Floristic Analysis of Vegetation Communities on Isla de Cedros, Baja California, Mexico

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Abstract — Isla de Cedros lies within an arid climatic region and supports a diversity of vegetation community associations. These range from succulent-stem desert, made up of succulent-stem trees and shrubs, to coastal sage scrub, chaparral and maritime pine forest typical of southern and central Alta California. Previous published discussions of the vegetation on Isla de Cedros addressed individual species or were general in nature. The availability of black and white aerial photographs presented an opportunity to analyze the distribution of vegetation in detail. Floristic descriptions of 18 vegetation communities were created from field observations on Isla de Cedros. These communities were mapped utilizing aerial photographs. The distribution and species composition of these vegetation associations is dependent upon the island’s topographic diversity, climate and biogeographic factors.

Introduction
Isla de Cedros lies about 23 km northwest of Punta Eugenia in central Baja California, Mexico (28°15’ N, 115°15’ W). The island is a nearly barren series of ridges and canyons. However, due to its size, topographic variation, geologic history, and biogeographical history, it supports a relatively high diversity of native plants, 18 discernable vegetation communities (Appendix 1) and about 224 species (Appendix 2).

Physical Features
Topography: Isla de Cedros is a dominant topographic feature of a 400 km long submerged ridge. The island represents a northwest extension of the Sierra Vizcaino of Baja California and is separated from the mainland by water only 109 m deep (Kilmer 1977, 1979). The highest points on the island are Monte or Cerro de Cedros at 1,194 m on the southern third of the island and Pico Gill at 1,194 m on the northern quarter of the island. The island is cut by a number of deep canyons including Gran Canon, Canon de la Mina and Canon Choyal on the east side, and Canons Colorado and Vargas on the west side.

Climate: The climate of Isla de Cedros is arid. Average annual precipitation from a station on the southern portion of the island is only 85 mm. Judging from vegetation characteristics, average seasonal rainfall on the upper regions of the island is approximately 200 mm. The majority of the rainfall occurs as the result of winter storm fronts and upper level low pressure systems (71 mm; Fig. 1); however, significant amounts fall in late summer and early fall (13.5 mm). Occasionally, torrential rains occur during the summer and fall due to unstable tropical air masses and chubascos. Heavy storms which caused flash floods and erosion of washes swept the island in October 1983 and September 1984.

The island has a high level of cloudiness during spring and summer (Table 1) due to stratus associated with the cool, California current. These clouds contact mountainous islands such as Isla Guadalupe and Isla de Cedros, producing fog. Contrasts between the windward contact area of fog and the clear, warm surroundings can be extreme. Due to condensation and reduction of evapo-
transpiration, the regular fog condition has had a substantial effect on the vegetation of Isla de Cedros (Libby et al. 1968). The coastal condition also reduces the temperature. While the average annual temperature for the southern end of the island is 19.9°C (Fig. 1), the northern end is several degrees cooler.

Geology: Isla de Cedros has a complex geologic history creating a variety of substrates for plant habitation (Kilmer 1977, 1979, 1984). Beginning in the late Jurassic, rock material accumulated in a deep trough. The material was subducted and metamorphosed beneath the oceanic crust while other rock materials were being deposited and compressed together. Intrusion by granitic magma then took place. From the Cretaceous, the formations were folded, faulted and overlaid by marine deposits. Finally, uplift occurred as recently as the late Pleistocene.

The extreme north end of the island consists of quartz diorite and granodiorite. The northern third of the island is made of ancient volcanics, breccia and chert. The southern two-thirds of the island is a mix of sandstone, shale, volcanics, limestone, serpentinite and peridotite. All of these rock materials affect the density and distribution of vegetation, particularly since the aridity of the island does not provide for extensive modern soil development.

Vegetation

Previous Reports: Brief discussions of vegetation communities on Isla de Cedros have been included in papers on endemic and unique species (Howell 1942; Libby et al. 1968; Moran & Benedict 1981). Others included short descriptions of the desert scrub, chaparral and pine forest vegetation (Madrigal 1970; Moran 1972; Rzedowski 1978). Hale (1943) included an excellent discussion of the general vegetation communities on Isla de Cedros in his survey and flora. New field information, understanding of additional communities and the availability of aerial photographs provided an opportunity to review the vegetation and produce a detailed map of the island. Furthermore, a survey of published information and collections allowed for a comprehensive understanding of the biogeography and known flora of the island.

Methods: The following vegetation community description is based on field visits by the author in February 1981, April 1983 (following a season of heavy rainfall and

<table>
<thead>
<tr>
<th>Condition</th>
<th>Season</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
<th>Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>S</td>
<td>65</td>
<td>53</td>
<td>58</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>76</td>
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<td></td>
<td></td>
<td>49</td>
<td>68</td>
<td>30</td>
<td>56</td>
</tr>
<tr>
<td>Cloudy</td>
<td>S</td>
<td>14</td>
<td>14</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>97</td>
<td>53</td>
<td>44</td>
<td>6</td>
</tr>
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<td>86</td>
<td>26</td>
</tr>
<tr>
<td>Partly Cloudy</td>
<td>S</td>
<td>12</td>
<td>14</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>44</td>
<td>13</td>
<td>33</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>27</td>
<td>10</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 1. Cloud cover conditions for Isla de Cedros, Isla Guadalupe and San Diego. Numbers are in mean percentages of total number of days observed with the identified weather condition on 1:15 p.m. PST SW U.S. weather satellite photographs over the three year period 1984 through 1986. The site categories are as follows: S = San Diego; G = Isla Guadalupe; C = Isla de Cedros.
excellent plant growth) and March 1988, and discussions by Hale (1941). Vouchers are filed at San Diego Museum of Natural History (SD) and University of Mexico, Mexico City (MEXU). Nomenclature largely follows Wiggins (1980). Vegetation was mapped (Fig. 2) from black and white aerial photographs at a scale of approximately 1:88,000. Mapped classifications follow those described below. Areas of mapped communities based on planimeter measurements and an approximation of the island area of 348 km$^2$ (Philbrick 1969) are listed in Table 2.

### Factors Affecting Vegetation on Isla de Cedros:

The composition of vegetation on Isla de Cedros is affected by elevation, slope aspect, substrate, northern or southern location on the island and bio-geographic history. Species composition of the vegetation communities in this region has varied through geologic time (Van Devender & Spaulding 1979). Some communities on Isla de Cedros are typical for modern Alta California, but most contain a mixture of species in unfamiliar combinations. The desert scrub community associations are fairly typical of central Baja California but have subtle differences in physiognomy, density and dominant species.

Vegetation on Isla de Cedros has another notable feature, a lack of heavy human disturbance and feral animal grazing. Though the island supports several thousand people and human caused fires recently have burned parts of the island, there is little to indicate a significant human presence beyond the town, villages and old mining areas.

### Table 2. Areas of vegetation communities on Isla de Cedros.

<table>
<thead>
<tr>
<th>Community</th>
<th>Area (km$^2$)</th>
<th>% of Island</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Desert Scrub</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Sarcocaulescent Desert Scrub</td>
<td>187.85</td>
<td>53.98</td>
</tr>
<tr>
<td>- Lower Slopes</td>
<td>137.85</td>
<td>39.98</td>
</tr>
<tr>
<td>- Upper Slopes</td>
<td>50.00</td>
<td>14.00</td>
</tr>
<tr>
<td>2. Cedros Wash Scrub</td>
<td>1.53</td>
<td>0.44</td>
</tr>
<tr>
<td>3. Desert Flat Scrub</td>
<td>173.15</td>
<td>4.90</td>
</tr>
<tr>
<td>4. Canyon Slope Scrub</td>
<td>15.69</td>
<td>0.45</td>
</tr>
<tr>
<td>5. Eroded Sandstone Scrub and</td>
<td>18.90</td>
<td>0.54</td>
</tr>
<tr>
<td>Nearly Barren Land Scrub</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B. Shrub Communities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Chaparral</td>
<td>8.34</td>
<td>0.40</td>
</tr>
<tr>
<td>2. Coastal Sage Scrub</td>
<td>0.10</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>3. Sonoran Scrub</td>
<td>4.02</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>C. Woodlands</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Pine Forest</td>
<td>1.65</td>
<td>0.47</td>
</tr>
<tr>
<td>2. Juniper Woodland</td>
<td>0.17</td>
<td>0.05</td>
</tr>
<tr>
<td><strong>D. Specialized Communities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Dune Psammophytic</td>
<td>1.15</td>
<td>0.03</td>
</tr>
<tr>
<td>2. Northern Bluff Succulent</td>
<td>4.11</td>
<td>1.18</td>
</tr>
<tr>
<td>3. Freshwater Aquatic</td>
<td>&lt;0.05</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>4. Herbaceous Vegetation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Salina Mudflats</td>
<td>0.07</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>E. Urban</strong></td>
<td>0.84</td>
<td>0.24</td>
</tr>
</tbody>
</table>

### Vegetation Description

**A. Desert Scrub Communities**

1. **Sarcocaulescent Desert Scrub - Lower Slopes:** This is a community with a significant area of open soil. The sarcocaulescent (Shreve 1951) *Pachycormus discolor*, is one of the dominants on the lower slopes of the entire island. Associated species include the sarcophyllous *Agave sebastianii*, the crassi-caulescent *Fernuca chrysacanthus* and low, drought adapted shrubs. *Ambrosia chenopodioides* is one of the most common species in Baja California and it is abundant on the lower slopes of Isla de Cedros. Appendix 1 lists the common species in each vegetation community.

- **Upper Slopes:** This community is found at elevations from roughly 240 m up to the lower edges of the chaparral and pine forest. *Pachycormus* is also a dominant in this community, but *Ambrosia chenopodioides* and other low shrubs are more prevalent than on the lower slopes, and the vegetation has greater density. California juniper sparsely mixes in with this community but is low and stunted. *Agave also* is present, but in lower numbers than on the lower slopes.

2. **Cedros Wash Scrub:** Cedros wash scrub is one of the most distinctive desert scrub associations on the island. Large areas of nearly barren alluvium are interspersed with pockets of large shrubs and subshrubs: *Rhus*...
lentii, Encelia asperifolia, the striking silver and gold Viguiera lanata, Bebbia juncea and Encide vertata. Some of the shrubs such as Rhus lentii reach large sizes, as much as 4 m high and 6 m across. All of the main canyons, especially Gran Canon and Canon Vargas, support this vegetation. The mouths of the large washes are sandy and cobbly and have an open cover of small shrubs, and suffrutescent and herbaceous perennials.

3. Desert Flat Scrub: Portions of the desert flats are dominated by the sarcophyllous Agave sebastiana which in some places forms dense patches similar to A. shawii on the mainland north of Ensenada. Other dominants are the low shrubs and suffrutescent perennials Ambrosia chrysoides, Esphoria mira, Lycium brevipes, Simmondsia chinesis, Sphaeralcea foemina and Frankenia palmeri. A fine example of this community is accessible near the lighthouse on Punta Norte but much larger areas exist on the southern and western portions of the island.

4. Canyon Slope Scrub: Canyon slopes around the island support the greatest desert scrub diversity. The combination of the shaded canyon slopes and steep walls create a variety of habitats for plants to occupy. Vegetation in this community is dominated by shrubs. Dominant species include Rhamnus insulae, Salvia edwardsii, Lycium brevipes, Trixis California, Galvezia juncea and Xylorhiza arborea. In the northern canyons where this vegetation is best developed, Monardella thymifolia, Leptodactylon veatchii and Verbeina hastata also are present.

5. Eroded Sandstone Scrub and Nearly Barren Land: The portion of the island south of the town of Cedros, consists of a Cretaceous sandstone. It has the general appearance of barrenness and low vegetation density. Pastincomus dicentor is the dominant shrub; however, it is small in stature in those areas. Frankenia palmeri also is a dominant subshrub. The southwest point of the island on Cabo San Agustin is composed of the Franciscan Cedros formation in a rocky and very sparsely vegetated terrain.

B. Chaparral and Scrub Communities

1. Chaparral: The vegetation which approximates the chaparral community forms stands north of Cerro de Cedros and on the highest northern peaks, both within and above the pine forest. It is dominated by a few woody shrubs: Adenostoma fasciculatum, Xylococcus brevipes and Quercus edwardsii. Other less common chaparral components include Cassia torviflora and Castrova rotundifolia. Hale describes vegetation in 1939 on top and north of Cerro de Cedros as growing in dense stands averaging 3 m high. A visit to that area in 1983 showed the effects of a recent, human caused fire over the upper 300 m of the mountain which left only an open covering of shrubs.

2. Coastal Sage Scrub: Artemisia californica is the key species of this community. It has been found in a familiar pattern with Eriophyllum confertiflorum and Eriogonum fasciculatum only on the north slope of Cerro de Cedros. However, it also occurs in isolated locations on the northern peaks of the island. Other associates of coastal sage scrub are found scattered in desert scrub associations on the island.

3. Sonoran Scrub: A non-diverse, homogenous vegetation community dominated by the low, bright green, Haplopappus sonorensis grows on the south and western slopes of Cerro de Cedros. Haplopappus sonorensis is found nearly to the base of the mountain west of town, but the greatest development is above 600 m.

C. Woodlands and Forest

1. Pine Forest: A dense forest of Pinus radiata is distributed in well-defined, linear groves from the ridge north of Gran Canon to the northern end of the island. The 5-10 m tall groves stand precisely in locations where clouds settle (between 500-800 m) during the spring and summer periods when stratus clouds form (Table 1). Within the groves themselves, understory vegetation is limited to occasional Senecio edwardsii and scattered pine.
vegetation. The island name "Cedros" may refer to this species.

3. Fresh Water Aquatic Community:
Several large, perennial fresh water springs are present on the island and have been used to supply water for human consumption, especially those on the south and east slopes of Cerro de Cedros. Introduced vegetation is prevalent near them including Polypogon monspeliensis, Saltum rugosum and Tamarix ramossissima. Several other indigenous semi-aquatic species occur in less disturbed springs and moist canyons. Juncus acutus forms dense rosettes in the narrow bottom of several of the larger canyons.

4. Herbaceous Vegetation Communities
- Talus-clay Slopes: Crumbly clays and loose shales occur northwest of the town and in some of the larger canyons. These substrates support a combination of herbaceous annuals and suffrutescent perennials. Dominants include Mentha hypericifolia, Eriogonum fasciculatum, and Lupinus albiflora.

- Herblands: On the upper slopes of Cerro de Cedros, herbaceous vegetation occurs on fine soils among dead juniper trunks following a human caused fire of 1981 or 1982. This community is analogous to fire-induced wildflower areas on the mainland and contains Lupinus, Sibara, Cryptantha, Avena, Bromus, Thysanocarpus, and Erodium cicutarium. If left with no further disturbance, chaparral may recover; however, shrub seedlings were not observed to be very numerous.

- Hemizonia Depressions: Hale (1941) describes shallow, vernal-pool-like depressions near the town. One of the dominants was H. kelloggii. Examination of suitable areas in 1983 did not indicate their persistence due to the expansion of the town, however, H. fasciculata still occurs near the village.

5. Salina Mudflat Community
South of the airport, a large, clay-bottom flat, salina, exists which collects sea water during periods of high tides. Much of the soils is barren; however, Atriplex glauca tends to grow up to four feet tall in scattered patches. Frankenia palmeri and Atriplex palus occur here and in similar habitats on the mainland of Baja California. Patches of this community also occur on low areas on the west coast of the island in the mouths of washes and near the dunes.

Biogeographic History
There are two possible ways that the plants on Isla de Cedros could have arrived: 1) by migration across a land bridge or 2) by over-water dispersal. During the latest pluvial period and possibly in earlier ones, the sea level was a maximum of 140 m lower than at present (Vedder & Howell 1980). This produced a land connection between Isla de Cedros and Punta Eugenia by which vegetation as well as the endemic deer and rattlesnakes could have migrated to the island.

Furthermore, during the Pleistocene pluvial maximum, the climatic conditions were cooler and more music than those that prevail in the southern California-northern Baja California region (Axelrod & Demere 1984; Abbott 1981; Wells 1969, 1987). Some component species of coastal sage scrub (Artemisia tridentata, Eriogonum fasciculatum) may have been able to migrate all the way around to Isla de Cedros during these periods (Axelrod 1978). However, based on the above referenced reports, it is not likely that chaparral and maritime pines extended as far down the coast as Isla de Cedros since its emergence.

Vegetation on Guadalupe Island which has never been connected to the mainland (Batiza 1977) is an example of over-water dispersal. It supports pines, palms, cypress and apparently at one time, chaparral. The location of closed-cone pine forest on the coast of southern Alta

D. Specialized Communities

1. Dune Psammophytic Community:
   On the long coastline on the western side of the island, north of the San Agustin range, the sandstones have eroded into shallow, wind-blowen dunes. A very sparse community consisting of low growing shrubs and herbaceous perennials occurs there. Dominant species are Atriplex palus and Frankenia palmeri.

2. Northern Bluff Succulent Community:
   This succulent community is characterized by members of the genus Dudleya. The community is confined to the windward, north-facing cliffs, and bluff slopes, north of Pico Punta Norte. Dudleya pachyphyta is a dominant in some places making up 15-20% of the plant cover. Associates are Eriogonum mollis, Ambrosia monopetala, Ambrosia chamissonis, and D. subulata.

3. Juniper Woodland:
   Juniperus californica is dominant below the chaparral belt on the highest peaks and on some slopes of large canyons. On the upper peaks it attains respectable sizes, but in the loose claystone canyons. On the upper peaks of Cerro de Cedros, juniper woodland is very abrupt.

- Northern Bluff Succulent Community:
   This succulent community is confined to the windward, north-facing cliffs, and bluff slopes, north of Pico Punta Norte. Dudleya pachyphyta is a
California and northern Baja California (Axelrod & Demere 1984; Axelrod 1980) in later Pleistocene and Pleistocene pluvial periods presented a source for propagules to inoculate the islands. Pines and some of the chaparral species produce salt-water resistant capsules, fruits and seeds which could have easily floated to the islands, and some coastal sage scrub species have seeds which may have been carried to the island by wind.

During a Pleistocene pluvial period (as shown on Fig. 3), under greater levels of rainfall, pines may have existed from near sea level at Punta Norte and along the island's main mountain divide to Cerro de Cedros. Chaparral would have occurred on slightly dryer slopes than the pines and intertwined with them. Coastal sage scrub may have occurred in a band below the chaparral. The rest of the island would have been covered with desert scrub vegetation. The modern distribution of vegetation on the island is the result of general climatic warming and drying during the xerothermal period. It is not clear how much this post-Pleistocene, xerothermal period would have affected Isla de Cedros since warmer periods result in greater levels of summer and fall rainfall in desert areas (Van Devender & Spaulding 1979) and this may have contributed to the survival of the pines.

Acknowledgments
Acknowledgments are due to Biologist Rene Luis Aguilar Vasquez, Oficina de Peces, Isla de Cedros, for arranging travel by abalone boat to Punta Norte; the Miller family of H&M Landing and Eddie McEwen and Margie Stinson of Fisherman's Landing for allowing me to serve as naturalist on trips to this and other islands; George Hale for a copy of his 1941 Master's thesis; Thomas Banks of the Foundation for Field Research, Alpine, for use of aerial photographs; Eric Wier, Harold Wier and James Dice who were travel companions on the island in 1983; Senior Jose of Los Cocoses Hotel who provided lodging and assisted in translating for us; Robert Thorne, Ralph Philbrick, Reid Moran and F.G. Hochberg for commenting on the manuscript; Mary Gooveia for typing parts of the manuscript, and to my wife Irene, who endured my absences while visiting the island.

Literature Cited


Appendix 1.
Species Composition of Vegetation
I. Sarcococender Desert Scrubs
- Lower slopes: Adenostoma fasciculatum
- Upper slopes: Adenostoma fasciculatum, Arctostaphylos uva-ursi, Larrea divaricata var. denudata, Muhlenbergia montana, Psorothamnus spinosus, Rhus lentii, Ribes tortuosum, Xylococcus bicolor, Zeigleria papyracea.

II. Coastal Sage Scrub
- Arctostaphylos uva-ursi, Larrea divaricata var. denudata, Muhlenbergia montana, Psorothamnus spinosus, Rhus lentii, Ribes tortuosum, Xylococcus bicolor, Zeigleria papyracea.

III. Sonoran Scrub
- Adenostoma fasciculatum, Larrea divaricata var. denudata, Muhlenbergia montana, Psorothamnus spinosus, Rhus lentii, Ribes tortuosum, Xylococcus bicolor, Zeigleria papyracea.

IV. Chapparal and Scrub Communities
- Adenostoma fasciculatum var. denudata, Castanea torminalis, Lithocarpus arbuscula, Diplacus integrifolia, Eriogonum confertiflorum, Garrya camphora, Haplopappus sonorensis, Juncus edulis, Larrea divaricata var. denudata, Muhlenbergia montana, Psorothamnus spinosus, Rhus lentii, Ribes tortuosum, Xylococcus bicolor, Zeigleria papyracea.
Preliminary Annotated List of Vascular Plants of Isla Cedros, Baja California, Mexico

C. Woodlands
1. Pine Forest
   Pinus radiata cedrosensis (Blake) Clark & Kyhos. Occurs on the main ridge of the island north of Gran Canon and Pico Punta Norte as well as the northern canyons.
2. Juniper Woodland
   Juniperus californica. Inhabits sandy soils on upper parts of the island.
3. Freshwater Aquatic
   Alkanea californica var. leopoldii, Polypogon monspeliensis, Scirpus domingensis. Inhabits sandy soils on upper parts of the island.
4. Herbaceous Vegetation
   - *Ambrosia chamissonis* (Greene) Payne. Found in disturbed areas around Cerro de Cedros Spring.
   - *Ambrosia camphorata* (Benth.) Greene. Inhabits sandy soils on upper parts of the island.

Appendix 2

Preliminary Annotated List of Vascular Plants of Isla de Cedros, Baja California, Mexico

Isla de Cedros has been visited by a number of collectors. Most notable have been A.W. Anthony, T.S. Brandegee, F.H. Elmore, E.L.Greene, J.T. Howell, Herbert Mason, Edward Palmer, J.A. Veitch and L.M. Walker. The first comprehensive species list for the island was created by George Hale in 1941 and included 212 species. Since then, a number of other collectors have visited the island including M.R. Benedict, D. Bronie, C. Davison, E.Y. Dawson, G. Fleming, A.L. Haines, J. Henryckson, D. House, S. Junak, G. Lindsay, C.H. Muller, R. Phillbrick, M.L. Stinson, R.F. Thorne, W. Williams, D.A. Young and the author with H. Eier, E. Eier and J. Dice. Currently, Jose Delgadillo Rodriguez of Universidad Autonoma de Baja California, Ensenada is preparing a diagnostic collection of the plants of Isla de Cedros. The greatest number of collections have been made by R. Moran and are housed at the San Diego Museum of Natural History. However, the Santa Barbara Botanic Garden herbarium also stores significant collections of Cedros Island plants.

This list is arranged alphabetically by families and genera. Names are as follows. The northern point of the island is Punto Norte, the southwestern point is Cabo San Agustin, and Punta Morro is located near the northern canyon mouth on the southwest coast. The northern canyon walls. Erroneously listed as *Ambrosia camphorata* (Benth.) Greene. Inhabits sandy soils on upper parts of the island.

A. Anacardiaceae
   - *Rhus integrifolia* var. *cataphylla* (Benth.) Payne. Found in disturbed areas around Cerro de Cedros Spring.

B. Apocynaceae
   - *Euphorbia polycarpa* (Greene) Payne. Most common on middle and upper elevations, but also lower canyon slopes.

C. Asteraceae
   - *Ambrosia chiotensis* (Less.) Greene. Inhabit sandy soils on middle and lower elevations.

D. Aizoaceae
   - *Eriogonum molle* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

E. Asclepiadaceae
   - *Asclepias subulata* (Greene) Payne. Found in disturbed areas around Cerro de Cedros Spring.

F. Apiales
   - *Ephedra agrestis* Engelm. Widespread on lower parts of the island.

G. Angrispermaceae
   - *Artemisia californica* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

H. Angiospermae
   - *Ambrosia camphorata* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

I. Apiales
   - *Ephedra agrestis* Engelm. Widespread on lower parts of the island.

J. Angrispermaceae
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N. Angiospermae
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P. Angrispermaceae
   - *Artemisia californica* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

Q. Angiospermae
   - *Ambrosia camphorata* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

R. Apiales
   - *Ephedra agrestis* Engelm. Widespread on lower parts of the island.

S. Angrispermaceae
   - *Artemisia californica* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

T. Angiospermae
   - *Ambrosia camphorata* (Benth.) Greene. Inhabit sandy soils on middle and lower elevations.

U. Apiales
   - *Ephedra agrestis* Engelm. Widespread on lower parts of the island.
Rafinisquia californica

Porophyllum gracile


Greenella ramulosa

Gnaphalium stramineum Nutt. Found on Cerro de Cedros and central uplands.

Filago californica

Filago arizonica Gray. Inhabits the pine ridge area north of the Gran Canon.

Cassia chrysochila

Cassia chilense Spreng.]

Descurainia pinnata halictorum (Woot. & Standl.) Detl. (Hook. & Arn.) *Capsella bursa-pastoris (Hook.) Greene. Occurs on low elevations, particularly washes.

Cryptantha barbigera (Gray) Greene. Occurs on the northeast slope of upper elevations but also on north slopes of uper elevations.

Thlaspi arvense var. halophilum (L.) Cass. Occurs on the southwest coastal beach.

*Euphorbia ilicis (L.) Mill. Inhabits disturbed areas on Cerro de Cedros.

Atriplex julacea Wats. Occurs on Cerro de Cedros and near the Gran Canon.

Dudleya acuminata (Hook.) Greene. Inhabits low elevations around the island.

Lepidium denudatum var. denudatum Rehd. Exists on the northern peaks.

Thysanocarpus tunartii Hook. Grows on upper slopes, north end of the island.

Thysanocarpus tunartii Nutt. Found on Cerro de Cedros.

Cactaceae

Bergenia macrata (Engel.) Britt. & Rose. Reported by Greene (1888) but not likely to occur.

Eclipta orientalis var. orientalis (Pari in Eng.) Ramp. Listed by Hale (1941), but probably refers to the following.

Eclipta norcina (fomes) K. Schum. Low elevations around the island.

Fenestraria chrysantha (Oerst.). Britt. & Rose. Occurs over most of the island up to intermediate elevations.

Lobelia sanderi (Engel.) Britt. & Rose. Isolated locations above Cerro de Cedros Spring and on the northeast coast.

Mammillaria hildae Boed. Alkaloid rich flats near the island.

Mammillaria phyllaloe Scherr. var. phyllaloe Endemic to the pine ridge area north of Pico Punta Norte.

Rhipsalis spinosa var. exigua Dawson. In Wiggins (1980) as endemic, but the relationship needs clarification.

Mammillaria hildae Boed. Inhabits sandy and gravelly washes and hillsides at low elevations.

Mammillaria (Colonia) puleg. Greene. Widespread in middle elevations.

*Jasione spinosa var. spinosa Dawson. Found on Kent slopes and flats on the northern third of the island.

Jasione polifolia Engelm. Occurs in scattered locations on Cerro de Cedros Spring.

Polycarpon depressum (Wats.) Kuntze. Occurs on low elevations, particularly washes.

Verbesina hastata L. Reported by Thorne (unpubl. list 1938). Reported by Thorne (unpubl. list 1938). Occurs in scattered locations the length of the island.

Amsinckia menziesii (Lehm.) Nels. & Macbr. Occurs in the Gran Canon and near town.

Amsinckia serpyllifolia var. yptochaeta (Macbr.) Jtn. Grows on flats behind beaches on the east side of the island.

Amsinckia serpyllifolia var. serpyllifolia (Greene) Jtn. Occurs in the Gran Canon and near town.

Caryophyllaceae

Althaea sp. (Ros.) Equus. Occurs on low areas, west and southern coasts, especially near the airfield.

Arctotheca australis Nutt. Grows near Punta Norte on cliff slopes north of the pines, and on the south coast.

Artemisia herba-alba (both) Dev. Known from sandy dunes in the south and western parts of the island.

Artemisia herba-alba var. subalba (Ruiz & Pav.) Berger in Eng. & Prantl. [=Tilia emota Hook. & Arn.]. Known from sandy dunes in the south and western parts of the island.

Boraginaceae

Anisopteris exilis (Reid.) Smith. Collected on Cerro de Cedros.

Brassicaceae

Alyssum nummularum (L.) Moq. in Decandolle. Found in the southern part of island.

* Aster triunfense L. South coast near airfield.

Arctivis longifolia (Moq. in Descendolle) Dietr. Grows on western heads dunes and southern pine area.

Atriplex paupera Nels. Occurs in scattered locations on northern end, west coast and Cerro de Cedros Spring.

Caryophyllaceae

Calandrinia angustissima (Engl.) & Prantl. [=Tilia emota Hook. & Arn.]. Known from middle and upper elevations north of Cerro de Cedros.

Calandrinia angustissima (Engl.) & Prantl. [=Tilia emota Hook. & Arn.]. Known from middle and upper elevations north of Cerro de Cedros.

Caryophyllus latifolius Poir. Occurs on ridge tops mostly north of Pico Punta Norte.
Errazurizia benthamii
Astragalus nuttallianus
Dalea mollis
Kell. Grows at low elevations over the entire island.
Astragalus fastidius
Millsp. Grows in rocky slopes in the canyon near Pico Gill.
Euphorbia misera
Argithamnia (Ditaxis) californica
Acalypha californica
Chamaesyce (Euphorbia) polycarpa
Chamaesyce (Euphorbia) albomarginata
Marah macrocarpus
Echinopepon minimus (Kell.) Wats. Inhabits washes over the entire island.
Dudleya cedrosensis
Dudleya albiflora
arroyo bottoms over the entire island.
Moran & Benedict. Endemic to the northern canyons and ridges north of Pico Punta Norte.
Phacelia ixodes Kell. Occurs on low elevations around the island.
Linaria multifida Greene. Widespread, growing up to middle elevations.
Phacelia nodosa Benth. Found in canyons mostly north of Cerro de Cedros.
Erodium texanum*
*Erodium cicutarium.
Frankenia palmeri
Lotus strigosus
Lotus scoparius
Lotus salsuginosus
Lotus nudatus
Brandegee (1900).

Dalea cedrosensis
Dorotheanthus bellidifolius var. var. nudatus (Greene) Erichsen. Grows on the northern portion of the island.
Dalea texana Kell. Widespread on slopes and washes.
Ribes viburnifolium
Ribes auriculatum

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Adenostoma fasciculatum
obtusifolium
Heteromeles arbutifolia
ined.
Zizyphus (Condaliopsis) parryi microphylla (Jtn.)
Kell. Present on north facing canyon
Rhamnus insula
Ranunculus hebecarpus
Galium stellatum
Galium angustifolium angustifolium.
Ceanothus verrucosus
Nutt. in Torr & Gray. Occurs
Delphinium cardinale
Pterostegia drymarioides
Lastarriaea chilensis
Oligomeris linifolia (Nutt.) Hook. & Arn. Found on
Claytonia perfoliata perfoliata.
Occurs on Cerro de Cedros and Canon de la Mina.
Cerastium texanum var. texana
(Celtis reticulata
Torr. Reported from
Cnephalium acuminatum var. acuminatum
Agrostis gigantea (L.) Desf. Occurs
Antirrhinum watsonii
Diplacus stellatus
Galvesia juncea
Cneoridium dumosum
Cedros Spring and Gran Carton.
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