U.S. Fish & Wildlife Service

Recovery Implementation Strategy

for Franciscan Manzanita

(*Arctostaphylos franciscana*)

Photo courtesy of Shelley Estelle

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INTRODUCTION

This Recovery Implementation Strategy specifies the activities necessary to fully implement the recovery actions that are specified in the Recovery Plan for Franciscan Manzanita (*Arctostaphylos franciscana*) (U.S. Fish and Wildlife Service (Service) 2018). Along with the recovery actions, the Recovery Plan contains the recovery strategy, recovery objectives, and recovery criteria for the species. Designed to provide more focused detail than the recovery actions in the Recovery Plan, the recovery activities found herein are prioritized in terms of their importance for recovery. An assessment of the biology, life history, and status of the Franciscan manzanita is available in the Species Biological Report, which can be found at https://ecos.fws.gov. The Species Biological Report and this Recovery Implementation Strategy will be updated on a routine basis as necessary.

RECOVERY ACTION AND ACTIVITY NARRATIVE

1. Establish new populations of Franciscan manzanita within the historic range of the species.

    1.1 Identify appropriate planting sites within the historic range of the species on the San Francisco peninsula. (Priority 1)

    Sites should be selected to include a gradient of factors including fog influence, slope, exposure, and soil moisture to maximize success. This gradient should be present among the various selected sites, but could also be present within a single site. Other factors that should be evaluated are included in the 2009 Conservation Plan (Chasse *et al.* 2009). Sites should have soils similar to historical sites, *i.e.* serpentine, greenstone, or chert. Soils should be nutrient poor (similar to historical sites) and have available water for irrigation during the first 5 years to ensure plant establishment through periods of drought.

    Outplantings should not be placed in areas where cross pollination with ornamental manzanita cultivars is likely to occur, thus creating hybrid seed[1]. Also, selecting sites isolated enough from other taxa that may harbor *Phytophthora* or other potential pathogens should be a priority.

    1.2 Plant at least six populations of Franciscan manzanita within the historical range of the species from cuttings or layers taken from the wild plant. (Priority 1)

    Plants should be planted in areas where their eventual growth to 2 to 3 meters in diameter does not impact any rare species[2]. Plants should be planted no closer than 3 m (10 ft) apart to avoid overlap of the plants[3].

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[1] Chasse *et al* 2009, pg. 31.

[2] Serpentine soils of the San Francisco peninsula provide habitat for various other federally listed species such as Presidio clarkia (*Clarkia franciscana)*, Raven's manzanita (*Arctostaphylos hookerii* spp. *ravenii*), and Marin dwarf flax (*Hesperolinon congestum*), as well as other non-listed species of concern. See Recovery Plan for Serpentine Soil Species of the San Francisco Bay Area (Service 1998) and Recovery Plan for Coastal Plants of the Northern San Francisco Peninsula (Service 2003) for more information.

[3] M. Chasse, pers. comm. 2016. This distance is based on the radius of the wild plant at the time it was discovered and on old photographs of Franciscan manzanita plants in situ.

1.3 Establish at least three populations of genetically distinct individuals in addition to the populations of clones of the wild plant. (Priority 1)

Each population should consist of three representatives of each known genotype[4]. Sources of cuttings and layers should be plants currently in botanic gardens that were transplanted from Laurel Hill Cemetery in the 1940s and likely represent individuals that are genetically distinct from the wild plant. See Criterion A/3 for target population size.

1.4 Ensure that all planting sites and cuttings or layers from the wild plant are free from infestation by *Phytophthora* sp. and other diseases at the time they are outplanted and that they are tested periodically for infestation thereafter. (Priority 1)

Clean technique should be followed for growing plants in nurseries and for handling cuttings (Presidio Trust, in prep). Also, additional cuttings collected from the wild plant should be taken using the technique described in the 2009 Conservation Plan (Chasse *et al* 2009).

1.5 Clones and seedlings should be planted within or adjacent to existing serpentine chaparral communities to facilitate pollination by insects and seed dispersal by mammals. (Priority 2)

If serpentine chaparral community is not present, appropriate species [*e.g.*, coast blue blossom (*Ceanothus thyrsiflorus*), coyote brush (*Baccharis pilularis*), toyon (*Heteromeles arbutifolia*), woolly sunflower (*Eriophyllum confertiflorum*), sticky monkeyflower (*Diplacus aurantiacus*), coast buckwheat (*Eriogonum latifolium*), and yarrow (*Achillea millefolium*)] should be planted.

2. Protect, monitor, and manage outplanted populations and the wild plant.

2.1 Conduct quarterly demographic monitoring and watering for the cuttings and the wild plant, as needed. For new cuttings, monitoring and watering (if needed) should occur monthly or more often until cuttings are established. (Priority 1)

2.2 Conduct quarterly monitoring of invasive plants that compete with the cuttings and the wild plant for sunlight, water, and nutrients. (Priority 1)

Hand removal of invasive plants should be conducted. Herbicide foliar spray should not be applied within 30 m (100 ft) of any Franciscan manzanita plant.

Cut and paint methods of herbicide application should not be used within 3 m (10 ft) of any Franciscan manzanita plant to avoid damaging the plants.

[4] Chasse *et al.* 2009. It is recommended that representatives of three genotypes are present to capture the greatest genetic diversity possible.

2.3 Conduct quarterly monitoring for mammals and mammal trapping around the cuttings and the wild plant. (Priority 1)

2.4 Collect and accession Franciscan manzanita seed. (Priority 1)

Seed should be collected according to guidelines established by Center for Plant Conservation (1991).

Collect seed from the wild plant and its clones at multiple year intervals and store in at least two locations, including the USDA National Center for Genetic Resources Preservation in Fort Collins, CO. The locations should be approved by the U.S. Fish and Wildlife Service, National Park Service, and Presidio Trust. The seed will be used to propagate new plants if the wild plant(s) fails to survive, as well as for long-term conservation storage. Seed storage facilities must be affiliates of the Center for Plant Conservation. Eventually a goal of 1,500 stored seeds from each genet (seedling or clone) should be reached as long as seed collection does not result in adverse impacts to the wild plant or the established outplantings.[5]

2.5 Collect pollen from the wild plant. (Priority 2)

If the distance between plantings of genetically distinct individuals and the wild plant exceeds pollinator flight range, thereby limiting cross pollination, pollen should be collected either for immediate pollination or stored for long-term conservation use. Pollen should be stored at facilities with sufficient capability to maintain viability of the pollen[6].

2.6 Map all Franciscan manzanita plants and make available to all partners in Franciscan manzanita recovery. (Priority 3)

A map should be created showing locations and origin of all Franciscan manzanita outplantings, including all cuttings, clones, and the wild plant so as to improve coordination between recovery partners on strategic habitat management and genetic management. This map should include those plantings performed at botanic gardens and universities and colleges, such as the University of California at Santa Cruz and University of San Francisco.

2.7 Record all data related to propagation, transplanting, watering, and plant death. (Priority 2)

All data relative to collection of seeds and cuttings, accession of seeds, techniques of collection and propagation of seed and cuttings, and irrigation, should be recorded and made available to parties involved in establishment or management of Franciscan manzanita populations.[7] Data should be used to adaptively modify management practices, as warranted.

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[5] Chasse *et al.* 2009.
[6] Chasse *et al* 2009.
[7] Chasse *et al.* 2009.

3. Conduct research to determine the full range of the species and to guide outplanting and management efforts and establishment of a supportive chaparral community.

    3.1 Conduct reconnaissance surveys to determine full range of species and additional opportunities for reintroduction.

        3.1.1 Determine whether Franciscan manzanita is present in Marin or San Mateo Counties. (Priority 2)

            These Counties may provide the closest suitable habitat and similar climate conditions as those found in San Francisco County.

        3.1.2 Determine whether suitable habitat for outplanting is present in Marin or San Mateo Counties. (Priority 2)

            These Counties may provide the closest suitable habitat and similar climate conditions as those found in San Francisco County.

    3.2 Conduct genetic research.

        3.2.1 Determine genotypic variation between the wild plant and those in botanic gardens which originate from plants removed from Laurel Hill Cemetery in the 1940s. (Priority 1)

        3.2.2 Seedlings germinated from seeds of wild plants should undergo genetic analysis to determine the degree of heterozygosity (*i.e.*, whether the seedlings are recombined offspring of the one plant or have unique characters from another plant) and to test for possible hybridization. This should be done 1 to 5 years after germination when the seedlings have reached sufficient size. (Priority 1)

        3.2.3 Determine the genotype of any newly discovered populations, including, in the future, rates of outcrossing and inbreeding. (Priority 2)

        3.2.4 Conduct research on the success of tissue culture if propagation material is limited or is infected with disease. (Priority 3)

    3.3 Research pollinator species diversity and long-term abundance trends at the wild plant and site of any introductions to determine if loss of pollinators threatens Franciscan manzanita. (Priority 2)

    3.4 Determine appropriate plant species to use in establishing a serpentine chaparral plant community for local restoration projects that will support native pollinators of Franciscan manzanita. Species should be selected that are found naturally on the San Francisco peninsula and provide a year-round source of pollen and nectar for pollinators known to visit the Franciscan manzanita. Taxa with high susceptibility to infection by *Phytophthora* species should be avoided. (Priority 3)

3.5 Determine whether fungal associates (mycorrhizae) of the wild plant are necessary or beneficial for outplanting Franciscan manzanita plants and if found to be beneficial, incorporate during outplanting the addition of mycorrhizal species from close serpentine relatives, such as Raven's manzanita (*A. montana* subsp. *montana*). To avoid pathogen concerns, this should be done without the transfer of soil. (Priority 2)

3.6 Conduct research into additional methods to discourage predators, such as California voles, from damaging Franciscan manzanita plants. (Priority 2)

IMPLEMENTATION SCHEDULE

The recovery activities identified below are those that, based on the best available science, we believe are necessary to work towards the recovery of Franciscan manzanita and its long-term conservation. These activities are guidance for meeting the objectives that were presented in the Recovery Plan for Franciscan Manzanita. However, these recovery activities are subject to modification as dictated by new information, changes in species status, and the completion of other recovery actions. Each recovery activity has been assigned a priority number (see below) according to our determination of what is most important for the recovery of Franciscan manzanita based on its status, life history, ecology, and threats.

Key to Terms and Acronyms Used in the Recovery Action Narrative and Implementation Schedule:

For the purposes of this recovery implementation strategy, priority numbers are defined as:

Priority 1: An activity that must be taken to prevent extinction or to prevent a species from declining irreversibly.

Priority 2: An activity that must be taken to prevent a significant decline in the species population/habitat quality or some other significant negative impact short of extinction.

Priority 3: All other activities necessary to provide for full recovery of the species.

Definition of Activity Durations:

Continual: An activity that is not currently underway but will be implemented throughout the recovery period on a routine basis, once initiated.

Ongoing: An activity that is currently being implemented and will continue throughout the recovery period.

TBD: To Be Determined.

Responsible Parties:

Responsible parties are those agencies who may voluntarily participate in any aspect of implementation of particular tasks listed within this recovery implementation strategy. Responsible parties may willingly participate in project planning, funding, staff time, or any other means of

implementation. Bold type indicates the entity most likely to lead the activity. Parties other than those listed below are also encouraged to participate in recovery activities for Franciscan manzanita.

ALL	All entities
EBRPD	East Bay Regional Park District
FWS	Fish and Wildlife Service
PT	Presidio Trust
GGNRA	Golden Gate National Recreation Area, National Park Service
OWN	Agency or organization that administers or owns each site
PVT	Private contractor
STO	Organization to Store/Propagate Seeds
UCBGB	University of California Botanical Garden at Berkeley
UNIV	San Francisco State University, UC Santa Cruz

IMPLEMENTATION SCHEDULE – Franciscan manzanita

Priority Number	Activity Number	Activity Description	Activity Duration	Responsible Party	Total Cost (in $1K units)	Year 1 Cost ($1K units)	Year 2 Cost ($1K units)	Year 3 Cost ($1K units)	Year 4 Cost ($1K units)	Year 5 Cost ($1K units)	Comments
1	1.1	Identify appropriate planting sites within the historic range of the species on the San Francisco peninsula.	4 days	**FWS, PT, GGNRA**, OWN, UCBGB, UNIV	6.6	6.6	-	-	-	-	4 days x 2 people x $825/day.
1	1.2	Plant at least six populations of Franciscan manzanita within the historical range of the species from cuttings or layers taken from the wild plant.	3 years	EBRPD, FWS, PT, GGNRA, OWN, **UCBGB, UNIV**	9.6	3.2	3.2	3.2	-	-	Assumes appropriate sites identified within the first FY. Initial preparation of cuttings: 8 days x $400/day= $3.2K. Planting: 2 sites/year x 2 days/site x 2 people x 3 years x $400/day= $3.2K.
1	1.3	Establish at least three populations of genetically distinct individuals in addition to the populations of clones of the wild plant.	3 years	EBRPD, FWS, PT, GGNRA, OWN, **UCBGB, UNIV**	4.8	1.6	1.6	1.6	-	-	Assumes appropriate sites identified within the first FY. Initial preparation of cuttings: 4 days x $400/day= $1.6K. Planting: 1 site/year x 2 days/site x 2 people x 3 years x $400/day= $1.6K.
1	1.4	Ensure that all planting sites and cuttings or layers from the wild plant are free from infestation by *Phytophthora* sp. and other diseases at the time they are outplanted and that	Every other year for 50 years	ALL	>25	1	-	1	-	1	Based on testing for presence of *Phytophthora* sp. every other year for 50 years.

Priority Number	Activity Number	Activity Description	Activity Duration	Responsible Party	Total Cost (in $1K units)	Year 1 Cost ($1K units)	Year 2 Cost ($1K units)	Year 3 Cost ($1K units)	Year 4 Cost ($1K units)	Year 5 Cost ($1K units)	Comments
		they are tested periodically for infestation thereafter.									
2	1.5	Clones and seedlings should be planted within or adjacent to existing serpentine chaparral communities to facilitate pollination by insects and seed dispersal by mammals.	Continual	EBRPD, FWS, PT, GGNRA, OWN, **UCBGB, UNIV**	-	-	-	-	-	-	No additional cost.
1	2.1	Conduct quarterly demographic monitoring and watering for the cuttings and the wild plant, as needed. For new cuttings, monitoring and watering (if needed) should occur monthly or more often until cuttings are established.	Monthly for 25 yrs then annually for 25 yrs	PT, GGNRA, **UNIV**	112.8	9.6	9.6	3.2	3.2	3.2	While introduction of new cuttings may occur intermittently, for cost calculation purposes, we assumed increased monitoring for first 2 years. Monthly monitoring for 2 years, quarterly monitoring for 23 years then, annual monitoring for 25 years when populations most established. [2 days/visit x 12 visits/yr x 2 yrs x $400/day] + [2 days/visit x 4 visits/yr x 23 yrs x $400/day] + [2 days/visit x 1 visit/yr x 25 yrs x $400/day].
1	2.2	Conduct quarterly monitoring of invasive plants that	Monthly for 25 yrs, then	PT, GGNRA, **UNIV**	-	-	-	-	-	-	No additional cost beyond Action 2.1.

Priority Number	Activity Number	Activity Description	Activity Duration	Responsible Party	Total Cost (in $1K units)	Year 1 Cost ($1K units)	Year 2 Cost ($1K units)	Year 3 Cost ($1K units)	Year 4 Cost ($1K units)	Year 5 Cost ($1K units)	Comments
		compete with the cuttings and wild plant for sunlight, water, and nutrients.	annually for 25 yrs								
1	2.3	Conduct quarterly monitoring for mammals and mammal trapping around the cuttings and the wild plant.	Monthly for 25 yrs then annually for 25 yrs	PT, GGNRA, **UNIV**	-	-	-	-	-	-	No additional cost beyond Action 2.1.
1	2.4	Collect and accession Franciscan manzanita seed.	Begin in FY1; on-going as needed	EBRPD, FWS, PT, GGNRA, **STO**, **UCBGB, UNIV**	10.2	4.6	-	2.4	-	3.2	Cost based on 2-4 days/yr x 2 people x $400/day x 3 yrs. plus single $3K flat fee in FY1 to bank seed (per Rancho Santa Ana Botanical Garden). Highly dependent on sufficient annual seed set and viability of existing banked seed.
2	2.5	Collect pollen from the wild plant.	Begin in FY1; on-going as needed	EBRPD, FWS, PT, GGNRA, **STO**, **UCBGB, UNIV**	14.4	3.2	-	4.8	-	6.4	Cost assumes twice the labor hours for pollen collection compared to seed collection and relies on flat fee included in Action 2.4. 4-8 days/yr x 2 people x $400/day.
3	2.6	Map all Franciscan manzanita plants and make available to all partners in Franciscan manzanita recovery.	Begin in FY1; on-going as needed	EBRPD, **PT, GGNRA,** UNIV	2.5	0.8	-	-	-	1.7	One day in FY1 and as a placeholder, 2 days in FY5 x $825/day.
2	2.7	Record all data related to	Continual	ALL	-	-	-	-	-	-	No additional costs beyond those for

Priority Number	Activity Number	Activity Description	Activity Duration	Responsible Party	Total Cost (in $1K units)	Year 1 Cost ($1K units)	Year 2 Cost ($1K units)	Year 3 Cost ($1K units)	Year 4 Cost ($1K units)	Year 5 Cost ($1K units)	Comments
		propagation, transplanting, watering, and plant death.									propagation, transplanting, and monitoring actions above.
2	3.1.1	Determine whether Franciscan manzanita is present in Marin or San Mateo Counties.	1 year	FWS, **PT, GGNRA, OWN,** PVT, UCBGB, UNIV	5	5	-	-	-	-	6 days x $825/day.
2	3.1.2	Determine whether suitable habitat for outplanting is present in Marin or San Mateo Counties.		FWS, **PT, GGNRA, OWN,** PVT, UCBGB, UNIV	-	-	-	-	-	-	No additional cost beyond that to search for actual plants in Marin and San Mateo Counties.
1	3.2.1	Determine genotypic variation between the wild plant and those in botanic gardens which originate from plants removed from Laurel Hill Cemetery in the 1940s.	2 years	EBRPD, PT, GGNRA, PVT, UCBGB, **UNIV**	60	30	30	-	-	-	Basic genetic study to determine genotypic variation= $60K.
1	3.2.2	Seedlings germinated from seeds of wild plant should undergo DNA sequencing to determine the degree of heterozygosity and to test for possible hybridization.	2 years	EBRPD, PT, GGNRA, PVT, STO, UCBGB, **UNIV**	40	20	20	-	-	-	Basic genetic study to conduct DNA sequencing= $40K.
2	3.2.3	Determine the genotype of any	Ongoing as needed	EBRPD, PT, GGNRA, PVT, STO,	TBD	TBD	TBD	TBD	TBD	TBD	Dependent on discovery of new populations.

Priority Number	Activity Number	Activity Description	Activity Duration	Responsible Party	Total Cost (in $1K units)	Year 1 Cost ($1K units)	Year 2 Cost ($1K units)	Year 3 Cost ($1K units)	Year 4 Cost ($1K units)	Year 5 Cost ($1K units)	Comments
		newly discovered populations.		UCBGB, **UNIV**							
3	3.2.4	Conduct research on the success of tissue culture if propagation material is limited or is infected with disease.	3 years	EBRPD, PT, GGNRA, PVT, **STO, UCBGB, UNIV**	60	20	20	20	-	-	Basic genetic study.
2	3.3	Research pollinator species diversity and long-term abundance trends at the wild plant and site of any introductions to determine if loss of pollinators threatens Franciscan manzanita.	3 years	**GGNRA, PT**, OWN, PVT, UNIV	14.4	4.8	4.8	4.8	-	-	4 days/mo x 3 mo (Dec-Feb) x $400/day x 3 yrs.
3	3.4	Determine appropriate plant species to use in establishing a serpentine chaparral plant community that will support native pollinators of Franciscan manzanita.	3 years	EBRPD, FWS, PT, GGNRA, OWN, PVT, **UCBGB,** UNIV	4.8	1.6	1.6	1.6	-	-	4 days/yr x $400/day x 3 yrs.
2	3.5	Determine whether fungal associates (mycorrhizae) of the wild plant are necessary or beneficial for outplanting	5 years	EBRPD, PT, GGNRA, OWN, PVT, **UCBGB, UNIV**	12	2.4	2.4	2.4	2.4	2.4	6 days/yr x $400/day x 5 yrs.

Priority Number	Activity Number	Activity Description	Activity Duration	Responsible Party	Total Cost (in $1K units)	Year 1 Cost ($1K units)	Year 2 Cost ($1K units)	Year 3 Cost ($1K units)	Year 4 Cost ($1K units)	Year 5 Cost ($1K units)	Comments
		Franciscan manzanita plants.									
2	3.6	Conduct research into additional methods to discourage predators, such as California voles, from damaging Franciscan manzanita plants.	2 years	EBRPD, FWS, **PT, GGNRA,** OWN, PVT, UCBGB, **UNIV**	2.4	1.2	1.2	-	-	-	3 days/yr x $400/day x 2 yrs.

Priority 1 activities: $269,000 Priority 2 activities: $48,200 Priority 3 activities: $67,300

Total Estimate: $384,500

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