

# Vascular Plants Diversity of El Aribabi Conservation Ranch: A Private Natural Protected Area in Northern Sonora, México

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**Abstract**—In northeastern Sonora, isolated Sky Island mountain ranges with desertscrub, desert grassland, oak woodland, and pine-oak forest have high biodiversity. El Aribabi Conservation Ranch in the Sierra Azul (from 30°51'13"N, 110°41'9"W to 30°46'38"N, 110°32'3"W) was designated a Private Protected Natural Area by the Comisión Nacional de Áreas Naturales Protegidas in March 2011. The flora contains 447 taxa in 81 families and 301 genera. The most diverse families are Asteraceae (63 taxa, 14.1%), Poaceae (41 taxa, 9.2%), Fabaceae (36 taxa, 8.1%), Euphorbiaceae (18 taxa, 4.1%), Cactaceae (13 taxa, 2.9%), Brassicaceae and Malvaceae (12 taxa, 2.7% each), Scrophulariaceae, Pteridaceae, and Solanaceae (10 taxa, 2.2% each). *Amoreuxia palmatifida*, *Carnegiea gigantea*, and *Juglans major* have Federal protection status in the Norma Oficial Mexicana NOM-059-2010. The life forms of El Aribabi are herbs (69.1%, including grasses), woody plants (26.0%), and succulents (4.7%). Of 23 non-native taxa in the flora (5.1%), only Natalgrass/zacate rosado (*Melinis repens*) and watercress/berro (*Nasturtium officinale*) are potentially invasive.

## Introduction

In northeastern Sonora, isolated Sky Island mountains ranges (Islas Serranas) with crowns of oak woodland and pine-oak forest are part of the Madrean Archipelago between the northern Sierra Madre Occidental and the Mogollon Rim in central Arizona (Van Devender and others 2010). Complex topography and geographic location in the broad transition from the New World tropics and the North Temperate Zone enrich the regional biodiversity. Desertscrub, desert grassland, or foothills thornscrub surround the Sky Islands in lowland valleys ('inland seas').

*La Frontera* is the area within 100 km of the Arizona border in northern Sonora (Van Devender and Reina-Guerrero, 2005). It is Ecoregion 12.1.1.1 in the Comisión para el Uso y Conocimiento de la Biodiversidad (CONABIO geographic classification (fig. 1). A subdivision of the ranch (area of 3,951 hectares) was certified as an Área Natural Protegida by the Comisión Nacional de Áreas Naturales Protegidas (CONANP) in March 2011 (Sánchez-Escalante 2011).

Rancho El Aribabi in the Sierra Azul has high biodiversity due to a variety of habitats and topographic features, including mountain

ridges and canyons, rolling hills, gentle slopes, a ciénega, and a perennial river bottom. The fauna includes a mixture of widespread species such as black bear (*Ursus americanus*), and tropical species such as jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), opossum (*Didelphis virginiana*), and Neotropical whipsnake (*Coluber mentovarius*) (Rorabaugh and others 2009). Here we summarize the flora of this important Sky Island protected natural area.

## Methods

### Study Area

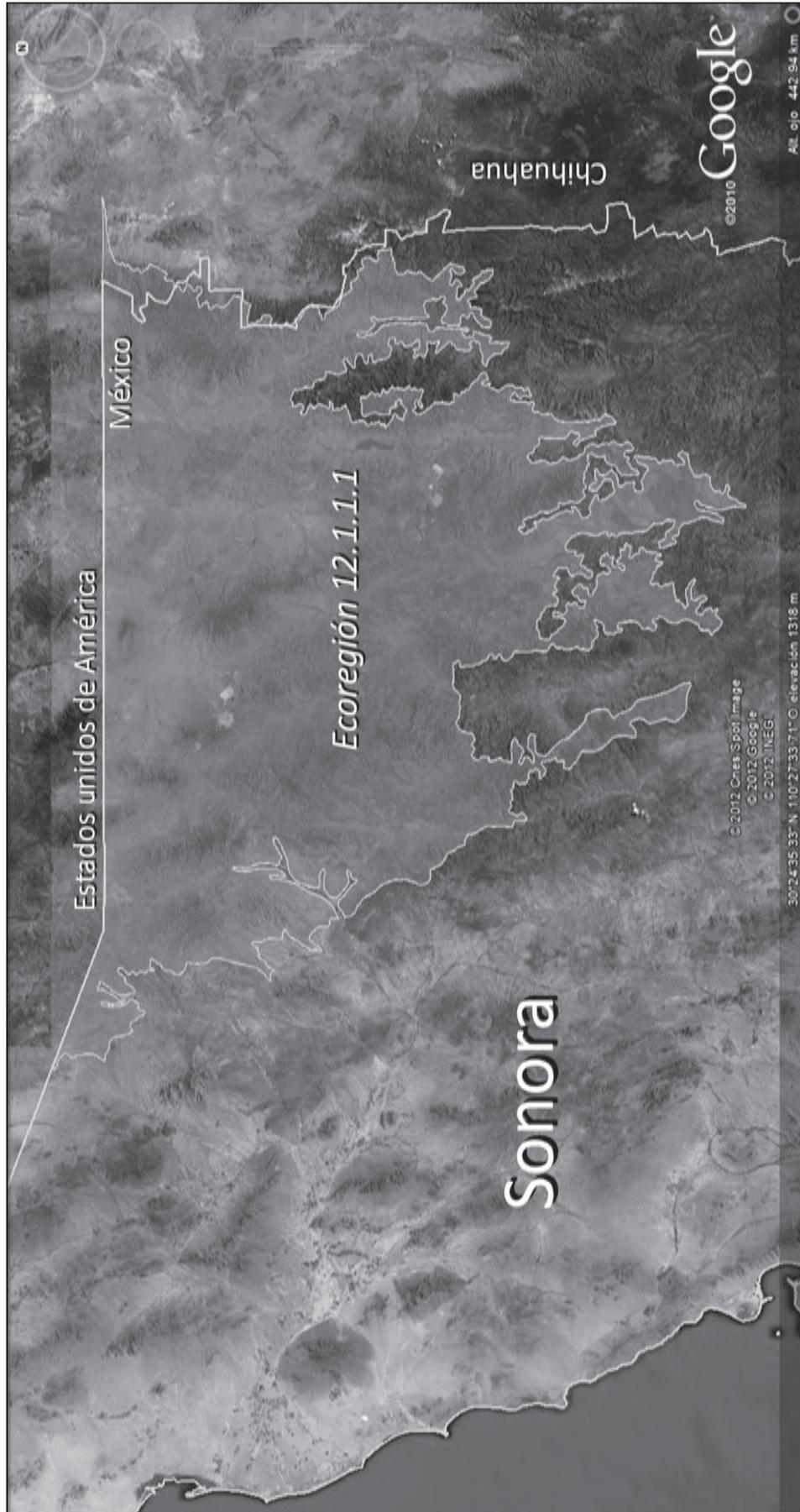
Rancho El Aribabi is an area of 13,000 hectares in the Municipio de Ímuris in northern Sonora in northwestern Mexico. Plant collections were made on ranch subdivisions A and B between 30°51'13"N 110°41'9"W and 30°46'38"N, 110°32'39"W (fig. 2). The southern subdivision C was not inventoried. The study area is 23.5 km east-northeast of Ímuris, 32 km southwest of Cananea, and 56 km south of the Arizona border. Collection localities were selected to provide coverage of all biotic communities on the ranch. Elevations ranged from 970 m on the Río Cocóspera to ca. 1,700 meters in the Sierra Azul. The Río Cocóspera is a northeastern tributary of the Río Magdalena-Río Altar drainage basin.

### Plant Collections

Plants were collected in a broad range of biotic communities on seven trips to the study area between March 2009 and September

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In: Gottfried, Gerald J.; Ffolliott, Peter F.; Gebow, Brooke S.; Eskew, Lane G., comps. 2013. Merging science and management in a rapidly changing world: Biodiversity and management of the Madrean Archipelago III; 2012 May 1-5; Tucson, AZ. Proceedings. RMRS-P-67. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.



**Figure 1** —Ecoregion 12.1.1.1. Hills and plains with foothills thornscrub, grasslands and isolated elevations woodland and forest of oaks and pines (INEGI-CONABIO-INE 2007).

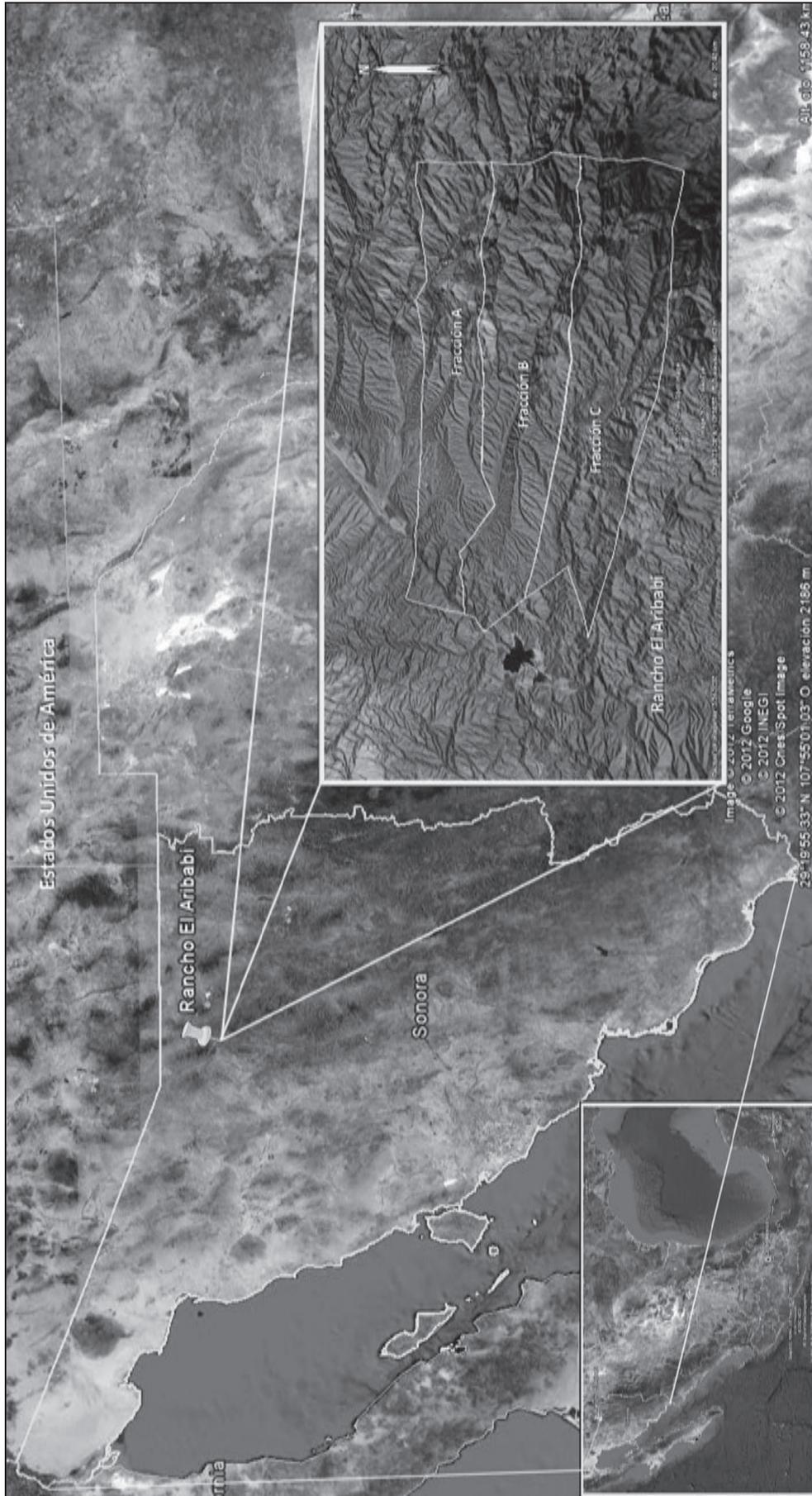


Figure 2— Location of Rancho El Aribabi. Enlarged area shows subdivisions of the ranch.

2011 under a SEMARNAT permit to Sánchez-Escalante. A total of 1,273 specimens were deposited into the herbaria at the Universidad de Sonora (USON) and University of Arizona (ARIZ). USON specimens will be available online in the CONABIO National Biodiversity Information System (SNIB) database. ARIZ and USON collections, field observations, and images will also be available on the Southwest Environmental Information Network (SEINet)/Madrean Archipelago Biodiversity Assessment (MABA) database (madrean.org).

Plant nomenclature follows Smith and others (2006) for Pteridophyta (ferns and allies), Gifford and Foster (1989) for Arthropophyta and Coniferophyta (gymnosperms), and Cronquist (1981) for Magnoliophyta (angiosperms). Nomenclature mostly follows the list in Van Devender and others (2010), which is available and updated in SEINet/MABA. A complete list of the Rancho El Aribabi flora will be available as a Research Species list in this database.

## Results

### Flora Composition

The flora of Rancho El Aribabi was compiled from collections in USON and ARIZ, and from observations in the MABA database. We documented 447 taxa in 81 families and 301 genera in Rancho El Aribabi. The families with the most taxa were Asteraceae (63 taxa, 14.1%), Poaceae (41 taxa, 9.2%), Fabaceae (36 taxa, 8.1%), Euphorbiaceae (18 taxa, 4.1%), Cactaceae (13 taxa, 2.9%), Brassicaceae and Malvaceae (12 taxa, 2.7% each), Scrophulariaceae, Pteridaceae, and Solanaceae (10 taxa, 2.2% each). The genera with the most species were *Euphorbia* (9 taxa), *Bouteloua* (8 taxa), *Dalea*, *Oenothera*, and *Salvia* (5 taxa each), and *Acalypha*, *Asclepias*, *Baccharis*, *Ipomoea*, *Lupinus*, and *Quercus* (4 taxa each). The life forms of El Aribabi were herbs (69.1%, including grasses), woody plants (26.0%), and succulents (4.7%). The dicot herbs (265 taxa) are perennial (122 taxa) and annual (143 taxa). The grasses and sedges (45 taxa) were perennial (38 taxa) and annual (19 taxa). *Amoreuxia palmatifida*, *Carnegiea gigantea*, and *Juglans major* have Mexican Federal protection status in the NOM-059-2010. The Huachuca water umbel (*Lilaeopsis schaffneriana* ssp. *recurva*) is a Listed Endangered species by the United States Endangered Species Act of 1973 (as amended). Only 23 species (9 grasses) are non-native (5.1%), including Bermudagrass/*zacate ingles* (*Cynodon dactylon*), Natalgrass/*zacate rosado* (*Melinis repens*), and buffelgrass/*zacate buffel* (*Pennisetum ciliare*) (Van Devender and others 2009). Only Natalgrass is a potential ecological problem on Rancho El Aribabi. Watercress/*berro* (*Nasturtium officinale*) is potentially invasive in the Río Cocóspera. Johnsongrass/*zacate juanón* (*Sorghum halepense*) has been found elsewhere in the Sierra Azul.

### Vegetation

We studied the flora along an environmental-elevational gradient from the Río Cocóspera valley bottom to the upper part of Rancho El Aribabi. Vegetation classification follows that of Brown (1982), Martin and others (1998), and Martínez-Yrizar and others (2010).

**Sonoran Desertscrub**—On dry ridges in the lower part of Rancho El Aribabi, there are local areas of Sonoran desertscrub with common saguaro (*Carnegiea gigantea*), ocotillo (*Fouquieria splendens*), and brittlebush (*Encelia farinosa*). Organpipe cactus/*pitahayo* (*Stenocereus thurberi*) is present but rare. These species are intermixed with common desert grassland species such as velvet mesquite (*Prosopis velutina*), wait-a-minute bush/*gatuña* (*Mimosa biuncifera*), Correll's

snakewood/*frutilla* (*Condalia correllii*), graythorn/*bachata* (*Ziziphus obtusifolia*), tropical cholla/*siviri* (*Cylindropuntia thurberi*), and prickly pears/*nopales* (*Opuntia* spp.). The nearest area of extensive Arizona Upland Sonoran desertscrub is ca. 20 km south-southwest near Ímuris.

**Desert Grassland**—Desert grassland is extensive on lower and middle slopes on the ranch. At upper elevations it forms an ecotone with oak woodland. Desert grassland species include beargrass/*pal-milla* (*Nolina microcarpa*), lechuguilla (*Agave palmeri*), shindagger/*amole* (*A. schottii*), and desert spoon/*serruchito* (*Dasyliion wheeleri*). A total of 41 species of grasses have been documented in the study area. The most important genera are *Aristida*, *Bothriochloa*, *Bouteloua*, *Dasyochloa*, *Hilaria*, *Muhlenbergia*, and *Setaria*. Mexican gamagrass/*zacate maíz* (*Tripsacum lanceolatum*), a perennial relative of corn, is of special interest. In the transition zone, oaks are mixed with foothills thornscrub species such as coralbean/*chilicote* (*Erythrina flabelliformis*) and feather bush/*tepeguaje* (*Lysiloma watsonii*). Netleaf hackberry/*cúmaro* (*Celtis reticulata*) and desert willow/*jano* (*Chilopsis linearis*) are mainly on arroyo margins.

**Oak Woodland**—Oak woodland and pine-oak and pine forests are present in the higher areas in the Sierra Azul. The upper portion of the study area is in Arroyo Las Palomas at ca. 1,350 m elevation. Oak woodland generally dominates this area, and is best developed on north-facing slopes. South-facing slopes often have desert grassland. Woodland dominant species are Emory oak/*bellota* (*Quercus emoryi*), Arizona oak (*Q. arizonica*), Mexican blue oak (*Q. oblongifolia*), and Toumey oak/*bellotita* (*Q. toumeyi*). Along the arroyo are alligator juniper/*sabino* (*Juniperus deppeana*), Coahuila juniper/*táscale* (*J. coahuilensis*), and madroño (*Arbutus arizonica*). Interesting shrubs in the area include Goodding ash/*fresnillo* (*Fraxinus gooddingii*), false mock orange (*Fendlera rupicola*), and littleleaf mock orange (*Philadelphus microphyllus*) as well as the claret cup cactus (*Echinocereus santaritensis*). Several ferns are present in this area, mainly in the genera *Adiantum*, *Bommeria*, *Cheilanthes*, and *Pellaea*.

**Riparian Forest**—Cottonwood-willow riparian forest in excellent condition occurs along ca. 4 kilometers of the northeast-southwest flowing Río Cocóspera along the eastern edge of Rancho El Aribabi. Dominant species are Fremont cottonwood/*álamo* (*Populus fremontii*), willows/*saucos* (*Salix gooddingii*, *S. bonplandiana*, and *S. taxifolia*), velvet ash/*fresno* (*Fraxinus velutina*), sycamore/*aliso* (*Platanus wrightii*), Mexican elderberry/*tápiro* (*Sambucus nigra* ssp. *cerulea*), Arizona walnut/*nogal* (*Juglans major*), and Texas mulberry/*mora silvestre* (*Morus microphylla*). Huérigo (*Populus monticola*) was found in an area bordering the ranch.

## Discussion

In this study, we documented the flora and vegetation of Rancho El Aribabi from cottonwood-willow forest along the Río Cocóspera through desertscrub and desert grassland to oak woodland. Plants were not collected in pine-oak and pine forests in the upper part of the Sierra Azul, which tops out at 2,460 m. In September 2010, we visited pine forest in the southern Sierra Azul above Rancho el Salto. As part of an inventory of breeding birds, Aaron D. Flesch observed trees in high forests in the Sierra Azul. Observations from both trips in the MABA database (Madrean.org) indicate the presence of more mesic species above Rancho el Aribabi. These include the trees Arizona pine (*Pinus arizonica*), Chihuahua pine (*P. chihuahuana*), southwestern white pine (*P. strobiformis*), silverleaf oak (*Quercus hypoleucoides*), and willowleaf oak (*Q. viminea*); the shrubs cream bush (*Holodiscus*

*discolor*) and netleaf oak (*Q. rugosa*); and the herbs cardinal catchfly (*Silene laciniata* var. *greggii*), Wright's goldenrod (*Solidago wrightii* var. *adenophora*), sawtooth candyleaf (*Stevia serrata* var. *serrata*), southwestern blue lobelia (*Lobelia anatina*), sweetclover vetch (*Vicia pulchella* ssp. *pulchella*), and others.

The flora of Rancho El Aribabi is an important contribution; however a great deal of additional botanical exploration (especially in high elevation forests), is needed to more fully document the flora of the Sierra Azul, and to better understand its diversity and biogeographic relationships with other Sky Islands in the Madrean Archipelago.

## Acknowledgments

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