

# The Succulent Scrub of San Martín Island, Baja California, Mexico

**B**aja California, Mexico, is home to enormous floristic diversity (Rieman & Ezcurra 2005; Peinado *et al.* 1995; Wiggins 1980) including a wealth of cacti and succulents. Readers may have accompanied CSSA trips to Baja California or may have read articles about the plants seen on those trips. On the Pacific Coast, near the southern edge of the California Floristic Province (which California shares with Oregon and Baja California), lies Greater San Quintín, a diverse and relatively unspoiled region (Howell 1957; Thorne 1993). The area includes eleven extinct volcanic cones with elevations up to 260 m, one of which is the island of San Martín that lies 5 km (3 mi) off shore.

Island floras are of particular interest to botanists due to their isolation from mainland source populations which, in the context of variation in dispersal abilities among plant groups, results in unique plant communities (Carlquist 1974). San Martín Island is the southernmost of the Pacific

Channel Islands on the continental shelf; it is also amongst the smallest, being only 0.9 square mile (2.3 square kilometers) in area (Junak & Philbrick 1994). San Martín is unusual never having had large introduced animals such as goats and pigs, which have seriously impacted most of the California Channel Islands at some point in their history. Thus despite the small size of San Martín Island, it remains home to several endemic vertebrates (Samaniego-Herrera 2007). Although rabbits and cats were reported on the Island historically, today the largest non-native inhabitants are a few chickens that forage in the area around the fishing camp.

San Martín Island is a cindercone, mostly composed of sharp volcanic lava rock, often with a dense covering of foliose lichens. There is relatively little soil buildup across most of the island, and the plants of the succulent maritime scrub grow among the rocks. There are also small areas

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**1 & 2** *Bergerocactus emoryi*, the golden cereus... leaving the island? Only a single clump of this species is known on San Martín Island.



3 *Opuntia ficus-indica* was introduced to the island as a food source and could be affecting pollen transfer and seed set between the two native *Opuntia* species on San Martín Island, each known from just a single plant



4 *Mammillaria lousiae* flowers in the hottest months on the island and has previously been confused with other *Mammillaria* taxa; this species is endemic to north-west Baja California.



5 *Senecio lyonii* is globally rare and very susceptible to extirpations due to its narrow habitat requirements. It occurs in just the south-eastern corner of San Martin island.



6 & 7 La senita, the old man cactus (*Lophocereus schottii*) is seen here with a crab spider hiding in its spine clusters. The failure of this one plant to reproduce suggests that it will soon be lost from the island.

of dunes and salt marsh in the southeastern corner of the island, adjacent to the small natural harbor where fisherman land. As part of the ongoing floristic study of the broader region, the island checklist developed earlier by Junak and Philbrick, is under revision (Vanderplank, Junak, & Delgadillo *In Prep* for Madroño). More than 100 species in total have been documented on the island; many are annuals with wind-blown seed, or coastally adapted species likely to have arrived via water.

Despite being less than two and a half square kilometers in area, San Martín Island is home to twelve native species of succulents, some with

connections to early explorers of the area. Early naturalists visiting the island included Townsend Brandegee and Alfred Anthony on the 1897 voyage of *Wahlberg* (Junak et al 1994). It is in honor of the ornithologist Alfred Anthony that the striking white dudleya, *Dudleya anthonyi* Rose was named. This large, rosette succulent is endemic to the San Quintín volcanic field where it creates a stunning display against the red and black background of the lava rock and has a global range of approximately 10 square miles (25 square kilometers). The population of this species on the island is perhaps the largest in the world, both in number



8 *Ferocactus fordii* is found throughout the island and in considerable numbers. The plants do not get very large, but appear to be quite old, many having various lichen species growing on their spines.

and perhaps also in plant size, with individual rosettes reaching about a meter across and flowering stems over a meter high.

In 1900, Townsend Brandegee reported 40 species on San Martín Island (Junak & Philbrick 1994); however, the flora is now known to include at least 106 species (Vanderplank, Junak & Delgadillo, In Prep), 87 of which are native to the area. Although there are small patches of dune and salt-marsh vegetation on the island that are home to succulent halophytic species (e.g. *Abrochia maritima* Nutt ex. S. Watson, *Artrocnemum subterminale* (Parish) Standl., *Suaeda taxifolia* (Standl.) Standl); it is the rosette-filled succulent maritime scrub (locally known as matorral roseto-filo) which dominates the island. This vegetation type is only found near the southern end of the California Floristic Province near the El Rosario region (ca 320 kilometers south of the international border) on the Pacific Coast of the Baja California Peninsula.

The maritime scrub of San Martín Island is home to at least 85 taxa (80% of the islands flora), with 26 perennial species (excluding geophytes), of which 17 are succulent or semi-succulent (see table). Cacti are abundant across the island and Cactaceae is the most species-rich plant family on the island with 10 reported taxa. Plants of two

*Dudleya* species and their hybrids are also abundant throughout most of the island. Other stem succulents such as *Euphorbia misera* and *Coreopsis maritima* are less common.

Not all the succulent taxa on the island are native: *Opuntia ficus-indica* is the only perennial non-native succulent. It was historically introduced, almost certainly for food, and has since naturalized on the island, around the fishing camp, although one individual has been documented near the center of the island. Two annual succulent non-native plants are also present: *Mesembryanthemum crystallinum* L. (first documented on the island in 1897) and *M. nodiflorum* L. (less abundant than *M. crystallinum* but spreading rapidly, first reported in 1991). Both *Mesembryanthemum* species are invasive in all disturbed areas on the island. They are most abundant in the areas of guano harvest and along the coastal footpaths and landing zones (as are the majority of the non-native species).

Thanks to a research grant from CSSA we were able to spend five days on San Martín Island in the summer of 2009. To better understand the distribution of the succulents there, we documented the occurrence and range of all of the perennial (non-ephemeral) species in the succulent scrub (some herbaceous taxa and two geophytes were excluded.) Table 1 shows all the taxa, their

**Table 1 lists all the perennial taxa of the maritime scrub, with notes on their global distribution and abundance on the island.**

TAXON	FAMILY	TYPE 1 OR 2 DISTRIB	
<i>Amauria rotundifolia</i> Benth	Asteraceae	Type 1 (broad)	
<i>Bergerocactus emoryi</i> (Engelm.) Britt. & Rose	Cactaceae	Only 1 individual	
<i>Coreopsis maritimus</i> (Nutt.) Hook. f.	Asteraceae	Type 2 (narrow)	
<i>Cylindropuntia prolifera</i> (Engelm.) F.M. Knuth	Cactaceae	Type 1 (broad)	
<i>Dudleya anthonyi</i> Rose	Crassulaceae	Type 1 (broad)	
<i>Dudleya cultrata</i> Rose	Crassulaceae	Type 1 (broad)	
<i>Dudleya cultrata</i> x <i>anthonyi</i>	Crassulaceae	Type 2 (narrow)	
<i>Echinocereus maritimus</i> (M.E. Jones) K. Schum. var. <i>maritimus</i>	Cactaceae	Type 2 (narrow)	
<i>Encelia californica</i> Nutt	Asteraceae	Type 1 (broad)	
<i>Euphorbia misera</i> Benth.	Euphorbiaceae	Type 2 (narrow)	
<i>Ferocactus fordii</i> (Orcutt) Britt. & Rose var. <i>fordii</i>	Cactaceae	Type 1 (broad)	
<i>Lophocereus schottii</i> (Engelm.) Britt. & Rose	Cactaceae	Only 1 individual	
<i>Lotus watsonii</i> Greene	Fabaceae	Type 2 (narrow)	
<i>Lycium andersonii</i> A. Gray	Solanaceae	Type 1 (broad)	
<i>Lycium brevipes</i> Benth.	Solanaceae	Type 1 (broad)	
<i>Lycium californicum</i> Nutt ex. A. Gray	Solanaceae	Type 2 (narrow)	
<i>Mammillaria louisae</i> G.E. Linds	Cactaceae	Type 1 (broad)	
<i>Mirabilis laevis</i> (Benth.) Curran	Nyctaginaceae	Type 1 (broad)	
<i>Myrtillocactus cochal</i> (Orcutt) Britt. & Rose	Cactaceae	Extirpated	
<i>Opuntia ficus-indica</i> (L.) Mill	Cactaceae	Type 2 (narrow)	
<i>Opuntia oricola</i> Philbrick	Cactaceae	Only 1 individual	
<i>Phacelia ixodes</i> Kellogg	Boraginaceae	Type 2 (narrow)	
<i>Pseudognaphalium biolettii</i> Anderb.	Asteraceae	Type 2 (narrow)	
<i>Senecio lyonii</i> A. Gray	Asteraceae	Type 2 (narrow)	
<i>Solanum palmeri</i> Vasey & Rose	Solanaceae	Type 2 (narrow)	
<i>Stenocereus gummosus</i> (Engelm.) Gibson & Horak.	Asteraceae	Type 2 (narrow)	

abundance on the island, and their global abundance and range.

Two main distribution patterns were observed within the perennial flora of the succulent scrub (Figure 1). Ten perennial species, including 5 succulents, are fairly ubiquitous across the island (referred to here as type one species). Their distribution and number are affected by the presence of large numbers of nesting seabirds (and historic guano harvesting) on the north and west coasts, but they are otherwise abundant throughout most of the succulent maritime scrub and sometimes creep into the neighboring patches of coastal strand habitats. The type-two species distribution is shared by 12 perennial taxa, including seven succulents, that are restricted to the south-east corner of the island (a range of approximately 0.65 square kilometers). Note that *Solanum palmeri* has a very restricted range concentrated around the peak at the center of the island and an exception to the general distributions patterns observed. Not included here in the type two species, but also highly restricted on the island are

three species known from just a single individual on the island (see table 1). One large cactus, well documented by previous botanists, appears to have been lost or extirpated from the flora of the island. *Myrtillocactus cochal*, a columnar cactus, was known from a small number of individuals in the south-eastern corner of the island as recently as 1994, but was not relocated during our surveys. This reduces the number of cacti on the island today to nine species.

The restricted distribution of the 13 type-two species forms an area of particularly high diversity and limited extent directly behind the seasonal fishing camp. This seems to be due to the shelter of the cindercone reducing wind and allowing higher effective moisture for the plants, but further research is warranted. Local distribution of plant species is undoubtedly influenced by lava formation and microclimates, as well as the paucity of soil build-up across much of the Island. Proximity to the mainland and the potential for human transport (accidental or deliberate) may also be affecting the distribution of species richness.

SUCCULENCE	NOTES
Semi-succulent	Peninsular endemic.
Succulent	Near-endemic to north-west Baja California. Watch-list.
Semi-succulent	Near-endemic to north-west Baja California. Globally rare and threatened.
Succulent	
Succulent	Endemic to northwest Baja California. Considered rare and threatened globally.
Succulent	Endemic to northwest Baja California. Considered rare and threatened globally.
Succulent	Both parents rare and locally endemic.
Succulent	Peninsular endemic. Watch-list.
None	
Succulent	
Succulent	Peninsular endemic. Rare in northwest Baja California.
Succulent	Listed as threatened by Mexico. Peninsular endemic
None	Endemic to northwest Baja California. Considered rare and threatened globally.
None	
None	
None	
Succulent	Endemic to CFP Baja California. Globally rare and threatened.
None	
Succulent	Peninsular endemic
Succulent	Introduced.
Succulent	Rare in CFP Baja but more common elsewhere
None	Endemic to north-west Baja California
None	
Semi-succulent	Rare in northwest Baja California, known only from Channel Islands in California.
None	Endemic to northwest Baja California. Considered rare and threatened globally.
Succulent	Peninsula endemic

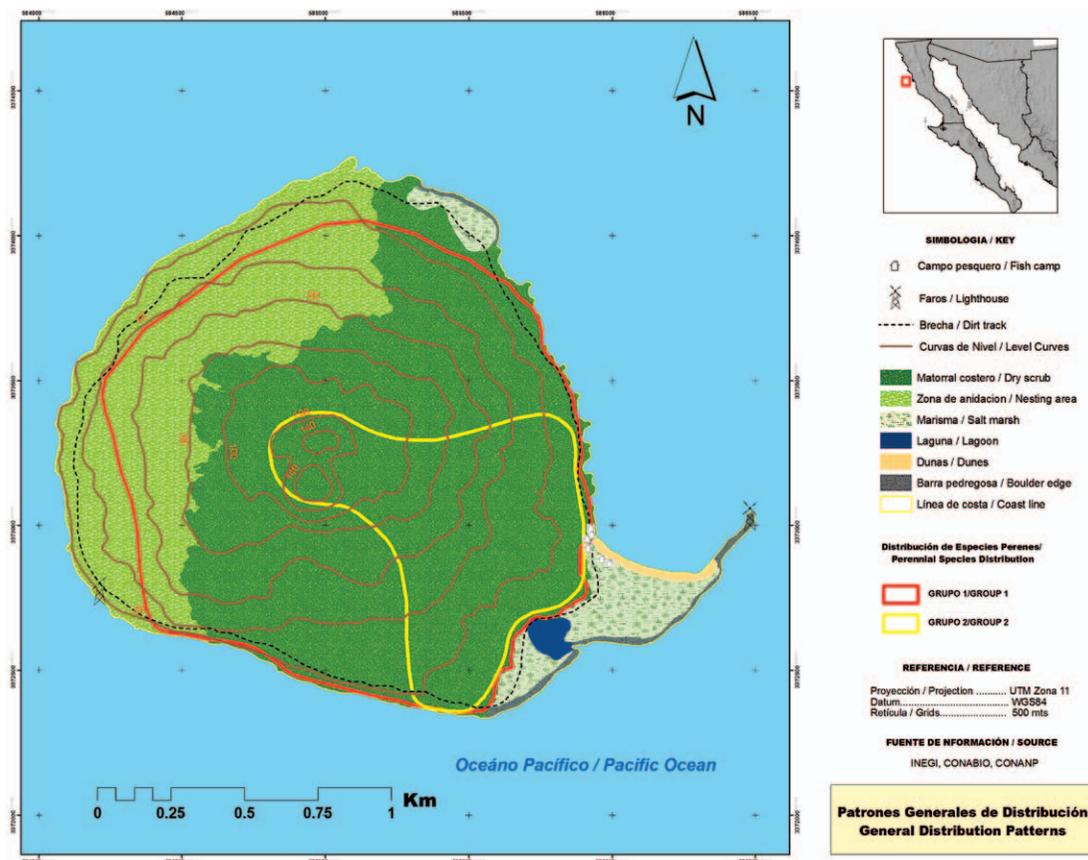
Conservation concerns for the island are exacerbated at this time by the initiation of an abalone farm on the eastern coast (north of the existing fishing camp). For the first time the Mexican federal government has granted a 15-year use concession allowing the development of 43,000 m<sup>2</sup> (SEMARNAT 2009). Although the current development site avoids large areas of important habitat for nesting sea-birds, it conflicts with the greatest plant species richness on the island and further development into the south-east corner of the island could prove devastating. Global climate change and rising sea levels could also quickly threaten the succulent flora of this island. Several species with the type two distribution appear to be further restricted to occur above the regular salt-spray zone on the island (e.g. *Coreopsis maritima*, *Senecio lyonii*, *Lotus watsonii*, *Euphorbia misera*).

Even if future disturbance is eliminated, the flora is likely to undergo a series of changes as the processes of colonization and extinction continue on this geologically young island (thought to date

back to the late Pleistocene period). In light of the current paucity of soil, soil accumulation over time is likely to have a substantial impact on species composition and may well favor more non-native taxa and more annual species.

Changes have already been observed in recent years, not just via the arrival of new plants, but in the failure of some perennial plants to successfully reproduce. The fate of the succulent taxa known from single individuals may well be the same as that of *Myrtillocactus cochal*, which was historically known from more than one individual. Ongoing monitoring of this island should be particularly interesting as weather patterns change, soil accumulates, and human impacts increase.

The island has been the subject of various conservation efforts from groups such as *Grupo de Ecología y Conservación de Islas*, A. C. yet has no formal protection (Samaniego-Herrera 2007). At the time of writing, the island is under consideration by the Mexican Government for inclusion in a Federal Biosphere Natural Protected



Area that would include all of the pacific islands in Mexico (SEMARNAT 2009). Such protection is already in place for islands in the Gulf of California (CONANP 2004). We hope that the information presented here will help inform this process and that ultimately the many rare succulents on this island will be protected.

For more information please visit: <http://www.rsabg.org/english-version/san-martin-island/>

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