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Reintroduction of *Lathyrus littoralis* to the Presidio of San Francisco,
Golden Gate National Recreation Area

A report submitted to
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18 June 1997
FINAL REPORT

by

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ABSTRACT: *Lathyrus littoralis* (Nutt.) Endl. is proposed for reintroduction at Crissy Field and Baker Beach on the Presidio of San Francisco. The species is absent from the Presidio at present; the only extant population in San Francisco is a small colony below the Great Highway at Fort Funston. We conclude that restored foredune habitat at Crissy Field provides an ecologically appropriate opportunity to ensure the future of this species in San Francisco. Although historical evidence concerning its distribution in San Francisco is inconclusive, there are strong indications that *L. littoralis* was an important feature of prehistoric dunes along the northern bayshore of the Presidio.

HISTORIC DISTRIBUTION: *Lathyrus littoralis* occupies coastal sand dunes and beaches along the Pacific coast of North America (Hickman, 1993). Its range extends north from Monterey County to British Columbia (Munz, 1968).

According to herbaria samples and the records of local botanists, *Lathyrus littoralis* was quite common among the dunes of historic San Francisco. In 1887, 1892, and 1893 it was reported to be "near the seashore at the outlet of Lake Merced" (Brandeggee, 1892; herbaria samples). The historic record demonstrates notable abundance in the 20th century. *L. littoralis* was observed "near the Cliff House" and found to be "common among the sand hills of San Francisco" in 1902 (herbarium sample). In 1926 it was still "common in the flats [strand] in front of the sand dunes" in "San Francisco dunes near Lake Merced" (herbarium sample). It was "found in large patches but not abundantly in the dunes" of San Francisco in the 1930s (Reynoldson, 1939). And as late as 1955, botanists found the species "near Lake Merced" where there was a "colony on the dunes of Ocean Beach" (Howell et al., 1958; herbaria sample). By the mid-1950s, however, after

most of the dunes in the Outer Sunset had been converted to housing, *L. littoralis* had nearly disappeared from the city's coastal strand.

Statewide herbaria samples originate from beaches up and down the California coast. Historic records to the north range from Stinson in 1938 and 1944 (specimens at herbaria) to Abbott's Lagoon in 1965 (Howell, 1949; specimens at herbaria) and then in patches along the coast to Humboldt Bay.

Geographic distribution to the south is dense and well-represented by the herbaria samples as far as Carmel River State Beach including specimens from Salada Beach [Laguna Salada?] (1924), Moss Beach (1905), Half Moon Bay (1940, 1946), San Gregorio (1954), and Pescadero in San Mateo County. It was also recorded at beaches from Santa Cruz to Watsonville (Thomas, 1961; specimens at herbaria).

There are no historic records for *L. littoralis* on beaches inside the Golden Gate within San Francisco Bay, although its close associate *Calystegia soldanella* was once found on a Berkeley beach (Holloran and Brastow, 1997).

CURRENT DISTRIBUTION: With the exception of a very small population (<10 individuals) at Fort Funston, *Lathyrus littoralis* is extirpated from the dunes of San Francisco. Seeds from this population have been propagated for use in restoration efforts elsewhere at Fort Funston (Ingrid Cabada, pers. comm.)

Surveys of beaches north of San Francisco in April 1997 revealed the following patchy distribution of *L. littoralis*:

<i>Absent</i>	<i>Present</i>
Rodeo Beach	Abbott's Lagoon (Point Reyes)
Muir Beach	
Stinson Beach	
Limantour Spit	

Fifty years of development and recreation at Stinson Beach as well as the invasion of *Ammophila arenaria* have clearly taken their toll on *L. littoralis*. The dunes of Rodeo Beach are dominated by iceplant, *Ambrosia chamissonis*, *Cakile* sp., and *C. soldanella*. Its dune flora is fairly diverse for such a heavily impacted area. Without iceplant removal, though, the native foredune plant community may lose additional species. Limantour Beach was so heavily invaded by *Ammophila arenaria* that barely any unstabilized dunes/open sandy areas exist there. The dune area at Muir Beach is small, though it harbors significant diversity of native dune plants including *Ambrosia chamissonis*, *Leymus mollis*, *Marah fabaceus*, *Abronia latifolia*, *Artemisia douglasiana*, *Artemisia pycnocephala*, *Scrophularia californica*, *Camissonia cheiranthifolia*, and *Fragaria chiloensis*. The dunes at the mouth of Redwood Creek are heavily trampled but retain a relatively high native plant diversity due to the relative absence of *Ammophila arenaria*.

Abbott's Lagoon features the most extensive and diverse remnant foredunes of any dune system along the central California coast (pers. obs.; Peter Baye, pers. comm.). *L. littoralis* was abundant in patches throughout the system, including some areas of active sand movement up to 0.5 km from the coastal strand. *Ammophila arenaria* is well-established within the dunes, but acres and acres remain relatively pristine.

Surveys of beaches south of San Francisco in April 1997 revealed the following patchy distribution of *L. littoralis*:

<i>Absent</i>	<i>Present</i>
Pacifica (Sharp Park Beach)	Fort Funston
Pacifica (Rockaway Beach)	Half Moon Bay (Francis Beach)
Pacifica (Linda Mar Beach)	Pescadero State Beach
Montara State Beach	
Fitzgerald Marine Reserve	
El Granada Beach	
Half Moon Bay (Dunes Beach)	
San Gregorio State Beach	
Pomponio State Beach	

We found no *L. littoralis* at any of the beaches between Fort Funston and Half Moon Bay, despite the abundance of *Calystegia soldanella* at Linda Mar Beach in Pacifica. Sharp Park Beach, Rockaway Beach, Montara State Beach, Fitzgerald Marine Reserve, and El Granada Beach all feature a very narrow coastal strand and consequently very little potential habitat for *L. littoralis*.

At Francis Beach, we found the greatest species diversity of any of the beaches to the south of that point, as well as healthy quantities of *L. littoralis* near the mouth of Pilarcitos Creek. The area from the north end of the campground to the mouth of the creek was well-populated with the plant, which grows primarily along the seaward edge but occasionally extends more inland throughout the dunes. The area is fenced seasonally to protect Western Snowy Plovers. *L. littoralis* is abundant in this large area but nearly absent from other sections of the beach.

While we found no traces of the species at either San Gregorio or Pomponio State Beaches, we found *Lathyrus littoralis* to be in unprecedented abundance at Pescadero State Beach. We found the plant on both sides of Highway 1, although it is sparse on the east side near the marsh. *L. littoralis* grows in many areas along the beach side of the highway where a dune restoration project has been underway for a couple of years.

LIFE HISTORY: *Lathyrus littoralis* (Nutt.) Endl. is an herbaceous perennial vine of the Fabaceae (Pea) Family that reproduces both sexually and asexually. The plant produces 4-8 relatively large purple and white flowers (corolla 1.5-1.8 cm) per inflorescence. (See attached photograph). The abundant flowering stems create a striking display of color in late spring and early summer; we have seen some patches remain in

flower for several months. Its densely gray-hairy stems are weakly ascending to 0.5 m; they are also often prostrate above the surface of the sand. The stems are produced from a large underground rootstock following winter dormancy. Its stems are sparsely distributed among other foredune plants, creating a beautiful image of coexistence and diversity. Its leaflets are relatively large (1-2 cm) and variable in number (4-8). The fruits contain 1-5 seeds, which are usually ready for collection in June and July (Hickman, 1993; Munz, 1968).

ECOLOGY: An early student of California's dunes noted that "*L. littoralis* is a minor species of the foredunes" (Cooper, 1936). One study of species zonation found that it reached a peak in the foredunes furthest from the driftline (Barbour et al., 1976). Another study found it to be co-dominant on the top of ridges, where it joined *Erigeron glaucus* and *Fragaria chiloensis* as sand binders. Others have named a foredune plant community after it, the *Poa douglasii*-*Lathyrus littoralis* community (see review in Barbour and Johnson, 1988; Pickart, 1987), which is found mostly on the north coast of California where additional rain appears to favor it.

These studies of *L. littoralis* zonation correspond with our observations of central California coast populations. At the three beaches we visited with *L. littoralis* populations, *Calystegia soldanella* was found wherever *L. littoralis* was found. At Abbott's Lagoon, both are patchily abundant in areas of significant sand accretion up to 0.5 km from the shoreline. At Half Moon Bay, we found that *L. littoralis* apparently tends to take hold in existing hummocks. This observation was corroborated by Jean Ferreira for other dunes on the coast (pers. comm.). And in general it appears to be especially abundant in the front of foredune hummocks or in deflation plains. These observations support the hypothesis that it displays significant tolerance for sand accretion, albeit lower than the dominant dune builders (pers. obs.; Peter Baye, pers. comm.).

At Abbott's Lagoon, we found that it grows throughout the unstabilized dunes between more stabilized and vegetated sand hills. And in Pescadero, we found it growing in mostly every foredune location, including the beach, seaward hummocks, deflation plains, on the tops of ridges, and in the back dune near the marsh. Its ecological niche appears to include and go beyond that of *Calystegia soldanella*. It can be the dominant species close to the beach and abundant elsewhere, seeming to occupy any niche with an open sandy area, an observation that appears to reveal its "pioneering" characteristics.

An article by Boyd (1991) from the *Journal of the Lepidopterist's Society* revealed that *Lathyrus littoralis* was one of the most preferred species by caterpillars of *Platyrepia guttata* (ranchman's tiger moth) in dune habitats at Point Reyes. While we do not know if this tiger moth inhabits the Presidio, this data helps demonstrate that *L. littoralis* can be an ecologically important species in foredune plant communities.

PROPAGATION: Several nursery professionals with experience growing central California coast dune species have propagated *L. littoralis*. Laurie Neville (pers. comm.) has been successful taking seeds from the Pescadero dunes, nursing them and then

returning the seedlings to Pescadero as well as Half Moon Bay State Beach. Betty Young (pers. comm.) did not have any experience growing it. Patti Kreiberg (pers. comm.) has tried this species from both cuttings and seed and found it very easy to grow from seed. In her experience, cuttings would root readily but did not prosper after transplanting. Jean Ferreira (pers. comm.) echoed the experience with seed propagation, stating that it comes up prolifically using this method. Ingrid Cabada (pers. comm.) has successfully grown this species from seed at the Fort Funston nursery using standard propagation treatment for lupines and sweet peas. She has noticed differential survival rates after outplanting. In areas with more sand accretion, just above the driftline, the plantings experienced nearly total mortality, but those in areas with less active sand movement on the top of the bank swallow cliffs appear to have survived.

Kreiberg, Neville and Cabada recommended collecting the seed in June and July. At Pescadero State Beach in May 1997 we found some seed pods already developing.

PERMIT PROCESS: We contacted personnel with the San Mateo County District of State Parks, which has jurisdiction over all potential source populations. Paul Keel at Ano Nuevo sent us an *Application and Permit to Conduct Biological, Geological, or Soil Investigations and Collections*. A copy of this form is attached. It appears to be a straightforward process that includes a requirement that "the permittee submit a summary of information gathered to the applicable District . . . and to the Chief, Resource Management Division, Department of Parks and Recreation in Sacramento." The form also states that "the Department further requires that the collector make available to the Department any material published as a result of this permit." The District Superintendent must be notified before collection.

REINTRODUCTION RECOMMENDATIONS: The ecologically important issue of species reintroduction was discussed recently at the latest board meeting of the Yerba Buena Chapter of the California Native Plant Society. Former president Jake Sigg, other members of the board, and ourselves are excited about the possibility of reintroducing *Lathyrus littoralis* to Crissy Field. In general the chapter has a fairly conservative policy towards species reintroductions. Although still in draft form, the chapter's current informal policy recognizes the value of maintaining genetic variability through the conservation of geographically diverse populations of species (e.g., plants for sale at our annual native plant sale are grown only from locally collected native species in order to maintain the genetic integrity of populations in the natural areas and wildlands of San Francisco). In the opinion of many of its members, including ourselves, reintroductions should take place only in historic locations using only the closest possible source material.

Although no historic records exist for *Lathyrus littoralis* along the northern shore of the Presidio, strong sentiment has emerged among our Yerba Buena chapter board members that GGNRA ought to take advantage of this large-scale restoration effort to create additional populations of *Lathyrus littoralis* in remnant San Francisco dunes. There are very few other opportunities to expand the species' range in San Francisco. The park has a unique opportunity to help safeguard the future of a locally-threatened plant community.

by enhancing foredune diversity at Crissy Field. In addition, the heavy visitor use at Crissy Field make this an outstanding opportunities to interpret beach and dune processes, local extinctions, species reintroduction, and ecological restoration.

Lathyrus littoralis is sensitive to trampling (Ferreira, pers. comm.; Neville, pers. comm.) and therefore ought to be planted only in areas that will be protected by fencing or other measures that minimize trampling such as boardwalks. Indeed, the susceptibility of this species to trampling may help explain why it was not recorded during the 19th century. It may have been extirpated during the early years of the occupation of the Presidio as a result of heavy use of the coastal strand as a landing for visitors from ships in the harbor.

In any case, there is abundant evidence that *Lathyrus littoralis* was once widespread in the 36-km² San Francisco dune complex. There are records from throughout the western edge of San Francisco, including a record from Land's End. Given the sketchy and incomplete nature of early botanical investigations of San Francisco and the Presidio, we trust that the park will include this species in its restoration plan for Crissy Field. It would also be a prime candidate for reintroduction in the Baker Beach foredunes by the water treatment plant.

Any one of the current *Lathyrus littoralis* populations (Half Moon Bay, Pescadero, and Abbott's Lagoon) are large enough to sustain harvesting for the proposed reintroduction at Crissy Field. The Fort Funston population is not large enough to provide more than a few propagules for the restoration effort. The draft restoration action plan calls for approximately 300 plants of *Lathyrus littoralis*. Which population should serve as the founder source for the Crissy Field reintroduction? Or which populations? For a discussion that attempts to address these questions, please refer to the *Recommendations* section of our *Calystegia soldanella* report (Holloran and Brastow, 1997).

The Golden Gate may have served as a major barrier to genetic interchange between northern and southern populations. The direction of the onshore current is northerly along the San Francisco and San Mateo coast, suggesting that the extirpated San Francisco and San Francisco Bay populations were more closely related to Half Moon Bay and Pescadero populations than to the population at Abbott's Lagoon. Natural processes of genetic interchange among populations may best be served by a conservative approach, i.e., one that does not mix individuals from various populations north and south of the Golden Gate at Crissy Field. We therefore make the tentative recommendation to reintroduce *L. littoralis* from the two San Mateo coast populations: Half Moon Bay and Pescadero. These two populations are only 14 miles apart with the northerly Half Moon Bay population being just 20 miles from Fort Funston and Ocean Beach.

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