss.	
family	Crassulaceae J. St.-Hil.	
family	Cupressaceae Gray	
family	Ehretiaceae Mart.	
family	Ephedraceae Dumort.	
family	Euphorbiaceae Juss.	
family	Fabaceae Lindl.	
family	Fagaceae Dumort.	
family	Fouquieriaceae DC.	
family	Heliotropiaceae Schrad.	
family	Koeberliniaceae Engl.	
family	Krameriaceae Dumort.	

family	Lamiaceae Martinov	
family	Malvaceae Juss.	
family	Oleaceae Hoffmanns. & Link	
family	Orobanchaceae Vent.	
family	Pinaceae Spreng. ex F. Rudolphi	
family	Poaceae Barnhart	
family	Polemoniaceae Juss.	
family	Pteridaceae E.D.M. Kirchn.	
family	Rhamnaceae Juss.	
family	Rosaceae Juss.	
family	Rubiaceae Juss.	
family	Scrophulariaceae Juss.	
family	Simaroubaceae DC.	
family	Solanaceae Juss.	
family	Verbenaceae J. St.-Hil.	
family	Zygophyllaceae R. Br.	
genus	*Acourtia* D.Don	
genus	*Adolphia* Meisn.	
genus	*Agave* L.	
genus	*Alloberberis* C.C.Yu & K.F.Chung	
genus	*Aloysia* Paláu	
genus	*Aphyllon* Mitch.	
genus	*Ariocarpus* Scheidw.	
genus	*Aristida* L.	
genus	*Artemisia* L.	
genus	*Asphodelus* L.	
genus	*Astrolepis* D.M.Benham & Windham	
genus	*Atriplex* L.	
genus	*Baccharis* L.	
genus	*Bauhinia* Plum. ex L.	
genus	*Bouteloua* Lag.	

genus	*Bouvardia* Salisb.	
genus	*Brickellia* Elliott	
genus	*Buddleja* L.	
genus	*Bursera* Jacq. ex L.	
genus	*Calanticaria* (B.L.Rob. & Greenm.) E.E.Schill. & Panero	
genus	*Calliandra* Benth.	
genus	*Castilleja* L.f.	
genus	*Cercocarpus* Kunth	
genus	*Chilopsis* D.Don	
genus	*Chrysactinia* A.Gray	
genus	*Citharexylum* B.Juss.	
genus	*Cochemiea* (K.Brandegee) Walton	
genus	*Condalia* Cav.	
genus	*Coryphantha* (Engelm.) Lem.	
genus	*Cuscuta* L.	
genus	*Cylindropuntia* (Engelm.) F.M.Knuth	
genus	*Dalea* L.	
genus	*Dasylirion* Zucc.	
genus	*Dasyochloa* Willd. ex Steud., 1840	
genus	*Datura* L.	
genus	*Dermatophyllum* Scheele	
genus	*Dysphania* R.Br.	
genus	*Dyssodia* Cav.	
genus	*Echeveria* DC.	
genus	*Echinocactus* Link & Otto	
genus	*Echinocereus* Engelm.	
genus	*Ephedra* Tourn. ex L.	
genus	*Euphorbia* L.	
genus	*Euploca* Nutt.	
genus	*Eysenhardtia* Kunth	
genus	*Ferocactus* Britton & Rose	

genus	*Flourensia* DC.	
genus	*Forestiera* Poir.	
genus	*Fouquieria* Kunth	
genus	*Fraxinus* Tourn. ex L.	
genus	*Grahamia* Gillies ex Hook. & Arn.	
genus	*Grusonia* F.Rchb. ex Britton & Rose	
genus	*Gymnosperma* Less.	
genus	*Hechtia* Klotzsch	
genus	*Hedosyne* Strother	
genus	*Holacantha* A.Gray	
genus	*Jatropha* L.	
genus	*Juniperus* L.	
genus	*Koeberlinia* Zucc.	
genus	*Krameria* L.	
genus	*Larrea* Cav.	
genus	*Leucophyllum* Humb. & Bonpl.	
genus	*Lindleya* Kunth	
genus	*Lippia* L.	
genus	*Loeselia* L.	
genus	*Lophophora* J.M.Coult.	
genus	*Lycium* L.	
genus	*Mammillaria* Haw.	
genus	*Mandevilla* Lindl.	
genus	*Mimosa* L.	
genus	*Mortonia* A.Gray	
genus	*Muhlenbergia* Schreb.	
genus	*Myriopteris* Fée	
genus	*Nahuatlea* V.A.Funk	
genus	*Neltuma* Raf.	
genus	*Nolina* Michx.	
genus	*Opuntia* Mill.	

genus	*Parthenium* L.	
genus	*Pellaea* Link	
genus	*Peniocereus* (A.Berger) Britton & Rose	
genus	*Physalis* L.	
genus	*Physaria* A.Gray	
genus	*Pinus* L.	
genus	*Pseudognaphalium* Kirp.	
genus	*Psilostrophe* DC.	
genus	*Purshia* DC.	
genus	*Quercus* L.	
genus	*Rhus* L.	
genus	*Salvia* L.	
genus	*Senna* Mill.	
genus	*Sidneya* E.E.Schill. & Panero	
genus	*Solanum* L.	
genus	*Sphaeralcea* A.St.-Hil.	
genus	*Sporobolus* R.Br.	
genus	*Stenocactus* (K.Schum.) A.Berger	
genus	*Tecoma* Juss.	
genus	*Thymophylla* Lag.	
genus	*Tillandsia* L.	
genus	*Tiquilia* Pers.	
genus	*Vachellia* Wight & Arn.	
genus	*Verbena* L.	
genus	*Viguiera* Kunth	
genus	*Xanthisma* DC.	
genus	*Yucca* L.	
genus	*Zinnia* L.	
species	*Acourtia nana* (A.Gray) Reveal & R.M.King	
species	*Adolphia infesta* (Kunth) Meisn.	
species	*Agave asperrima* Jacobi	Maguey

species	*Agave lechuguilla* Torr.	Lechuguilla
species	*Agave salmiana* Otto ex Salm-Dyck	Maguey verde
species	*Agave striata* Zucc.	Guapilla
species	*Alloberberis pinifolia* (Lundell) C.C.Yu & K.F.Chung	Agrito
species	*Aloysia gratissima* (Gillies & Hook.) Tronc.	Vara dulce
species	*Aloysia wrightii* A.Heller	Vara dulce
species	*Aphyllon cooperi* A.Gray	
species	*Ariocarpus retusus* Scheidw.	Chaute
species	*Artemisia klotzschiana* Besser	Estafiate
species	*Asphodelus fistulosus* L.	Cebollín
species	*Astrolepis cochisensis* (Goodd.) D.M.Benham & Windham	Helecho
species	*Atriplex canescens* (Pursh) Nutt.	Costilla de vaca
species	*Baccharis pteronioides* DC.	
species	*Bouteloua gracilis* (Kunth) Lag. ex Griffiths	Navajita
species	*Bouteloua reederorum* Columbus	Zacate rueda
species	*Bouvardia ternifolia* (Cav.) Schltdl.	Trompetilla
species	*Brickellia veronicifolia* (Kunth) A.Gray	Paistón
species	*Buddleja* marrubiifolia Benth.	
species	*Buddleja scordioides* Kunth	
species	*Bursera fagaroides* (Kunth) Engl.	Palo mulato
species	*Calanticaria greggii* (A.Gray) E.E.Schill. & Panero	Chamizo
species	*Castilleja lanata* A.Gray	
species	*Chilopsis linearis* (Cav.) Sweet	Mimbre
species	*Chrysactinia mexicana* A.Gray	San Nicolás
species	*Citharexylum brachyanthum* (A.Gray ex Hemsl.) A.Gray	Pata de gallo
species	*Cochemiea conoidea* (DC.) P.B.Breslin & Majure	Pumilla
species	*Condalia fasciculata* I.M.Johnst.	
species	*Condalia warnockii* M.C.Johnst.	Chaparro
species	*Coryphantha delicata* L.Bremer	
species	*Cylindropuntia imbricata* (Haw.) F.M.Knuth	Cardenche
species	*Cylindropuntia kleiniae* (DC.) F.M.Knuth	Tasajillo

species	*Cylindropuntia leptocaulis* (DC.) F.M.Knuth	Tasajillo
species	*Cylindropuntia tunicata* (Lehm.) F.M.Knuth	Clavellina
species	*Dalea bicolor* Humb. & Bonpl. ex Willd.	Ramoncillo
species	*Dasylirion acrotrichum* (Schiede) Zucc.	Sotol
species	*Dasylirion cedrosanum* Trel.	Sotol
species	*Dasyochloa pulchella* Willd.	Pasto borreguero
species	*Datura quercifolia* Kunth	Toloache
species	*Dermatophyllum secundiflorum* (Ortega) Gandhi & Reveal	Patol
species	*Dysphania graveolens* (Willd.) Mosyakin & Clemants	
species	*Dyssodia papposa* (Vent.) A.Hitchc.	
species	*Echeveria paniculata* A.Gray	
species	*Echeveria schaffneri* (S.Watson) Rose	
species	*Echinocactus horizonthalonius* Lem.	Mancacaballo
species	*Echinocactus platyacanthus* Link & Otto	Biznaga burra
species	*Echinocereus enneacanthus* Engelm.	Alicoche
species	*Echinocereus parkeri* N.P.Taylor	Chayotillo
species	*Echinocereus pectinatus* (Scheidw.) Engelm.	Huevo de toro
species	*Ephedra antisyphilitica* Berland. ex C.A.Mey.	Pitorreal
species	*Ephedra aspera* Engelm. ex S.Watson	Pitorreal
species	*Euphorbia antisyphilitica* Zucc.	Candelilla
species	*Euploca torreyi* (I.M.Johnst.) Halse & Feuillet	
species	*Ferocactus hamatacanthus* (Muehlenpf.) Britton & Rose	Biznaga ganchuda
species	*Ferocactus pilosus* (Salm-Dyck) Werderm.	Biznaga cabuchera
species	*Ferocactus uncinatus* (Galeotti) Britton & Rose	
species	*Flourensia cernua* DC.	Hojasén
species	*Forestiera angustifolia* Torr.	Garrapata
species	*Fouquieria splendens* Engelm.	Albarda
species	*Grahamia frutescens* (A.Gray) G.D.Rowley	
species	*Grusonia vilis* (Rose) H.Rob.	Perritos
species	*Gymnosperma glutinosum* (Spreng.) Less.	Nota
species	*Hechtia texensis* S.Watson	Guapilla china

species	*Hedosyne ambrosiifolia* (A.Gray) Strother	
species	*Holacantha stewartii* C.H.Mull.	Corona de cristo
species	*Jatropha dioica* Sessé	Sangre de grado
species	*Koeberlinia spinosa* Zucc.	Junco
species	*Krameria cytisoides* Cav.	Pegaropa
species	*Larrea tridentata* (DC.) Coville	Gobernadora
species	*Leucophyllum frutescens* (Berl.) I.M.Johnst.	Cenizo
species	*Lindleya mespiloides* Kunth	Manzanilla
species	*Lippia origanoides* Kunth	Oregano
species	*Loeselia coerulea* (Cav.) G.Don	
species	*Lophophora williamsii* (Lem. ex Salm-Dyck) J.M.Coult.	Peyote
species	*Lycium berlandieri* Dunal	
species	*Mammillaria formosa* Galeotti ex Scheidw.	Biznaga
species	*Mammillaria heyderi* Muehlenpf.	Chilitos
species	*Mammillaria pottsii* Scheer ex Salm-Dyck	Biznaga chilera
species	*Mimosa aculeaticarpa* Ortega	Gatuño
species	*Mimosa zygophylla* Benth.	Uña de gato
species	*Mortonia greggii* A.Gray	Afinador
species	*Mortonia palmeri* Hemsl.	Afinador
species	*Muhlenbergia rigida* (Kunth) Kunth	Zacate
species	*Nahuatlea hypoleuca* (DC.) V.A.Funk	Ocotillo
species	*Neltuma laevigata* (Humb. & Bonpl. ex Willd.) Britton & Rose	Mezquite
species	*Nolina cespitifera* Trel.	Cortadillo
species	*Opuntia engelmannii* Salm-Dyck ex Engelm.	Nopal cuijo
species	*Opuntia leucotricha* DC.	Nopal duraznillo
species	*Opuntia microdasys* (Lehm.) Pfeiff.	Nopal cegador
species	*Opuntia rastrera* F.A.C.Weber	Nopal rastrero
species	*Opuntia robusta* H.L.Wendl.	Nopal tapón
species	*Opuntia stenopetala* Engelm.	Nopal sierreño
species	*Opuntia streptacantha* Lem.	Nopal cardón
species	*Parthenium argentatum* A.Gray	Guayule

species	*Parthenium incanum* Kunth	Mariola
species	*Pellaea intermedia* Mett.	
species	*Peniocereus greggii* (Engelm.) Britton & Rose	Huevo de venado
species	*Pinus cembroides* Zucc.	Pino piñonero
species	*Pinus pinceana* Gordon	Pinabete
species	*Psilostrophe gnaphalioides* DC.	
species	*Purshia plicata* (D.Don) Henrickson	Rosa de castilla
species	*Quercus microphylla* Née	Charrasquillo
species	*Quercus pringlei* Seemen ex Loes.	
species	Rhus microphylla Engelm.	
species	*Rhus virens* Lindh. ex A.Gray	Lantrisco
species	*Salvia ballotiflora* Benth.	Peistón
species	*Senna wislizeni* (A.Gray) H.S.Irwin & Barneby	Pinacate
species	*Sidneya tenuifolia* (A.Gray) E.E.Schill. & Panero	
species	*Solanum angustifolium* Houst. ex Mill.	
species	*Solanum elaeagnifolium* Cav.	Tomatillo
species	*Stenocactus multicostatus* (Hildm.) A.Berger	
species	*Tecoma stans* (L.) Juss. ex Kunth	San Pedro
species	*Thymophylla acerosa* (DC.) Strother	
species	*Thymophylla setifolia* Lag.	Parraleña
species	*Tillandsia recurvata* (L.) L.	Paixtle
species	*Tiquilia canescens* (DC.) A.T.Richardson	
species	*Tiquilia greggii* (Torr. & A.Gray) A.T.Richardson	Cenizo
species	*Vachellia constricta* (Benth.) Seigler & Ebinger	Huizache
species	*Vachellia farnesiana* (L.) Wight & Arn.	Huizache
species	*Verbena bipinnatifida* Schauer	
species	*Xanthisma spinulosum* (Pursh) D.R.Morgan & R.L.Hartm.	Árnica
species	*Yucca carnerosana* (Trel.) McKelvey	Palma loca
species	*Yucca filifera* Chabaud	Palma china
species	*Yucca luminosa* M.H.J.van der Meer	
species	*Zinnia acerosa* (DC.) A.Gray	Hierba del burro

species	*Zinnia juniperifolia* (DC.) A.Gray	
subspecies	*Mammillaria heyderi* subsp. *meiacantha* (Engelm.) D.R.Hunt	

Temporal coverage

Data range: 2020-12-16 - 2026-4-02.

Notes: Field sampling campaigns were distributed across 2020–2026 and were mainly concentrated in the dry season, with additional surveys during the rainy season in 5 ejidos. Monthly effort was highest in January, June, November, and December, while the greatest annual effort occurred in 2025, followed by 2026. These temporal patterns should be considered when interpreting occurrence completeness, associated-flora richness, and potential phenological variation among records. (Fig. 7).

Usage licence

Usage licence: Other

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Data resources

Data package title: Sampling-event dataset of non-timber forest products and associated vascular flora from ejidos in Zacatecas, Mexico, within the Chihuahuan Desert Ecoregion (2020–2026); Checklist dataset of non-timber forest products and associated vascular flora from ejidos in Zacatecas, Mexico, within the Chihuahuan Desert Ecoregion (2020–2026)

Resource link: https://doi.org/10.15468/kwu72u, https://doi.org/10.15468/qrx582

Alternative identifiers: https://www.gbif.org/dataset/f133b909-7c5b-405b-b9f9-9da0e4040446, https://www.gbif.org/dataset/cc49c8e6-d3e6-4b56-9b8a-cddb4baf2da5

Number of data sets: 5

> **Data set name:** Event core
>
> **Character set:** UTF-8
>
> **Data format:** Darwin Core Archive
>
> **Data format version:** 1.4
>
> **Description:** The Event Table contains the sampling-event records generated during field inventories of non-timber forest products and associated vascular flora in ejidos

in Zacatecas, Mexico. The data package is structured as a sampling-event dataset. Parent events represent ejido-year field campaigns and use date intervals corresponding to ejido-level field campaigns, while child events represent individual 500 square meter circular plots and use the specific single-day eventDate on which each plot was recorded in the field. Each event includes information on sampling protocol, date, locality, geographic coordinates, elevation, habitat, georeferencing and project metadata. The verbatimElevation field contains the elevation recorded during the sampling event, both and minimumElevationInMeters and maximumElevationInMeters fields contain the elevation extracted from a Digital Elevation Model raster.

Column label	Column description
eventID	Identifier of the event, unique within the dataset.
parentEventID	Identifier of the broader event that groups the sampling event (the ejido field campaign).
eventDate	Date or date interval during which the sampling event occurred.
samplingProtocol	Sampling protocol used to collect the data.
sampleSizeValue	Numeric size of the sampling unit.
sampleSizeUnit	Unit of measurement of the sampling unit size.
locality	Locality or ejido associated with the sampling event.
verbatimLocality	Original locality or toponym recorded or assigned during data curation.
language	Language code of the record content.
country	Country where the sampling event took place.
countryCode	ISO code of the country where the sampling event took place.
stateProvince	State where the sampling event took place.
municipality	Municipality where the sampling event took place.
habitat	Vegetation type associated with the sampling plot.
dynamicProperties	Additional event properties.
decimalLatitude	Latitude of the sampling point in decimal degrees.
decimalLongitude	Longitude of the sampling point in decimal degrees.
geodeticDatum	Geodetic datum or spatial reference system of the coordinates.
coordinatePrecision	Decimal precision of the coordinates.
coordinateUncertaintyInMeters	Horizontal uncertainty of the coordinates in meters.
verbatimElevation	Elevation recorded during sampling event.
minimumElevationInMeters	Minimum elevation of the sampling event in meters.

maximumElevationInMeters	Maximum elevation of the sampling event, in meters above sea level.
footprintWKT	Well-Known Text representation of the sampling area.
footprintSRS	Spatial reference system of the footprintWKT geometry.
recordedBy	People responsible for recording the sampling event.
eventRemarks	Additional remarks related to the sampling event.

Data set name: Occurrence (extension)

Character set: UTF-8

Data format: Darwin Core Archive

Data format version: 1.4

Description: Contains plant occurrence records linked to the Event Table through eventID. It includes commercially important non-timber forest product taxa and associated vascular flora recorded during plot-based inventories. Each record includes taxonomic information, occurrence identifiers, basis of record, recording and identification information, occurrence status, and the number of individuals counted when available. Counts are standardized in Darwin Core as individualCount/ organismQuantity, with organismQuantityType = individuals. These values are suitable for abundance analyses of focal NTFP taxa, for which field-counting rules followed the forestry inventory protocol. Associated vascular flora should be interpreted as presence records.

Column label	Column description
occurrenceID	Identifier of the occurrence record, unique within the dataset.
eventID	Identifier of the sampling event to which the occurrence belongs.
basisOfRecord	Specific nature of the data record.
occurrenceStatus	Statement about the presence or absence of the taxon at the sampling event.
individualCount	Number of individuals counted for the occurrence.
organismQuantity	Number or value representing the quantity of organisms recorded.
organismQuantityType	Type of quantification used for organismQuantity, for example individuals.
recordedBy	Person, group or organization responsible for recording the original occurrence.
institutionCode	Code of the institution responsible for the original technical study or dataset.
datasetName	Name of the dataset to which the occurrence belongs.
taxonID	Identifier of the taxon associated with the occurrence record.
scientificName	Scientific name of the species recorded in the occurrence.

acceptedNameUsage	Accepted scientific name corresponding to the species.
scientificNameAuthorship	Authorship information associated with the scientific name.
taxonRank	Taxonomic rank of the scientific name.
taxonomicStatus	Taxonomic status of the name.
family	Family to which the taxon belongs.
genus	Genus to which the taxon belongs.
specificEpithet	Specific epithet of the scientific name.
vernacularName	Common name of the species used by local population.
language	Language code of the vernacular name.
occurrenceRemarks	Additional remarks related to the occurrence record.

Data set name: Measurement or Facts (extension)

Character set: UTF-8

Data format: Darwin Core Archive

Data format version: 1.4

Description: Contains measurements, attributes, or facts associated with occurrence records and their corresponding sampling events. It is used to document additional information such as sampling-related attributes, organism measurements, or other observed facts that complement the Event and Occurrence tables. Each record is linked through eventID and measurmentID, that corresponds to the occurrenceID, allowing measurements to be associated with a specific sampling event and biological record.

Column label	Column description
measurementID	occurrenceID of the occurrence record to which the measurment or fact is related.
eventID	Identifier that links the measurement or fact to the sampling event where data were recorded.
measurementType	Type of measurement, attribute or fact being reported.
measurementValue	Value recorded for the measurement, attribute or fact described in measurementType.
measurementUnit	Unit of measurement associated with the reported value.
measurementMethod	Description of the method or procedure used to obtain the measurement or fact.

Data set name: Distribution (extension)

Character set: UTF-8

Data format: Darwin Core Archive

Data format version: 1.3

Description: Contains distribution records linking each taxon in the checklist to the ejidos where it was sampled. Each record represents the occurrence of a taxon within a specific ejido and includes geographic, legal, and conservation attributes. Records are linked to the Taxon Core through taxonID. Threat status follows IUCN Red List categories (IUCN 2025) and CITES appendix (CITES 2026) designations where applicable.

Column label	Column description
taxonID	Identifier of the taxon associated with the distribution record. Links to the Taxon Core.
locationID	Identifier of the ejido or locality where the taxon was recorded.
locality	Name of the ejido where the taxon was recorded.
countryCode	ISO code of the country where the taxon was recorded.
occurrenceStatus	Statement about the presence or absence of the taxon at the locality.
establishmentMeans	How the taxon came to be present at the location, e.g., native or introduced.
threatStatus	Global threat status of the taxon according to IUCN Red List categories.
appendixCITES	CITES appendix in which the taxon is listed, if applicable.
eventDate	Date or date interval associated with the distribution record.
startDayOfYear	Earliest ordinal day of the year for the distribution record.
endDayOfYear	Latest ordinal day of the year for the distribution record.

Data set name: Plinian Threat Status (extension)

Character set: UTF-8

Data format: Darwin Core Archive

Data format version: 1.3

Description: Contains conservation status records for taxa included in the checklist according to the Official Mexican Standard NOM-059-SEMARNAT-2010 (SEMARNAT 2010, SEMARNAT 2019), which establishes risk categories for wild species in Mexico. Each record is linked to the Taxon Core through taxonID. This checklist includes 5 species subject to special protection (Pr), 2 Endangered (P), and 2 Threatened (A) under this standard.

Column label	Column description
taxonID	Identifier of the taxon associated with the threat status record. Links to the Taxon Core.

threatCategory	Risk category assigned to the taxon according to NOM-059-SEMARNAT-2010.
Authority	Regulatory instrument or authority establishing the threat status: NOM-059-SEMARNAT-2010.

Additional information

This dataset provides a resource for future studies aiming to document how plant communities change over time under communal (ejido) management. Phylogenetic trees are provided at species and family levels, placing recorded taxa in an evolutionary context and enabling exploration of diversification, functional similarity, and phylogenetic signal. Because the phylogenies were generated with reproducible workflows and are directly linked to the validated checklist, they can be combined with external data for a wide range of community and conservation studies.

Threat status

Out of the 129 terminal taxa, 44 species are listed under some risk category under the IUCN red list, CITES Appendix and/or the checklist of risk categories for wild species in Mexico, published under the Official Mexican Standard NOM-059-SEMARNAT-2010. Table 3 contains these 44 species and 1 subspecies from 9 families, out of these taxa, 6.98% are listed under a risk category from the NOM-059, 25.58% on the IUCN red list and 24.03% on CITES (Table 4).

Measurement or Facts

The MeasurementOrFact extension was used to document quantitative attributes recorded for NTFP taxa. These measurements include plant size measurements such as height, diameter, canopy cover, weight, and count of cones or cladodes, depending on the biological characteristics of each species. A measurement dictionary is presented to improve the interpretation of the measurementOrFact records (Table 5). Table 6 links each NTFP with the corresponding taken measurements.

How to use these datasets

The datasets described here (Delgadillo Escobar et al. 2026a, Delgadillo Escobar et al. 2026b) are openly available on GBIF.

The sampling-event archive contains 2,629 event records, 21,451 occurrence records, and 50,167 measurement records. Of the total event records, 2,617 correspond to individual sampling plots, while 12 correspond to parent events representing ejido-level field campaigns. The Event Core contains the sampling framework. It includes parent-event data for each ejido and field-sampling events associated with 500 m² circular plots. The Occurrence extension file contains the biological records linked to sampling events. Each record represents the detection of a taxon within a given sampling event. The

MeasurementOrFact extension file contains measurements associated with occurrence records and sampling events. These include morphometric and resource-related variables such as plant height, canopy cover, biomass, number of cones, number of cladodes, and other attributes depending on the species and resource assessed.

Measurement records are linked to biological records through occurrenceID and to sampling events through eventID. Users interested in floristic composition may work primarily with the Occurrence file; users focused on spatial or sampling structure should begin with the Event Core; and users interested in abundance, plant structure, or resource attributes should join all three files using eventID and occurrenceID.

The checklist contains 306 taxonomic entries representing all vascular plant taxa recorded across the twelve ejidos surveyed in northern Zacatecas, Mexico. The Taxon Core provides the taxonomic backbone for the dataset. Each record represents an accepted taxon. Vernacular names in Spanish are provided for 97 entries. Four records include taxonRemarks documenting nomenclatural decisions made during taxonomic validation. The checklist is organized hierarchically through the parentNameUsageID field, which links each taxon to its immediate parent in the classification. All 306 entries have taxonomicStatus = accepted; no synonyms are included in this resource. The nomenclature follows the International Code of Nomenclature for algae, fungi, and plants (ICN). The distribution file contains the location records linked to ejidos where the species were sampled. The Plinian Threat Status extension includes the risk category according to the Official Mexican Standard NOM-059-SEMARNAT-2010 (SEMARNAT 2010, SEMARNAT 2019).

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Author contributions

A. A. D. E. and **M. C. E. L.** conceived the study. **A. A. D. E.** and **E. S. S.** developed the sampling methodology and coordinated fieldwork during the study period. **E. S. S.**, **M. R. M.**, and **D. C. D. I.** participated in fieldwork. **M. R. M.** verified the dataset against the paper logs. **D. C. D. I.** contributed to species determination, photographs and data quality control. **J. P. E.** contributed to database design, validated the data, prepared tables and contributed to quality assurance. **K. S. F. P.** contributed to database design, elaboration of the phylogenetic tree, as well as quality assurance and quality control. **A. A. D. E.** compiled, reviewed, and curated the database, prepared maps, figures, and tables, performed quality control, and wrote the manuscript. All authors contributed and reviewed the manuscript and approved the final version.

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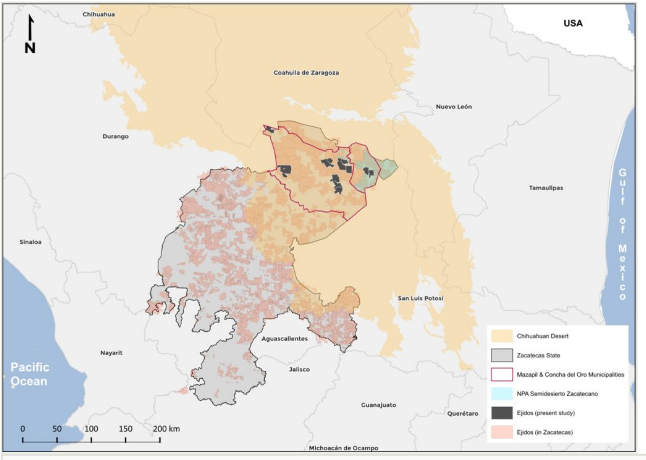

Figure 1.

Geographic location of the studied *ejidos* in Zacatecas, Mexico (RAN 2026, Suppl. material 1). The map illustrates the study sites in relation to the Semidesierto Zacatecano Natural Protected Area (NPA) and the broader Chihuahuan Desert ecoregion.

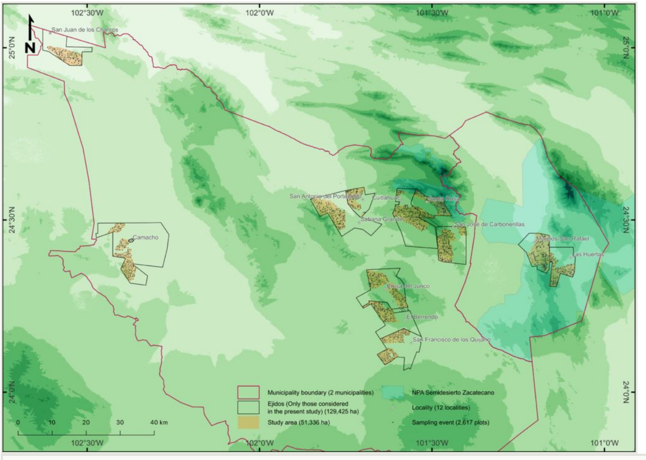

Figure 2.

Spatial distribution of georeferenced sampling plots within forest-management polygons.

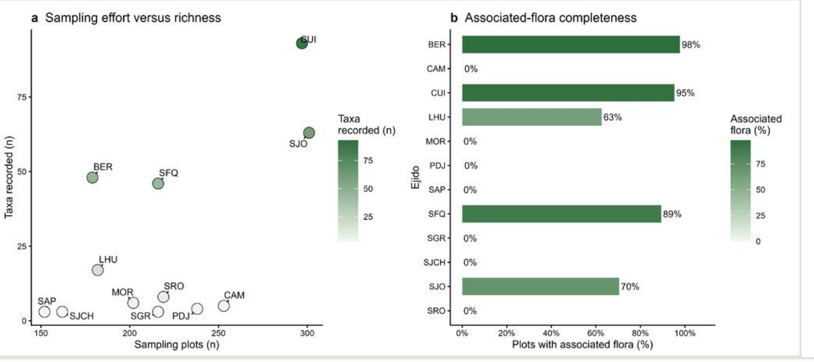

Figure 3.

Sampling effort and associated-flora completeness by ejido. **a** Number of taxa recorded against number of sampling plots per ejido; shading denotes taxa richness. **b** Proportion of plots per ejido with associated-flora records, including NTFP taxa. Values of 0% indicate that cases were recorded at the ejido level, not that there was an absence of associated flora.

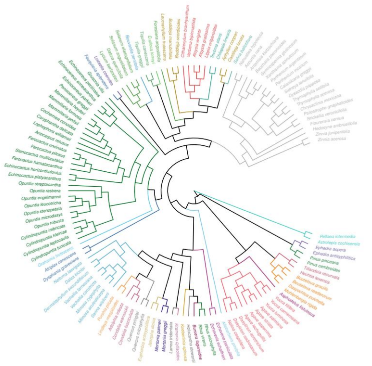

Figure 4.

A circular phylogenetic tree that includes all species recorded in the study area. Branches and tip labels were colored according to family affiliation to allow visualization of the phylogenetic distribution of species.

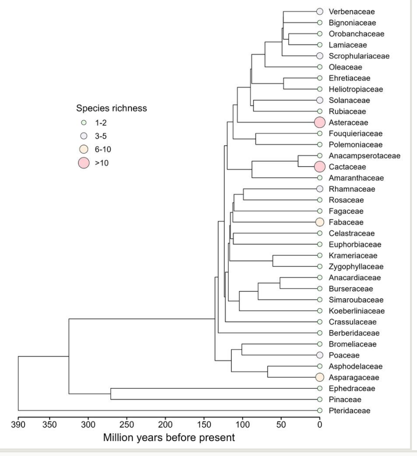

Figure 5.

A divergence-time-scaled phylogenetic tree at family level including the 37 families represented by species/subspecies-level phylogenetic terminals. Branch lengths are proportional to divergence time and are expressed in millions of years before present. Family species richness was calculated from the floristic inventory and represented by the size and color of circles located
at the tips of the tree. Species richness was grouped into four categories: 1–2, 3–5, 6–10, and >10 species. Although the complete taxonomic checklist includes 42 family-rank entries, five families were represented only by higher-rank checklist entries and lacked species/subspecies-level terminal taxa. Therefore, they were not included in the family-level phylogenetic tree.

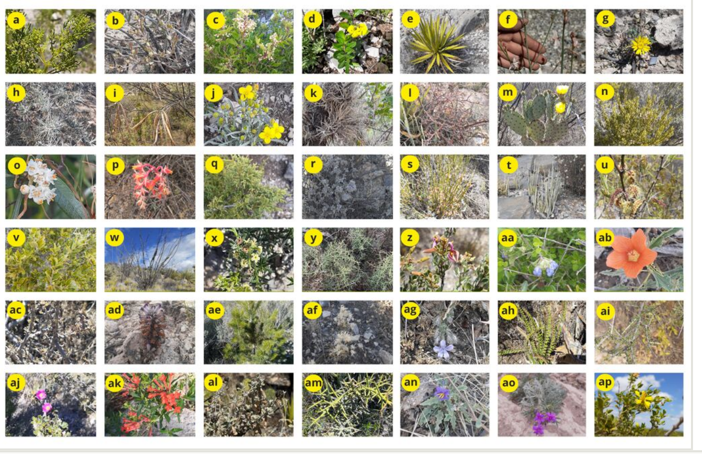

Figure 6.

Photographic mosaic of the vascular plant families recorded in the study area: **a** Amaranthaceae family: *Dysphania graveolens* (Willd.) Mosyakin & Clemants, **b** Anacampserotaceae family: *Grahamia frutescens* (A.Gray) G.D.Rowley, **c** Anacardiaceae family: *Rhus virens* Lindh. ex A.Gray, **d** Apocynaceae family: *Mandevilla* sp., **e** Asparagaceae family: *Agave lechuguilla* Torr., **f** Asphodelaceae family: *Asphodelus fistulosus* L., **g** Asteraceae family: *Xanthisma spinulosum* (Pursh) D.R.Morgan & R.L.Hartm., **h** Berberidaceae family: *Alloberberis pinifolia* (Lundell) C.C.Yu & K.F.Chung, **i** Bignoniaceae family: *Chilopsis linearis* (Cav.) Sweet, **j** Brassicaceae family: *Physaria* sp., **k** Bromeliaceae family: *Tillandsia recurvata* (L.) L., **l** Burseraceae family: *Bursera fagaroides* (Kunth) Engl., **m** Cactaceae family: *Opuntia engelmannii* Salm-Dyck ex Engelm., **n** Celastraceae family: *Mortonia greggii* A.Gray, **o** Convolvulaceae family: *Cuscuta* sp., **p** Crassulaceae family: *Echeveria schaffneri* (S.Watson) Rose, **q** Cupressaceae family: *Juniperus* sp., **r** Ehretiaceae family: *Tiquilia greggii* (Torr. & A.Gray) A.T.Richardson, **s** Ephedraceae family: *Ephedra* sp., **t** Euphorbiaceae family: *Euphorbia antisyphilitica* Zucc., **u** Fabaceae family: *Neltuma laevigata* (Humb. & Bonpl. ex Willd.) Britton & Rose, **v** Fagaceae family: *Quercus pringlei* Seemen ex Loes., **w** Fouquieriaceae family: *Fouquieria splendens* Engelm., **x** Heliotropiaceae family: *Euploca torreyi* (I.M.Johnst.) Halse & Feuillet, **y** Koeberliniaceae family: *Koeberlinia spinosa* Zucc., **z** Krameriaceae family: *Krameria cytisoides* Cav., **aa** Lamiaceae family: *Salvia ballotiflora* Benth., **ab** Malvaceae family: *Sphaeralcea* sp., **ac** Oleaceae family: *Forestiera angustifolia* Torr., **ad** Orobanchaceae family: *Aphyllon cooperi* A.Gray, **ae** Pinaceae family: *Pinus cembroides* Zucc., **af** Poaceae family: *Dasyochloa pulchella* Willd., **ag** Polemoniaceae family: *Loeselia coerulea* (Cav.) G.Don, **ah** Pteridaceae family: *Astrolepis cochisensis* (Goodd.) D.M.Benham & Windham, **ai** Rhamnaceae family: *Condalia warnockii* M.C.Johnst., **aj** Rosaceae family: *Purshia plicata* (D.Don) Henrickson, **ak** Rubiaceae family: *Bouvardia ternifolia* (Cav.) Schltdl., **al** Scrophulariaceae family: *Buddleja marrubiifolia* Benth., **am** Simaroubaceae family: *Holacantha stewartii* C.H.Mull., **an** Solanaceae family: *Solanum elaeagnifolium* Cav., **ao** Verbenaceae family: *Verbena bipinnatifida* Schauer and **ap** Zygophyllaceae family: *Larrea tridentata* (DC.) Coville. All photographs were taken by **D. C. D. I.** Except **ae** by **E. S. S.**; **i**, **p** by **M. R. M.**; **f** by **J. R. R. E.**; **z** by Daniel Solorio (Solorio 2021).

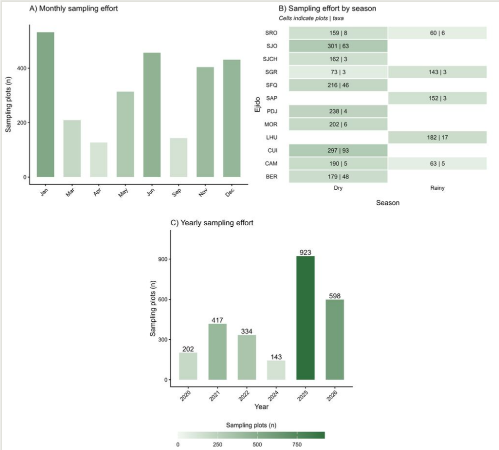

Figure 7.

Temporal distribution of sampling effort across the twelve ejidos. **a** Monthly distribution of sampling plots. **b** Sampling effort by season and ejido; cell labels give plots and taxa, separated as plots | taxa. **c** Annual distribution of plots, 2020–2026. No surveys were conducted in 2023.

Table 1.

Sampling effort and achieved sampling intensity by ejido. Sampling effort is expressed as the number of 500 m² circular plots, and sampling intensity was calculated relative to the study area of each ejido. The table summarizes the criteria used to record associated vascular flora and the temporal coverage of each ejido-level field campaign.

No	Ejido	Municipality	Ejido area (ha)	Study area (ha)	Sampling effort (# plots)	Sampling intensity (%)	Associated vascular flora criteria	Yea
1	Berrendo	Mazapil	8,867.99	3,012.37	179	0.297	Ejido-level	202
2	Camacho	Mazapil	25,483.02	5,036.23	253	0.251	Sampling site (plot-level)	202
3	Cuitláhuac	Mazapil	14,606.26	5,024.64	297	0.296	Ejido-level	202
4	Las Huertas	Concepción del Oro	7,172.64	3,599.27	182	0.253	Sampling site (plot-level)	202
5	Morelos	Concepción del Oro	7,884.39	5,585.04	202	0.181	Ejido-level	202
6	Presa del Junco	Mazapil	12,711.55	5,000.07	238	0.238	Sampling site (plot-level)	202
7	San Antonio del Portezuelo	Mazapil	5,000.99	2,499.69	152	0.304	Sampling site (plot-level)	202
8	San Francisco de los Quijano	Mazapil	10,226.67	4,099.97	216	0.263	Ejido-level	202
9	Sabana Grande	Mazapil	13,157.55	5,001.10	216	0.216	Sampling site (plot-level)	202
10	San José de Carbonerillas	Mazapil	9,746.21	5,045.90	301	0.298	Ejido-level	202
11	San Juan de los Charcos	Mazapil	8,292.37	3,544.47	162	0.229	Sampling site (plot-level)	202

12	Santa Rosa	Mazapil	6,275.72	3,887.48	219	0.282	Ejido-level	202
		Total	119,225.36	51,336.23	2,617	0.255		

Table 2.

Reference thresholds used to interpret growth-stage or harvestability categories for focal NTFP taxa. Growth stage is not stored in the measurementOrFact extension; these criteria are provided as interpretive metadata for users who need to classify measurements by taxon-specific size or harvestability classes. For *Jatropha dioica*, growth stages are defined using relative size classes (lower, middle and upper thirds) derived from the local field inventory based on plant height and crown diameter measurements.

Species	**Growth stage**			**Reference**
	Sprout	**Medium growth**	**Harvestable**	
Agave asperrima Jacobi	>0 - 15 cm	16 - 25 cm	≥ 26 cm	López-Serrano et al. 2021b, López-Serrano et al. 2021g
Agave lechuguilla Torr.	>0 - 15 cm	16 - 25 cm	≥ 26 cm	López-Serrano et al. 2021b
Agave salmiana Otto ex Salm-Dyck	>0 - 15 cm	16 - 25 cm	≥ 26 cm	López-Serrano et al. 2021g
Flourensia cernua DC.	>0 - 40 cm	41 - 79 cm	≥ 80 cm	SEMARNAT 1997
Larrea tridentata (DC.) Coville	>0 - 40 cm	41 - 79 cm	≥ 80 cm	SEMARNAT 1997
Lippia origanoides Kunth	>0 a 25 cm	26 - 59 cm	≥ 60 cm	López-Serrano et al. 2021e
Euphorbia antisyphilitica Zucc.	>0 a 25 cm	26 - 59 cm	≥ 60 cm	López-Serrano et al. 2021d
Don't have a defined growth stage				
Nolina cespitifera Trel.	-	-	≥ 20	López-Serrano et al. 2021a
Opuntia Rastrera F.A.C.Weber	0 - 5 cladodes	6 - 14 cladodes	≥ 15 cladodes	SEMARNAT 1997
Jatropha dioica Sessé	Lower third of local size distribution	Middle third of local size distribution	Upper third of local size distribution (vigorous plants with well developed rhizomes)	López-Serrano et al. 2021c
Pinus cembroides Zucc.	-	-	Has strobili with viable seed	SEMARNAT 1997, Solís et al. 1989
Dasylirion cedrosanum Trel.	-	-	≥ 20 kg	López-Serrano et al. 2021f

Table 3.

Taxa listed under IUCN, CITES, and NOM-059-SEMARNAT-2010 risk or protection categories. Blank values in NOM-059, IUCN or CITES fields should be interpreted as no listed category found in the consulted sources at the stated access date, not as evidence that the taxon was formally evaluated as not threatened or not listed.

No	Family	Scientific name
1	Asparagaceae	*Agave asperrima* Jacobi
2	Asparagaceae	*Agave lechuguilla* Torr.
3	Asparagaceae	*Agave striata* Zucc.
4	Cactaceae	*Ariocarpus retusus* Scheidw.
5	Cactaceae	*Cochemiea conoidea* (DC.) P.B.Breslin & Majure
6	Cactaceae	*Coryphantha delicata* L.Bremer
7	Cactaceae	*Cylindropuntia imbricata* (Haw.) F.M.Knuth
8	Cactaceae	*Cylindropuntia kleiniae* (DC.) F.M.Knuth
9	Cactaceae	*Cylindropuntia leptocaulis* (DC.) F.M.Knuth
10	Cactaceae	*Cylindropuntia tunicata* (Lehm.) F.M.Knuth
11	Fabaceae	*Dalea bicolor* Humb. & Bonpl. ex Willd.
12	Asparagaceae	*Dasylirion acrotrichum* (Schiede) Zucc.
13	Cactaceae	*Echinocactus horizonthalonius* Lem.
14	Cactaceae	*Echinocactus platyacanthus* Link & Otto
15	Cactaceae	*Echinocereus enneacanthus* Engelm.
16	Cactaceae	*Echinocereus parkeri* N.P.Taylor
17	Cactaceae	*Echinocereus pectinatus* (Scheidw.) Engelm.
18	Ephedraceae	*Ephedra antisyphilitica* Berland. ex C.A.Mey.
19	Euphorbiaceae	*Euphorbia antisyphilitica* Zucc.
20	Cactaceae	*Ferocactus hamatacanthus* (Muehlenpf.) Britton & Rose
21	Cactaceae	*Ferocactus pilosus* (Salm-Dyck) Werderm.
22	Cactaceae	*Ferocactus uncinatus* (Galeotti) Britton & Rose

23	Cactaceae	*Grusonia vilis* (Rose) H.Rob.
24	Euphorbiaceae	*Jatropha dioica* Sessé
25	Koeberliniaceae	*Koeberlinia spinosa* Zucc.
26	Cactaceae	*Lophophora williamsii* (Lem. ex Salm-Dyck) J.M.Coult.
27	Cactaceae	*Mammillaria formosa* Galeotti ex Scheidw.
28	Cactaceae	*Mammillaria heyderi* Muehlenpf.
29	Cactaceae	*Mammillaria heyderi* subsp. *meiacantha* (Engelm.) D.R.Hunt
30	Cactaceae	*Mammillaria pottsii* Scheer ex Salm-Dyck
31	Fabaceae	*Neltuma laevigata* (Humb. & Bonpl. ex Willd.) Britton & Rose
32	Cactaceae	*Opuntia engelmannii* Salm-Dyck ex Engelm.
33	Cactaceae	*Opuntia leucotricha* DC.
34	Cactaceae	*Opuntia microdasys* (Lehm.) Pfeiff.
35	Cactaceae	*Opuntia rastrera* F.A.C.Weber
36	Cactaceae	*Opuntia robusta* H.L.Wendl.
37	Cactaceae	*Opuntia stenopetala* Engelm.
38	Cactaceae	*Opuntia streptacantha* Lem.
39	Cactaceae	*Peniocereus greggii* (Engelm.) Britton & Rose
40	Pinaceae	*Pinus pinceana* Gordon
41	Anacardiaceae	*Rhus microphylla* Engelm.
42	Cactaceae	*Stenocactus multicostatus* (Hildm.) A.Berger
43	Bignoniaceae	*Tecoma stans* (L.) Juss. ex Kunth
44	Asparagaceae	*Yucca carnerosana* (Trel.) McKelvey
45	Asparagaceae	*Yucca filifera* Chabaud

Table 4.

Summary of taxa listed under threat classification systems.

Threat classification system	Category / Appendix	Taxa	Total percentage
NOM-059	A	2	1.55%
NOM-059	P	2	1.55%
NOM-059	Pr	5	3.88%
IUCN	DD	1	0.78%
IUCN	LC	30	23.26%
IUCN	NT	1	0.78%
IUCN	VU	1	0.78%
CITES	I	1	0.78%
CITES	II	30	23.26%

Table 5.

Measurement dictionary

measurementType	Description
plant height	Vertical height of the individual measured from the ground surface to the highest point.
bud height	Height of the apical bud measured from the ground surface to the bud position.
clean stem length	Length of the stem measured from the base of the tree to the first main branching.
canopy cover	Projection of the plant canopy, recorded as north-south and east-west.
normal diameter	Diameter at breast height.
number of cladodes	Count of cladodes recorded for cactus species where cladodes are relevant harvestable units.
number of cones	Count of cones recorded for pine species when cone production was assessed.
fresh weight	Mean weight of the fresh harvested species.

Table 6.

Measurement types, methods, and number of records by focal NTFP taxon.

Measured NTFP	measurementTypes	measurementMethod	Measurement records
Agave asperrima Jacobi	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	4,411
Agave lechuguilla Torr.	bud height; east-west canopy cover; fresh weight; north-south canopy cover; plant height	digital gram scale - arithmetic mean; measuring tape - arithmetic mean	12,918
Agave salmiana Otto ex Salm-Dyck	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	519
Dasylirion cedrosanum Trel.	east-west canopy cover; normal diameter; north-south canopy cover; plant height	measuring tape - arithmetic mean	3,522
Euphorbia antisyphilitica Zucc.	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	750
Flourensia cernua DC.	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	5,111
Jatropha dioica Sessé	bud height; east-west canopy cover; fresh weight; north-south canopy cover; plant height	digital gram scale - arithmetic mean; measuring tape - arithmetic mean	1,347
Larrea tridentata (DC.) Coville	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	7,027
Lippia origanoides Kunth	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	153
Nolina cespitifera Trel.	east-west canopy cover; north-south canopy cover; plant height	measuring tape - arithmetic mean	903
Opuntia rastrera F.A.C.Weber	east-west canopy cover; north-south canopy cover; number of cladodes; plant height	handheld tally counter - arithmetic mean; measuring tape - arithmetic mean	4,159
Pinus cembroides Zucc.	clean stem length; east-west canopy cover; normal diameter; north-south canopy cover; number of cones; plant height	handheld tally counter; measuring tape - direct measurement	9,347

Supplementary materials

Suppl. material 1: Boundary polygons of the studied ejidos, Zacatecas, Mexico

Authors: Ariel Armando Delgadillo-Escobar
Data type: GIS vector layer — ESRI Shapefile (polygons); CRS WGS84 / EPSG:4326
Brief description: Polygon boundaries of the 12 ejidos in which sampling was carried out. Attribute table: ejido, mun (municipality), state, area (ha). Source: Registro Agrario Nacional (RAN), for Zacatecas (RAN, 2026), clipped to the ejidos of interest and with the attribute table reduced to the fields of interest. The ejido of Presa del Junco is not included in the RAN layer because it is not certified; its boundary was reconstructed from the original survey plans of its *carpeta básica* (the property's legal title document) and from field data obtained with GNSS GPS. File provided as a zipped Shapefile.
Download file (10.23 kb)

Suppl. material 2: Study-area polygons (sampling areas) within each ejido

Authors: Ariel Armando Delgadillo-Escobar & Eutropio Sánchez-Sánchez
Data type: GIS vector layer — ESRI Shapefile (polygons); CRS WGS84 / EPSG:4326
Brief description: Polygons delimiting the study areas sampled within each ejido. These areas were defined with the ejidatarios and local inhabitants of each ejido, according to their harvesting practices and the location of the target NTFP species. File provided as a zipped Shapefile.
Download file (96.54 kb)

Suppl. material 3: Sampling plots (point localities of the sampling events)

Authors: Ariel Armando Delgadillo-Escobar & Eutropio Sánchez-Sánchez
Data type: GIS vector layer — ESRI Shapefile (points); CRS WGS84 / EPSG:4326
Brief description: Point localities of the sampling plots (500 m² circular plots) used in this study, one feature per sampling event. The layer holds 2,629 features: 2,617 georeferenced plots plus the 12 ejido-level parent events (which have no point geometry, as they denote the whole ejido). The attribute table mirrors the Darwin Core event fields. File provided as a zipped Shapefile.
Download file (424.58 kb)

Suppl. material 4: Boundary of the Área de Protección de Flora y Fauna "Semidesierto Zacatecano" (federal NPA)

Authors: Ariel Armando Delgadillo-Escobar
Data type: GIS vector layer — ESRI Shapefile (polygon); CRS WGS84 / EPSG:4326
Brief description: Boundary of the federal protected area APFF "Semidesierto Zacatecano" (decreed 8 Jan 2024; ~223,796 ha; Zacatecas), providing the conservation context of the study region. Extracted from CONANP's national layer of federal protected areas (https://sig.conanp.gob.mx/Shape) and presented as-is. File provided as a zipped Shapefile.
Download file (14.43 kb)

Suppl. material 5: Taxonomic validation workflow for Darwin Core checklists

Authors: Jocelyn Palacios Esquivel
Data type: Code repository

Brief description: The RStudio workflow used for validating vascular plant names against the GBIF Backbone Taxonomy and exporting a Darwin Core `Taxon` table. The repository is available on GitHub: https://github.com/jocelynpalaciose/Taxonomic-validation-workflow-for-Darwin-Core-checklists

Download file (11.44 kb)

Suppl. material 6: Phylogenetic tree workflow for vascular flora

Authors: Karen Stephania Flores Pro

Data type: Code repository

Brief description: The RStudio workflow used for building and plotting phylogenetic trees from a Darwin Core vascular flora checklist. This repository is available on GitHub: https://github.com/ksfloresp/flora-phylogeny-tree

Download file (642.65 kb)