

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 sarcocaulous 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 bio-geographic 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 approximately 39 km long and about 15 km wide at the widest point, totalling roughly 348 km². From outward appearances, Isla de Cedros is a nearly barren series of ridges and canyons. However, due to its size, topographic variation, geologic history, climate 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 1,063 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-

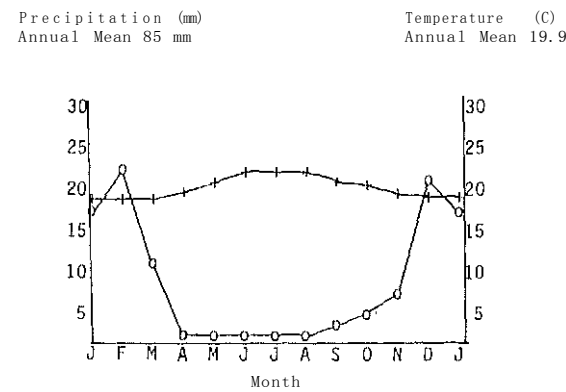


Figure 1. Climatic data for the town on Isla de Cedros. Data is from Hastings & Humphrey (1969). Plus signs indicate average monthly temperature and zeros signify average monthly precipitation.

transpiration, the regular fog condition has had a substantial effect on the vegetation of Isla de Cedros (Libby *et al.* 1968). The cloud 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 overlain by marine deposits. Finally, uplift occurred as recently as the late Pleistocene.

Table 1. Cloud cover conditions for Isla de Cedros, Isla Guadalupe and San Diego. Numbers are in mean percentage 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.

Condition	Season:	Percentage Condition (%)											
		Winter			Spring			Summer			Fall		
		S	G	C	S	G	C	S	G	C	S	G	C
Clear		65	53	58	73	28	32	80	38	49	68	50	56
Cloudy		23	34	28	14	57	53	13	44	34	19	86	26
Partly Cloudy		12	14	44	13	15	15	6	17	17	10	22	18

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 (Madriral 1970; Moran 1972; Rzedowski 1978). Hale (1941) 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

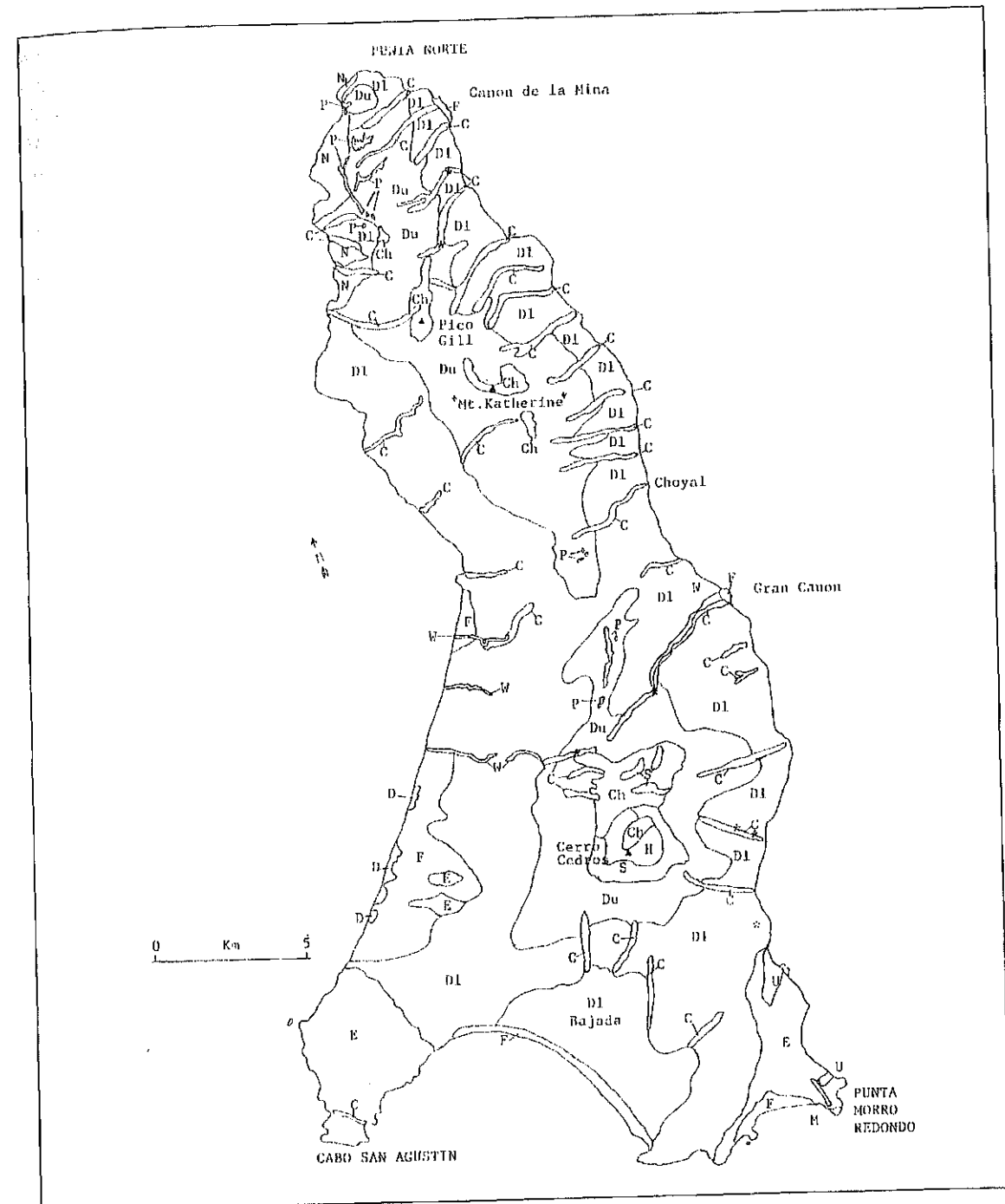


Figure 2. Vegetation map of Isla de Cedros. Vegetation communities represent those described in the text. The map was created from black and white aerial photographs at a scale of 1:88,000, field information and discussions by Hale (1941). Symbols and abbreviations: C = Canyon Slope Scrub; Ch = Chaparral; D = Dunes; D1 = Sarcocaulic Desert Scrub - upper slope; E = Eroded Sandstone Scrub and Nearly Barren Land; F = Desert flat scrub; H = Herblands; M = Salina mudflat; N = Northern bluff succulent; P = Pine forest; S = Sonoran scrub; U = Human Development (Urban); W = Cedros Wash Scrub; * = Freshwater Spring.

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 km² (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.

Vegetation Description

A. Desert Scrub Communities

1. Sarcocaullescent Desert Scrub - Lower Slopes: This is a community with a significant area of open soil. The sarcocaullescent (Shreve 1951) *Pachycormus discolor*, is one of the dominants on the lower slopes of the entire island. Associated species include the sarcophyllous *Agave sebastiana*, the crassicaulescent *Ferocactus chrysacanthus* and low, drought adapted shrubs. *Ambrosia chenopodiifolia* 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 camphorata* 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*

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

Community	Area (km ²)	% of Island
A. Desert Scrub		
1. Sarcocaullescent Desert Scrub		
Lower Slopes	187.85	53.98
Upper Slopes	79.76	22.98
2. Cedros Wash Scrub	1.53	0.44
3. Desert Flat Scrub	17.05	4.90
4. Canyon Slope Scrub	15.69	4.51
5. Eroded Sandstone Scrub and Nearly Barren Land Scrub	23.80	6.84
B. Shrub Communities		
1. Chaparral	8.34	2.40
2. Coastal Sage Scrub	<10	<01
3. Sonoran Scrub	4.02	1.15
C. Woodlands		
1. Pine Forest	1.65	0.47
2. Juniper Woodland	0.17	0.05
D. Specialized Communities		
1. Dune Psammophytic	1.15	0.33
2. Northern Bluff Succulent	4.11	1.18
3. Freshwater Aquatic	<05	<01
4. Herbaceous Vegetation		
Talus-Clay Slopes	<05	<01
Herblands	1.88	0.54
<i>Hemizonia</i> Depressions	<05	<01
5. Salina Mudflat	0.07	0.02
E. Urban	0.84	0.24

lentii, *Encelia asperifolia*, the striking silver and gold *Viguiera lanata*, *Bebbia juncea* and *Encide cordata*. 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 chenopodiifolia*, *Euphorbia misera*, *Lycium brevipes*, *Simmondsia chinensis*, *Sphaeralcea fulva* 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 insula*, *Salvia cedrosensis*, *Lycium brevipes*, *Trixis California*, *Galvezia juncea* and *Xylonagra arborea*. In the northern canyons where this vegetation is best developed, *Monardella thymifolia*, *Leptodactylon veatchii* and *Verbesina 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. *Pachycormus discolor* 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 bicolor* and *Quercus cedrosensis*. Other less common chaparral components include *Ceanothus verrucosus* and *Garrya veatchii*. 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 cedrosensis* and scattered pine

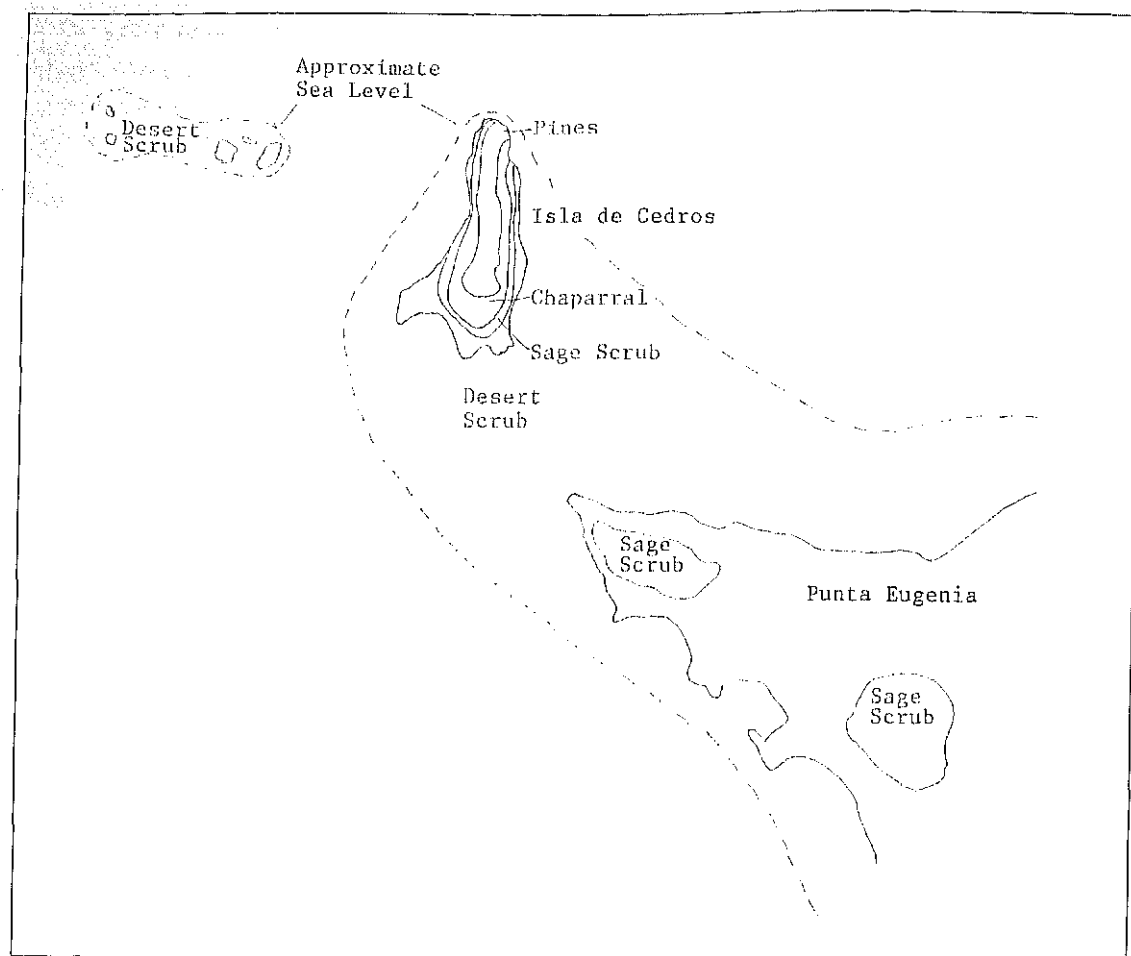


Figure 3. Theoretical Pleistocene pluvial period vegetation for Isla de Cedros.

seedlings in a needle duff layer. The edges of the forest in some places support chaparral community species but also *Diplacus stellatus*, *Rhus laurina* and *Eriogonum molle*; however, the boundary between pine forest and desert scrub is very abrupt.

2. 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 soils in large canyons such as Gran Canon, the species form low shrubs with little other vegetation. The island name "Cedros" may refer to this species.

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-blown dunes. A very sparse community consisting of low growing shrubs and herbaceous perennials occurs there. Dominant species are *Atriplex julacea* and *Frankenia palmeri*.

2. Northern Bluff Succulent Community: This sarcophyllous 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 pachyphytum* is a

dominant in some places making up 15-20% of the plant cover. Associates are *Eriogonum molle*, *Agave sebastiana*, *Ambrosia camphorata*, *Frankenia palmeri*, *Dudleya acuminata* and *D. albiflora*.

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*, *Sorghum vulgare* and *Tamarix ramosissima*. 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 *Mentzelia hirsutissima*, *Eschscholzia ramosa*, *Mirabilis californica* and *Lepidium oblongum*.

- 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 *Lepidium*, *Sibara*, *Cryptantha*, *Avena*, *Bromus*, *Thysanocarpus*, *Lupinus concinnus*, *Caulanthus heterophyllus* 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 soil is barren; however, *Allenrolfea occidentalis* grows up to four feet tall in scattered patches. *Frankenia palmeri* and *Atriplex julacea* 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 mesic 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 (*Haplopappus venetus*, *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

California and northern Baja California (Axelrod & Demere 1984; Axelrod 1980) in later Pliocene and Pleistocene pluvial periods presented a source for propagules to inoculate the islands. Pines and some of the chaparral species produce salt-water resistant cones, 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 intermixed 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 the 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.

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Appendix 1.

Species Composition of Vegetation

A. Desert Scrub Communities

1. Sarcocaulous Desert Scrub

- Lower Slopes: *Agave sebastiana*, *Ambrosia chenopodiifolia*, *Ephedra aspera*, *Eriogonum fasciculatum*, *E. pondii*, *Euphorbia misera*, *Ferocactus chrysacanthus*, *Harfordia macroptera* var. *fruticosa*, *Mirabilis California cedrosensis*, *Pachycormus discolor veatchiana*, *Perityle emoryi*, *Porophyllum gracile*, *Salvia cedrosensis*, *Simmondsia chinensis*.

- Upper Slopes: *Ambrosia camphorata*, *Mammillaria pondii*, *Encelia stenophylla*, *Eriogonum*

fasciculatum, *Ferocactus chrysacanthus*, *Haplopappus sonorensis*, *Juniperus californica*, *Cheilanthes deserti*, *Pachycormus discolor veatchiana*, *Simmondsia chinensis*.

2. Cedros Wash Scrub

Ambrosia chenopodiifolia, *Baccharis sarothroides*, *Bebbia juncea*, *Camissonia cardiophylla cedrosensis*, *Encelia cordata*, *Ferocactus chrysacanthus*, *Ina hayesiana*, *Lupinus sparsiflorus* var. *pondii*, *Malosma laurina*, *Pachycormus discolor veatchiana*, *Petalonyx linearis*, *Phacelia Isodes*, *Paseolus filiformis*, *Rhamnus insula*, *Rhus lentii*, *Sibara pectinata*, *Simmondsia chinensis*, *Stipa lepida*, *Verbesina hastata*, *Viguiera lanata*.

3. Desert Flat Scrub

Acalypha californica, *Agave sebastiana*, *Ambrosia chenopodiifolia*, *Atriplex barclayana*, *Calandrinia maritima*, *Chenopodium murale*, *Cleome isomeris*, *Dudleya albiflora*, *Echinocereus maritimus*, *Encelia californica*, *Eriogonum fasciculatum*, *Euphorbia misera*, *Fagonia laevis*, *Ferocactus chrysacanthus*, *Frankenia palmeri*, *Mammillaria pondii*, *Mesembryanthemum nodiflorum*, *Harfordia macroptera* var. *fruticosa*, *Lophocereus schottii*, *Lycium brevipes*, *Opuntia oricola*, *Pachycormus discolor veatchiana*, *Perityle emoryi*, *Simmondsia chinensis*, *Sphaeralcea fulva*, *Teucrium glandulosum*.

4. Canyon Slope Scrub

Dudleya acuminata, *Encelia stenophylla*, *Galvezia juncea*, *Leptodactylon veatchii*, *Lycium brevipes*, *Mirabilis californica*, *Monardella thymifolia*, *Penstemon cedrosensis*, *Rhamnus insula*, *Salvia cedrosensis*, *Trixis californica*, *Viguiera lanata*, *Xylonagra arborea*.

5. Eroded Sandstone Scrub and Nearly Barren Land

Frankenia palmeri, *Pachycormus discolor veatchiana*.

B. Chaparral and Scrub Communities

1. Chaparral

Adenostoma fasciculatum var. *obtusifolium*, *Ceanothus verrucosus*, *Delphinium cardinale*, *Diplactus stellatus*, *Eriophyllum confertiflorum*, *Garrya veatchii*, *Heteromeles arbutifolia*, *Juniperus californica*, *Lonicera subspicata* var. *denudata*, *Marab macrocarpus*, *Pellaea andromedaefolia*, *Pholistoma racemosum*, *Pityrogramma triangularis* var. *maxonii*, *Quercus cedrosensis*, *Rhamnus insula*, *Rhus lentii*, *Ribes tortuosum*, *Xylococcus bicolor*, *Ziziphus parryi microphylla*.

2. Coastal Sage Scrub

Ambrosia camphorata, *Artemisia californica*, *Eriogonum fasciculatum*, *Eriophyllum confertiflorum*.

3. Sonoran Scrub

Ambrosia camphorata, *Haplopappus sonorensis*, *Gutierrezia sarothrae*.

C. Woodlands

1. Pine Forest

Descurainia pinnata, *Diplacus stellatus*, *Eriogonum molle*, *Heteromeles arbutifolia*, *Malosma laurina*, *Microseris linearifolia*, *Pinus radiata cedrosensis*, *Rhus integrifolia*, *Senecio cedrosensis*.

2. Juniper Woodland

Ambrosia campborata, *Juniperus californica*.

D. Specialized Communities

1. Dune Psammophytic

Abronia maritima, *Achyroxychia cooperi*, *Ambrosia chamissonis*, *Atriplex julacea*, *Camissonia crassifolia*, *Frankenia palmeri*, *Lycium andersonii*, *Triteliopsis palmeri*, *Perityle emoryi*.

2. Northern Bluff Succulent

Agave sebastiana, *Amblyopappus pusillus*, *Ambrosia campborata*, *Dudleya acuminata*, *D. albiflora*, *D. pachyphytum*, *Echinocereus maritimus*, *Eriogonum molle*, *Euphorbia misera*, *Ferocactus chrysacanthus*, *Frankenia palmeri*, *Mammillaria goodridgei*, *M.pondii*.

3. Freshwater Aquatic

Adiantum capillus-veneris, *Iva hayesiana*, *Juncus acutus leopoldii*, *Polygonum monspeliensis*, *Scirpus cernuus californicus*, *Tamarix ramosissima*, *Typha domingensis*.

4. Herbaceous Vegetation

- Talus-Clay Slopes: *Calandrinia maritima*, *Echinopepon minus*, *Eriogonum intricatum*, *Eschscholzia ramosa*, *Euphorbia polycarpa*, *Fagonia laevis*, *Hemizonia fasciculata*, *Lepidium oblongum* var. *insulare*, *Mentzelia hirsutissima* var. *nesiotes*, *Mirabilis californica cedrosensis*, *Phaseolus filiformis*.

- Herblands: *Avena barbata*, *Bromus rubens*, *Caulanthus heterophyllus*, *Cryptantha* sp., *Descurainia pinnata*, *Dichelostemma pulchellum*, *Erodium cicutarium*, *Lepidium lasiocarpum*, *Lupinus concinnus*, *L. sparsiflorus pondii*, *Pectocarya linearis*, *Phaseolus filiformis*, *Plagiobothrys californicus*, *Salvia columbariae*, *Sibara filifolia*, *Thysanocarpus laciniatus*, *Vulpia myuros*.

- Hemizonia Depressions: *Astragalus cedrosensis*, *Atriplex pacifica*, *Calandrinia maritima*, *Cryptantha maritima*, *Hemizonia kelloggii*, *Lastarriaea chilensis*, *Perityle emoryi*.

5. Salina Mudflat

Allenrolfea occidentalis, *Mesembryanthemum crystallinum*, *Frankenia palmeri*, *Atriplex julacea*.

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. Veatch 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. Bostic, C. Davison, E.Y. Dawson, G. Fleming, A.L. Haines, J. Henrickson, D. Howe, S. Junak, G. Lindsay, C.H. Muller, R. Philbrick, M.L. Stinson, R.F. Thorne, W. Williams, D.A. Young and the author with H. Wier, E. Wier 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.

In this list, species presence is based on collections by the author at (SD), Hale's 1941 thesis, published reports, museum herbaria San Diego Museum of Natural History (SD) and Rancho Santa Ana Botanic Garden (RSA) and collection lists by R. Moran and R.F. Thorne. Distribution is based on field observation, information in Hale's unpublished thesis and location data on herbarium specimens.

Parts of Cedros still remain relatively unexplored botanically, particularly the southwest portion including Cabo San Agustin and the north portions of the west coast. Though they have been partially surveyed, the higher peaks and northern end still may contain surprises.

This list is arranged alphabetically by families with nomenclature generally following Wiggins (1980). Species denoted with an asterisk (*) presumably are introduced. Low elevations refer to less than approximately 150 m elevation, intermediate and middle elevations are roughly 150-700 m and upper elevations are between 700 m and the island's highest points.

Location names are as follows. The northern point of the island is Punta Norte, the southwestern point is Cabo San Agustin, and Punta Morro Redondo is the southeastern point of the island. Cerro de Cedros located on the southern third of the island is the island's highest peak at 1,194 m. North of Cerro de Cedros are two large canyons, Gran Canon on the east side and Canon Vargas on the west. The mountain north of these canyons was referred to by Hale as Mt. Katherine but has no official designation. Two peaks, Pico Gill at 1,063 m

and Pico Punta Norte respectively rise north of that mountain. Canon de la Mina drains to the northeast of Pico Punta Norte. A small fish camp, Campo Punta Norte is located near the mouth of this canyon. Canon or Arroyo Choyal is the large canyon north of Gran Canon.

PTEROPSIDA

FILICAE

Adiantaceae

Adiantum capillus-veneris L. Found in a moist canyon northwest of town and an arroyo east of Pico Gill. *Cheilanthes brandegeei* Eat. Collected from Cerro de Cedros.

Cheilanthes deserti Mickel [= *Nothalaena californica* Eat.]. Inhabits high elevations on all peaks.

Pellaea andromedaefolia var. *pubescens* Eat. Found in canyons and on upper slopes, Cerro de Cedros northward.

Pityrogramma triangularis (Kaulf.) Maxon. Found in canyons and on upper slopes, Cerro de Cedros northward.

Polypodiaceae

Polypodium californicum Kaulf. Grows in northern canyons. CONIFERAE

Pinaceae

Pinus radiata cedrosensis (Howell) Axelrod [= *P. muricata* var. *cedrosensis*]. Endemic and growing in linear groves and isolated stands north of Gran Canon and Pico Punta Norte.

Cupressaceae

Juniperus californica Carr. Common on north facing and upper slopes.

Ephedraceae

Ephedra aspera Engelm. Widespread on lower parts of the island.

ANGIOSPERMAE

DICOTYLEDONAE

Aizoaceae

**Mesembryanthemum crystallinum* L. Common on beaches and low bluffs.

**Mesembryanthemum nodiflorum* L. Common on beaches and low bluffs but also high cliffs on Punta Norte.

Anacardiaceae

Malosma laurina (Nutt. in Torr. & Gray) Nutt. ex Abrams. Occurs from sea level to the highest

peaks but most common on upper elevations.

Pachycormus discolor var. *veatchiana* (Kell.) Gentry. Occurs over the entire island up to middle elevations.

Rhus integrifolia var. *cedrosensis* Barkley. Endemic and found mostly on the northern end of the island in canyons and on highest peaks.

Rhus integrifolia x *R. lentii* Kell. Scattered locations on upper part of the island.

Rhus lentii Kell. Found over the entire island, especially washes, up to middle elevations.

Apiaceae

Apiastrum angustifolium Nutt. ex T. & G. Occurs on middle and lower elevations, mostly on the northern third of the island.

Bowlesia incana Ruiz & Pavon. Reported by Brandegee (1900).

**Coriandrum sativum* L. Found in disturbed areas near town.

Apocynaceae

Asclepias subulata Decne. Occurs on the south slope of Cerro de Cedros.

Asteraceae

Amblyopappus pusillus Hook & Arn. Occurs on the main ridge of the island north of Gran Canon and Pico Punta Norte as well as the northern canyons.

Ambrosia campborata (Greene) Payne. Most common on middle and upper elevations, but also lower canyon slopes.

Ambrosia chamissonis (Less.) Greene. Inhabits sandy soils of the southwest coast.

Ambrosia chenopodiifolia (Benth.) Payne. Widespread up to middle elevations.

Ambrosia magdalenae (Brandegee) Payne. Found in a canyon mouth on the southwest coast.

Artemisia californica Less. Exists on north slopes of Cerro de Cedros and Pico Gill.

Baccharis sarothroides Gray. Inhabits large canyon and wash bottoms as well as spring areas on Cerro de Cedros.

Bebbia juncea (Benth.) Greene. Widespread in arroyo beds.

Brickellia microphylla (Nutt.) Gray. Inhabits rocky, northern canyon walls. Erroneously listed as endemic in Wiggins (1980).

**Centaurea melitensis* L. Invading disturbed areas around Cerro de Cedros Spring.

Encelia asperifolia (Blake) Clark & Kyhos. Occurs mostly on the lowlands of the entire island.

Encelia stenophylla Greene. Widespread to middle and upper elevations.

Eriophyllum confertiflorum (Decandolle) Gray. Occurs

on north slopes of upper elevations but also northern canyons.

Filago arizonica Gray. Inhabits ridges and canyons north of Pico Punta Norte.

Filago californica Nutt. Found on Cerro de Cedros and the northern peaks.

Gnaphalium bicolor Bioletti. Scattered in canyons near the north end of the island.

Gnaphalium stramineum HBK. [=G. *chilense* Spreng.] Scattered in canyons near the north end of the island.

Greenella ramulosa Greene. Reported by Moran (unpubl. list 1978).

Gutierrezia sarothrae (Pursh.) Britt. & Rusby. Found on the south slopes of Cerro de Cedros and Pico Gill.

Haplopappus propinquus Blake. Exists on the summits of Pico Gill and Cerro de Cedros.

Haplopappus sonorensis (Gray) Blake. Widespread, especially in the intermediate elevations.

Haplopappus venetus tridentatus (Greene) Hall. Widespread, especially in the middle and upper elevations.

Hemizonia fasciculata (Decandolle) Torr. & Gray. Grows on the low areas northwest of town.

Hemizonia kelloggii Greene. Collections of this and *H. fasciculata* from the area west of the town have been annotated by B. Tanowitz.

**Hypochoeris glabra* L. Found on Pico Gill and some of the eastern canyons.

Iva hayesiana Gray. Grows on arroyo bottoms on the northern portion of the island.

Lasthenia californica Decandolle in Lindl. [=L. *chrysostoma* (F. & M.) Ornduff]. Reported by Brandegee (1900).

Malacothrix similis Davis & Raven. Inhabits the pine areas north of Gran Canon and Pico Punta Norte.

Microseris lindleyi (Decandolle) Gray [=M. *linearifolia* (Nutt.) Sch. Bip.]. Occurs on Cerro de Cedros and near the pines north of Pico Punta Norte.

Perityle emoryi Torr. in Emory. Widespread over the island to upper elevations.

Pluchea symphytifolia (Miller) Gillis [=P. *odorata* (L.) Cass]. Exists in a moist arroyo near Campo Punta Norte.

Porophyllum cedrense Rose & Standi. Listed in Wiggins (1980) as endemic. Its relationship to *P. gracile* needs clarification.

Porophyllum confertum Greene. Erroneously listed in Wiggins (1980) as endemic to Isla Cedros, but actually is confined to the Cape Region of the Baja California peninsula.

Porophyllum gracile Benth. Widespread, nearly the entire island.

Rafinisquia californica Nutt. Found on Cerro de

Cedros, Pico Gill and among the pines north of the Gran Canon.

Senecio cedrosensis Greene. Endemic and found mostly in the northern and central pine areas and canyons.

**Senecio vulgaris* L. Invading disturbed areas near town.

**Sonchus oleraceus* L. Occurs in the Gran Canon and northern canyons.

**Sonchus tenerimus* L. Found in Gran Canon.

Trixis californica Kell. Widespread to upper elevations.

Verbesina hastata Kell. Endemic, inhabiting arroyo beds mostly on the northern third of the island.

Viguiera lanata (Kell.) Gray. Widespread, mostly at low elevations, particularly washes.

Boraginaceae

Amsinckia intermedia Fisch. & Mey. Reported by Thorne (unpubl. list 1988).

Amsinckia menziesii (Lehm.) Nels. & Macbr. Occurs on the north slope east of Pico Gill.

Cryptantha barbiger (Gray) Greene. Occurs on the south slope of Cerro de Cedros.

Cryptantha grayi var. *cryptochaeta* (Macbr.) Jtn. Grows on flats behind beaches on the east side of the island.

Cryptantha maritima var. *cedrosensis* (Greene) Jtn. Endemic to intermediate elevations from Cerro de Cedros northward.

Heliotropium curassavicum oculatum. (Heller) Thorne. Known from wash bottoms on the east side.

Pectocarya linearisferocula (Jtn.) Thorne. Collected on Cerro de Cedros.

Plagiobothrys californicus var. *gracilis* Jtn. Occurs on the ridge north of Pico Punta Norte.

Brassicaceae

Athyrium pusillus (Hook.) Greene. Occurs on low elevations at Punta Norte.

**Cakile maritima* Scop. Found on the southwest coastal beach.

**Capsella bursa-pastoris* (L.) Medic. Invading disturbed areas near town and on Cerro de Cedros.

Caulanthus (Streptanthus) heterophyllus (Nutt. in Torr. & Gray) Pays. Collected from Cerro de Cedros.

Caulanthus (Thelypodium) lasiophyllus (Hook. & Arn.) Pays. Found among the pines above Punta Norte.

Descurainia pinnata glabra (Woot. & Standi.) Detl. Occurs on Cerro de Cedros.

Descurainia pinnata halictorum (Cockl.) Detl. Inhabits Cerro de Cedros and central uplands.

Draba cuneifolia var. *integrifolia* S. Wats. Grows on

slopes in middle elevations, northern and central portions of the island.

Lepidium oblongum Small. Appearing in scattered locations the length of the island.

Sibara pectinata (Greene) Greene. Observed in scattered locations the length of the island.

**Sisymbrium irio* L. Collected on Cerro de Cedros and near town.

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

Thysanocarpus laciniatus Nutt. Found on Cerro de Cedros.

Cactaceae

Bergerocactus emoryi (Engelm.) Britt. & Rose. Reported by Greene (1888) but not likely to occur.

Echinocereus engelmannii var. *engelmannii* (Parry in Engelm.) Rumpel. Listed by Hale (1941), but probably refers to the following.

Echinocereus maritimus (Jones) K. Schum. Low elevations around the island.

Ferocactus chrysacanthus (Orcutt.) Britt. & Rose. Occurs over most of the island up to intermediate elevations.

Lophocereus schottii (Engelm.) Britt. & Rose. Isolated locations above Cerro de Cedros Spring and on the northeast coast.

Mammillaria blossfeldiana Boed. Alluvial flats around the island.

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

Mammillaria goodridgei var. *rectispina* Dawson. In Wiggins (1980) as endemic, but the relationship with *M. g. goodridgei* needs clarification.

Mammillaria butchinsoniana (Gates) Boed. Occurs on sandy and gravelly washes and hillsides at low elevations.

Mammillaria (Cochemia) pondii Greene. Widespread to middle elevations.

Opuntia oricola Philbrick. Found on canyon slopes and flats on the northern third of the island.

Opuntia prolifera Engelm. Occurs in Arroyo Choyal, on the northeast coast.

Pachycereus pringlei (Wats.) Britt. & Rose. Four individuals occur on the south slope of Cerro de Cedros.

Stenocereus (Machaerocereus) gummosus (Engelm.) Gibs. & Horak. Known from scattered, isolated locations on the east side of the island.

Capparaceae

Cleome isomeris Greene [=Isomeris *arborea* Nutt. in Torr. & Gray]. Grows on lowlands, mostly east

side of the island.

Caprifoliaceae

Lonicera subspicata var. *denudata* Rehd. Exists on the north slope of Cerro de Cedros and the area north of Pico Punta Norte.

Caryophyllaceae

Achyronychia cooperi Torr. & Gray. Known from sandy soils on the west coast.

Drymaria holosteoides var. *holosteoides*. Found on the southern part of island.

Polycarpon depressum Nutt. in Torr. & Gray. Occurs on northern peaks.

**Silene gallica* L. Reported by Brandegee (1900) in disturbed places.

Chenopodiaceae

Allenrolfea occidentalis (Wats.) Kuntze. Occurs on low areas, west and southern coasts, especially near the airfield.

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

Atriplex barclayana barclayana (Benth.) Dietr. Known from lowlands near Punta Norte.

Atriplex californica Moq. in Decandolle. Found in the Punta Norte region and on Cerro de Cedros.

Atriplex coulteri (Moq.) Dietr. Occurs on the southern coast near airfield.

Atriplex julacea Wats. Found on the west coast dunes and south coast near airfield.

Atriplex leucophylla (Moq. in Decandolle) Dietr. Grows on western beach dunes and southern pine area.

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

**Atriplex semibaccata* Br. Invades disturbed areas in scattered locations.

**Chenopodium album* L. Reported by Moran.

**Chenopodium murale* L. Occurs in scattered locations over the entire island.

**Salsola australis* Br. Found on the south end of the island, near town.

Suaeda californica Wats. Grows on sea bluffs and dunes in the south and western parts of the island.

Crassulaceae

Crassula connata var. *connata* (Ruiz & Pav.) Berger in Engl. & Prantl [=Tillea *erecta* Hook. & Arn.]. Known from middle and upper elevations north of Cerro de Cedros.

Dudleya acuminata Rose. Occurs on ridge tops mostly north of Pico Punta Norte.

Dudleya albiflora Rose. Widespread from south to northern parts.

Dudleya cedrosensis Moran ined. Endemic and found in rocky slopes in the canyon near Pico Gill.

Dudleya pachyphytum Moran & Benedict. Endemic and found on west and north sloping bluffs, north of Pico Punta Norte.

Cucurbitaceae

Echinopepon minimus (Kell.) Wats. Inhabits lower elevations especially on the southern part of the island, but also near Campo Punta Norte.

Marab macrocarpus (Greene) Greene. Grows on the northern peaks, but also the southern washes.

Ericaceae

Xylococcus bicolor Nutt. Occurs on the north slopes of the highest peaks.

Euphorbiaceae

Acalypha californica Benth. Present in canyons mostly north of Cerro de Cedros.

Argythamnia (Ditaxis) californica Brandg. Reported by Brandegee (1900).

Chamaesyce (Euphorbia) albomarginata (Torr. & Gray.) Small. Found on southern and western parts of the island.

Chamaesyce (Euphorbia) polycarpa var. *hirtella* (Boiss.) Millsp. Inhabits the southern portion of the island to the ridge north of Gran Canon.

Chamaesyce (Euphorbia) polycarpa var. *polycarpa* (Benth.) Millsp. in Parish. Present in arroyos on the southern part of the island.

Euphorbia misera Benth. Occurs up to middle elevations over the entire island.

Savia (Andrachne) ciliato-glandulosa Millsp. Grows in washes and on slopes west of the town.

Fabaceae

Astragalus fastidius (Kell.) Jones. Present in washes of the northern and eastern portion of the island and the pine area north of Pico Punta Norte.

Astragalus insularis var. *insularis* Kell. Grows at low elevations of the southern and middle part of the island.

Astragalus nuttallianus var. *cedrosensis* Jones. Inhabits the lower elevations of the southern two thirds of the island and Cerro de Cedros.

Dalea mollis Benth. Collected southwest of the town.

Erazurizja benthamii (Brangegee) Jtn. Occurs at low elevations of the southern portion of the island.

Lotus cedrosensis Greene. Endemic and found in arroyo bottoms over the entire island and northern pine area.

Lotus nudatus Greene. Widespread in arroyo bottoms at low elevations over the entire island.

Lotus salsuginosus var. *brevivescillus* (Ottley) Munz. Present in arroyos and on ridges to middle elevations over the entire island.

Lotus scoparius var. *veatchii* (Greene) Ottley. Found at high elevations from Cerro de Cedros north.

Lotus strigosus var. *strigosus*. Known from Cerro de Cedros.

Lupinus concinnus cf. var. *agardbianus* (Heller) Smith. Collected from Cerro de Cedros.

Lupinus sparsiflorus pondii (Greene) Dziek. & Dunn. Inhabits washes and slopes over the entire island.

**Melilotus indians* (L.) All. Found near town and on Cerro de Cedros.

Phaseolus filiformis Benth. Present on low elevation terraces and washes over the entire island.

Fagaceae

Quercus cedrosensis Mull. A component of chaparral on the upper island peaks and ridges.

Frankeniaceae

Frankenia palmeri Wats. Widespread and most common at low elevations, but also on high sea bluffs north of Pico Punta Norte.

Garryaceae

Garrya veatchii C. H. Mull. Occurs from Cerro de Cedros to the upper end of Vargas Canon.

Gentianaceae

Centaurium cf. *venustum* (Gray) Robins. Found on the northwest shoulder of Cerro de Cedros.

Geraniaceae

**Erodium cicutarium*. (L.) L'Her. ex Ait. Grows at middle elevations.

Erodium texanum Gray. Found on sandy washes on the southern end of the island.

Grossulariaceae

Ribes tortuosum Benth. Grows on all three northern peaks and nearby canyon areas.

Ribes viburnifolium Gray. Occurs in pine groves north of Gran Canon.

Hydrophyllaceae

Eucrypta chrysanthemifolia var. *chrysanthemifolia* (Benth.) Greene. Reported by Palmer (1889, in Vasey & Rose).

Phacelia cedrosensis Rose. Found in scattered locations to the higher elevations.

Phacelia crenulata Torr. ex Wats. Occurs on the northern portion of the island.

Phacelia ixodes Kell. Widespread on slopes and washes.

Pholistoma auritum var. *arizonicum* (Jones) Constance. Collected by Pond, reported by Greene (1888).

Pholistoma racemosum (Nutt.) Const. Occurs on the north slope of Cerro de Cedros and in the pines north of Pico Punta Norte.

Labiatae

Monardella thymifolia Greene. Endemic to north facing slopes and canyon walls on Cerro de Cedros and northern canyons.

Salvia cedrosensis Greene. Widespread, growing up to intermediate elevations.

Salvia columbariae columbariae Benth. Found on the south slope of Cerro de Cedros.

Teucrium glandulosum Kell. Occurs on low elevations around the island.

Loasaceae

Euclide cordata (Kell.) Kell. ex Curran. Present in wash bottoms and at bases of cliffs at low elevations over the entire island

Mentzelia adhaerens Benth. Grows on crumbly soil at low elevations west of town and in northern canyons.

Mentzelia hirsutissima var. *nesotes* Jtn. Seen on south facing slopes near town and mouths of northern canyons.

Petalonyx linearis Greene. Occurs at low elevations around the island.

Malvaceae

Abutilon californicum Benth. Present on south facing slopes of northern canyons.

Lavatera venosa Wats. Reported by Thorne (Pers. comm. 1988) near the Punta Norte light.

**Lavatera assurgentiflora* Kell. Planted at Campo Punta Norte.

**Malva parviflora* L. Invaded disturbed areas near town and Campo Punta Norte.

**Malva sylvestris* var. *mauritanica* (L.) Boiss. Reported by Thorne (Unpubl. list 1988).

Sphaeralcea fulva Greene. Widespread but most common at lower elevations.

Nyctaginaceae

Abronia maritima Nutt. ex Wats. Grows on the western dunes and mouths of large washes.

Mirabilis californica cedrosensis (Standl.) ined. Present on low to intermediate elevations over the entire island.

Onagraceae

Camissonia cardiophylla cedrosensis (Greene) Raven. Occurs in washes of the southern part of the island.

Camissonia crassifolia (Greene) Raven. Occurs on sand dunes of the west coast.

Xylolagra arborea arborea (Kell.) Donn. - Smith & Rose. Endemic to the northern canyons and ridges north of Pico Punta Norte.

Xylolagra arborea wigginsii Munz. Present in canyons of the north end of the island and Pico Gill. The relationship to *X. u. arborea* needs clarification.

Papaveraceae

Eschscholzia ramosa Greene. Grows on crumbly soils south and northwest of town.

Plantaginaceae

Plantago ovata Forsk. [=P. insularis Eastw.]. Inhabits Vargas Spring and ridges of the central portion of the island.

Polemoniaceae

Leptodactylon veatchii (Parry ex Gray) Wherry. Endemic to north facing slopes in the northern canyons.

Linanthus uncialis (Brandegee) Moran. Occurs on the top of Cerro de Cedros and middle elevations of the central part of the island.

Microsteris gracilis (Dougl. ex Hook.) Greene. Reported by Brandegee (1900).

Polygonaceae

Eriogonum fasciculatum fasciculatum Benth. Known from the entire island.

Eriogonum intricatum Benth. Present in scattered locations around island at low elevations.

Eriogonum molle Greene. Endemic to the upper slopes north of Pico Punta Norte.

Eriogonum molle x *E. fasciculatum*. Occasionally found near the northern pines.

Eriogonum pondii Greene. Known from lower and intermediate elevations, mostly in the southern parts.

Eriogonum wrightii var. *taxifolium* (Greene) Parish. Occurs on upper elevations.

Harfordia macroptera var. *fruticosa* (Greene) Reveal. Endemic to lower and intermediate elevations, mostly north of Cerro de Cedros.

Lastarriaca chilensis Remy. in Gray. Found on flats near the town.
Pterostegia drymarioides Fischer & Meyer. Present on north slopes of upper elevations.

Portulacaceae

Calandrinia maritima Nutt. in Torr. & Gray. Grows on mesas near town and on flats near Punta Norte.
Claytonia perfoliata perfoliata. Occurs on Cerro de Cedros and in pines north of Pico Punta Norte.
Claytonia spatulata Dougl. ex hook. Collected from the north slope near Pico Gill.

Ranunculaceae

Clematis pauciflora Nutt. in T. & G. Found on Pico Gill.
Delphinium cardinale Hook. Grows on slopes northwest of Cerro de Cedros.
Delphinium cf. *parryi* A. Gray. Found on the north slope of Cerro de Cedros.
Ranunculus hebecarpus Hook. & Arn. Inhabits a moist gully near Vargas spring.

Resedaceae

Oligomeris linifolia (Vahl) Macbr. Present at low to intermediate elevations.

Rhamnaceae

Ceanothus verrucosus Nutt. in Torr & Gray. Occurs on the north slopes of upper Canon de la Mina with pines.
Rhamnus insula Kell. Present on north facing canyon slopes and peaks from Gran Canon north.
Zizyphus (Condaliopsis) parryi microphylla (Tn.) ined. Known from north slopes of upper elevations, from Cerro de Cedros north.

Rosaceae

Adenostoma fasciculatum var. *obtusifolium* Torr & Gray. Wats. Occurs on the upper slopes of the highest peaks from Cerro de Cedros to the pine covered ridge north of the Gran Canon.
Heteromeles arbutifolia (Ait.) Roem. North slope, Cerro de Cedros and in the pine groves north of Gran Canon and Pico Punta Norte.

Rubiaceae

Galium angustifolium angustifolium. Reported by Greene (1888).
**Galium aparine* L. Reported by Brandegee (1900).
Galium stellatum Kell. Exists on middle elevations of the northern portion of the island.

Rutaceae

Cneoridium dumosum (Nutt.) Hook. Reported by Axelrod (1980).

Saururaceae

Anemopsis californica (Nutt.) Hook. & Arn. Reported by Moran (unpubl. list 1978).

Scrophulariaceae

Antirrhinum watsonii Vasey & Rose. Grows in canyon bottoms over the entire island up to upper elevations of Cerro de Cedros and Canon de la Mina.
Antirrhinum nuttallianum Benth. in DC. Occurs in canyons near Punta Norte.
Diplacus stellatus Kell. Found in upper reaches of northern canyons and pine forest areas.
Galvesia juncea (Benth.) Ball. Present in arroyos and on canyon slopes over the entire island.
Linaria canadensis var. *texana* (Scheele) Pennell. Found on Cerro de Cedros.
Mimulus cardinalis (Kell.) Grant. Endemic to high elevations and the pine forest areas.
Penstemon cedrosensis Kell. Endemic to talus canyon slopes over the entire island.

Simmondsiaceae

Simmondsia chinensis (Link.) Schneider. Present on low to middle elevations over the entire island.

Solanaceae

Datura discolor Bernh. Grows near the shoreline along the east side of the island.
Lycium andersonii Gray. Occurs on low elevations.
Lycium brevipes var. *brevipes*. Found at low elevations around the island and northern canyons.
Lycium exsertum Gray. Found in the pine area north of Pico Punta Norte.
Nicotiana clevelandii Gray [=N. *greeneana* Roe.]. Found at low elevations near the shoreline.
Physalis crassifolia Benth. Occurs on the pine ridge north of Gran Canon.
Physalis greenei Vasey & Rose. Grows on the slopes northwest of town.
Solanum bindsianum Benth. Found northwest of town.

Tamaricaceae

**Tamarix aphylla* (L.) Karst. Growing at Campo Punta Norte.
**Tamarix ramosissima* Ledeb. Present in Cerro de Cedros Spring and Gran Carton.

Ulmaceae

Celtis reticulata Torr. Reported from Canon Vargas by Hale (1941).

Urticaceae

Parietaria hespera hespera [=P. *floridana* Nutt.]. Reported by Palmer (1889, in Vasey & Rose).

Verbenaceae

Verbena lilacina Greene. Grows on wash bottoms and north facing slopes, north of Cerro de Cedros.

Zygophyllaceae

Fagonia laevis Standley. Occurs on the southern end of the island, west of town.
Viscainoa geniculata var. *geniculata* (Kell.) Greene. Reported by Greene (1889).

MONOCOTYLEDONAE

Agavaceae

Agave sebastiana Greene. Occurs from near sea level to 700 m. in elevation over the entire island.

Alliaceae

Dichelostemma pulchellum (Salisb.) Heller. Grows on peaks above 600 m.
Triteliopsis palmeri (Wats.) Hoover. Occurs in sandy soils on the west coast of the island.

Cyperaceae

Carex spissa Bailey. Exists on Cerro de Cedros and in the canyon east of Pico Gill.
Eleocharis geniculata (L.) Roemer & Schuttes. Found in the arroyo east of Pico Gill.
Scirpus cernuus californicus (Torr.) Thorne. Reported by Greene (1888).

Juncaceae

Juncus acutus leopoldii Snogerup. Inhabits springs and moist canyons in scattered locations.

Poaceae

**Agrostis semiverticillata* (Forsk.) Chr. Found in arroyo beds in scattered locations.
Aristida adscensionis L. Occurs at low elevations.
**Arundo donax* L. Invading a spring area near Campo Punta Norte.

**Avena barbata* Brot. Growing in disturbed areas around the island.

**Avena fatua* L. Found on Cerro de Cedros.

**Bromus mollis* L. Invading disturbed areas over the entire island.

**Bromus rubens* L. Found on Cerro de Cedros.

Bromus trinitii Desv. Grows on slopes of the northern two thirds of the island.

**Cynodon dactylon* (L.) Pers. Invading arroyo beds on eastern part of the island.

Distichlis spicata var. *stolonifera* Beetle. Inhabits sandy soils of the west coast.

**Hordium murinum glaucum* (Steud.) Tzvel. Found in northern canyons and on Cerro de Cedros.

**Lamarckia aurea* (L.) Moench. Invading open areas on Cerro de Cedros.

Melica frutescens Scribn. Inhabits north facing slopes in northern canyons.

Melica imperfecta Trin. Occurs on upper elevations of the island.

Muhlenbergia microsperma (Decandolle) Kunth. Widespread at low elevations.

**Polygonum australe* Brogn. Reported by P. Rubtsoff (according to Thorne, Pers. Comm. 1988)..

**Polygonum monspeliense* (L.) Desf. Occurs near Cerro de Cedros Spring and Vargas Spring.

**Sorghum vulgare* Pers. Found at Cerro de Cedros Spring.

Stipa lepida Hitch. Widespread on middle elevations, the entire island.

**Triticum aestivum* L. Found at Cerro de Cedros Spring.

**Vulpia myuros* var. *hirsuta* Hackel. Widespread on middle elevations.

Vulpia octoflora (Walt.) Rydb. Widespread on middle and upper elevations.

Typhaceae

Typha latifolia L. Listed by Moran (unpubl. 1978) as occurring.

Typha angustifolia L. Listed by Hale (1941) from a moist canyon northwest of town.

Typha domingensis Pers. Stated by Thorne (pers. comm.) as the only species of *Typha* likely to occur on the island.

Zosteraceae

Phyllospadix scouleri Hook. Occurs in intertidal zone.
Phyllospadix torreyi Wats. Present in intertidal zone.