La Graciosa Thistle (*Cirsium scariosum* var. *loncholepis*)

Recovery Implementation Strategy



La Graciosa thistle (*Cirsium scariousum* var. *loncholepis*) in bloom at Pond B-2 within the Chevron Oil Field in San Luis Obispo County, California, May 17, 2019, Kristie Scarazzo, U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service Ventura, California

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Recovery Team:

Ronnie Glick, Senior Environmental Scientist – California Department of Parks and Recreation Jennifer Langford, Senior Biologist – Trihydro Corporation Steve Madsen, Property Manager – Dunes Lakes Limited Lindsey Roddick, Restoration Ecologist – Land Conservancy of San Luis Obispo County Mark Skinner, Restoration Specialist II – Coastal San Luis Resource Conservation District Jenn Yost, Assistant Professor of Botany – California Polytechnic State University, San Luis Obispo

U.S. Fish and Wildlife Service:

Kristie Scarazzo, Botanist – Ventura Fish and Wildlife Office Chris Kofron, Senior Biologist – Ventura Fish and Wildlife Office Cat Darst, Assistant Field Supervisor – Ventura Fish and Wildlife Office Debora Kirkland, Refuge Manager – Guadalupe-Nipomo Dunes National Wildlife Refuge Colleen Grant, Biologist – Ventura Fish and Wildlife Office Shawn Milar, Coastal Program Coordinator – Ventura Fish and Wildlife Office

Introduction

The primary purpose of this Recovery Implementation Strategy (RIS) is to present the specific and operational plan of activities necessary to fully implement the recovery actions identified in the Recovery Plan the U.S. Fish and Wildlife Service (USFWS) prepared for La Graciosa thistle (*Cirsium scariosum* var. *loncholepis* [*C. loncholepis*] – USFWS 2021, entire). In addition to the recovery actions, the Recovery Plan contains: the recovery strategy, recovery goals and objectives, and recovery criteria for the species. The recovery activities contained within this document are intended to provide more focused and step-wise details than the recovery actions in the Recovery Plan and they are prioritized in terms of their importance for recovery of the species. The Recovery Plan is available at: https://ecos.fws.gov.

The Recovery Plan is based on the USFWS Species Status Assessment Report (SSA) for La Graciosa thistle (USFWS 2020, entire). This report provides a synthesis and evaluation of the best available scientific information on the status of the species, including the species biology and needs, current condition, and anticipated future viability. The RIS and SSA will be updated and refined periodically, as new information on the species becomes available, as recovery activities are accomplished, and/or if the overall approach to recovery implementation needs to be adjusted.

Recovery Actions and Activity Narratives

The near-term and longer-term recovery actions, as specified in the Recovery Plan, as well as the more detailed activities provided below are those that, based on the best available science, we consider necessary to achieve recovery of La Graciosa thistle. Together, these recovery actions and activities compose the fundamental guidance to achieve the recovery goals and objectives presented in the Recovery Plan.

Following the USFWS 1983 guidance on Endangered and Threatened Species Listing and Recovery Priority Guidelines (48 FR 43098), each recovery action is assigned a recovery priority number (see below). Assignments of these numbers to each of the actions is also based on our determination of what is most important for recovery of La Graciosa thistle, given its current status, life history, ecology, and threats. Priority numbers do not imply that some recovery activities are of low priority. Rather, they imply that certain activities may be deferred to a later time, while the higher priority recovery activities are being implemented. And in certain circumstances, implementation of the highest priority activities will inform implementation of subsequent activities initially given a lower priority number. Therefore, priority numbers are meant to guide, not to constrain, allocation of limited conservation resources towards those efforts that have the most urgency within the greater scope of the entire recovery program.

The Recovery Activity Priority Numbers are defined as follows:

- <u>Priority 1</u>: An activity that must be taken to prevent extinction or to prevent the species from declining irreversibly.
- <u>Priority 2</u>: An activity that must be taken to prevent a significant decline in species

population/habitat quality, or some other significant negative impact short of extinction.

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

The timing and order in which the recovery actions and activities will be implemented is likely to be affected by funding availability, land ownership and permissions, logistics and access, partner interest and engagement, and overall feasibility. While the Recovery Actions and Activities Narrative provides detailed information on the steps that need to be taken to achieve La Graciosa thistle recovery, both the Recovery Plan and the RIS are guidance documents intended for planning purposes only. Partnering agencies and other stakeholders identified below (Table 1) are those entities who are likely to voluntarily and willingly participate in implementation of the particular recovery tasks listed within this RIS, including: project planning, funding, staff time, labor, public education and outreach, and any other aspects of the La Graciosa thistle recovery program. Interested parties other than those listed herein are also encouraged to participate in recovery implementation activities for the species. Being listed as a partnering agency or stakeholder does not create a legal obligation beyond the existing legal requirements and regulatory framework. Implementation of the recovery activities will require consistent coordination, commitment, and ongoing collaboration with the appropriate partnering agencies and stakeholders.

Acronym	Partnering Entity
GNDNWR	USFWS Guadalupe-Nipomo Dunes National Wildlife Refuge
ODSVRA	California State Parks Oceano Dunes State Vehicular Recreation Area
USFSW	U.S. Fish and Wildlife Service, Region 8 Listing and Recovery
DLL	Dunes Lakes Limited, Private Land Manger
LC-SLO	Land Conservancy of San Luis Obispo County
CCG	Chevron Corporation, Guadalupe Restoration Project
VAFB	Vandenberg Air Force Base

Table 1: La Graciosa Thistle Recovery Partnering Agencies and Stakeholders

Near-Term Recovery Actions and Activities:

The aim of the near-term recovery actions is to prevent extirpation of La Graciosa thistle at the eight extant occurrences.

1. Habitat restoration and enhancement efforts (Priority 1)

- 1.1. Conduct invasive weed treatments with herbicides, and abatement and removal activities to prevent re-infestations;
- 1.2. Conduct woody debris removal to clear out dead and downed trees and tree limb debris;
- 1.3. Conduct thinning and trimming of excessive riparian vegetative growth;
- 1.4. Conduct thatch removal and sedimentation management;
- 1.5. Conduct dredging and re-contouring of wetland features to maximize hydrologic function and renovate local hydrologic regimes.

Some combination or all of the recovery activities listed under Action 1 should be undertaken by the following partnering agencies and stakeholders, and they are listed in order of highest to lowest precedence: GNDNWR, ODSVRA, CCG, and DLL. Both GNDNWR and CCG have more than one occurrence on their respective properties. The greatest needs and highest levels of urgency for the recommended habitat restoration activities are for GNDNWR and ODSVRA because these properties have experienced the greatest declines, currently harbor the lowest number of individuals, and are considered to have the highest risk of extirpation due to the degraded habitat conditions. The occurrences at the other two sites, (CCG and DLL) are more stable and have higher abundance. These properties can benefit from implementation of the activities for more active management and habitat enhancement efforts for the species.

2. Supplemental watering (Priority 1)

When necessary, in times of drought or lack of water, supplemental water should be applied to certain La Graciosa thistle colonies and/or at particular occurrences to ensure survival of the species at these locations.

In addition to declining numbers of individuals, we have recently observed La Graciosa thistle failing to produce viable seed and complete its life cycle, presumably because of insufficient water. Individual plants flowered, then quickly died either without having produced any seed at all (flowers still on the plants), or with immature, mutant, and/or not fully formed seed within developmentally arrested seed heads. Therefore, it is critical that water be supplied exogenously. Decisions regarding how to best conduct supplemental watering will depend on the specific sit conditions, logistics, water availability, and access.

- 2.1. Conduct hand watering with bottles,
- 2.2. Conduct supplemental watering with trucks that have tanks on them, or
- 2.3. Conduct supplemental watering by installation of solar pump systems, submersible/temporary wells, and other sustainable irrigation infrastructure.

Recovery activities listed under Action 2 should be undertaken by the following partnering agencies and stakeholders, and they are listed in order of highest to lowest necessity: GNDNWR, ODSVRA, and CCG. Both GNDNWR and CCG have more than one occurrence on their respective properties. Again, the highest concern and greatest level of need for supplemental watering is at GNDNWR and ODSVRA because these sites have had the greatest declines, lowest number of individuals, and have the highest risk of extirpation due to degraded habitat quality. Certain colonies located at CCG would also benefit from supplemental watering activities.

3. Installation of exclusionary fencing and/or cages (Priority 1)

- 3.1. Exclusionary devices should be installed to prevent trampling from feral pigs (*Sus scrofa*)
- 3.2. Exclusionary devices should be installed to prevent herbivory from deer (*Odocoileus hemionus*)
- 3.3. Exclusionary devices should be installed to prevent other small mammals, such as mice (*Peromyscus* spp.) and rabbit (*Sylvilagus* spp.).

3.4. Fencing may also be used to restrict cattle grazing in particular areas during certain times of the year or for particular studies designed to evaluate the role of disturbance associated with seasonal grazing regimes.

Feral pig fencing repairs and installation of other restrictive devices to prevent herbivory from small mammals are needed at GNDNWR. Restrictive caging and/or fencing is also needed at ODSVRA to prevent detrimental herbivory from deer, which continues to pose a significant threat at this location. Each of these sites currently has the greatest need for the activities listed in Action 3. Other occurrences may also need these activities and will be pursued subsequently, if needed to ameliorate these threats.

4. Propagation of the species for supplemental outplanting (Priority 1)

- 4.1. Collect seed from La Graciosa thistle occurrences when and if it is readily available for the purposes of producing viable seedlings from tracked maternal lines.
- 4.2. Seedlings produced from these activities should then be outplanted at locations that face a high risk of extirpation to augment them and at other sites in close proximity to extant occurrences. Successful outplanting projects associated with sites that currently support occurrences will increase the resiliency of populations and overall redundancy of the species.

USFWS will facilitate the seed collecting activities with its partner agencies, stakeholders, and other organizations. Subcontractors such as botanic gardens, universities, or other partner organizations that have suitable greenhouse facilities (for example, LC-SLO and CCG) can propagate the seeds for individual outplanting projects as they are funded and able to be implemented. At present, GNDNWR is the most important site for supplemental outplanting at 3-Pond West and Myrtle Pond because they are at high risk of extirpation due to poor recruitment and declining numbers of individuals. This site has other suitable pond sites where establishing new colonies is likely warranted and feasible. ODSVRA is the next most important site for supplemental outplanting at Surprise Lake because it too faces a high risk of extirpation due to alarmingly low numbers of individuals. It also has other suitable habitat areas where establishing new colonies is likely warranted and feasible.

5. Annual monitoring and reporting program (Priority 2)

- 5.1. Development of an annual monitoring and reporting program is necessary to track and census the numbers of individuals at each of the eight extant occurrences, to assess the effectiveness and progress of the recovery activities, and to both guide and devise the course of future recovery activities, projects, and endeavors. Annual monitoring methods and data collection efforts should be standardized so that the various partnering agencies and stakeholders are conducting the surveys, collecting the data, and reporting in the same uniform way to ensure continuity and data quality. Standardization will make sure that the annual monitoring data is correct, complete, and in the most useable, manageable format. This activity will also foster collaborative research and permits larger-scale analytics of the data being collected.
- 5.2. Conduct annual monitoring at eight extant occurrences and newly outplanted sites.

USFWS will develop a standardized La Graciosa thistle annual monitoring and reporting program including: a data form for use in the field, a simple reporting template, and an identification tool with photos and technical descriptions of the plant to differentiate it

from the other common and co-occurring thistles. All of the partnering agencies and stakeholders associated with the eight extant occurrences should commit to conducting a minimum of five years of annual La Graciosa thistle monitoring and reporting initially, including: GNDNWR, ODSVRA, DLL, and CCG. The LC-SLO administers a conservation easement at DLL and will likely be the entity conducting the annual monitoring and reporting at this site. After the monitoring and reporting program and tools are developed, USFWS may provide assistance and technical support to the partnering agencies and stakeholders to ensure that they are comfortable with the skills, techniques, and methodologies for success of the annual monitoring and reporting program.

Longer-Term Recovery Actions:

The longer-term recovery actions are intended to inform the strategic future development of the species recovery program across the historical range, fill important knowledge gaps, and to systematically move the species towards downlisting and eventual delisting.

6. Establish and maintain a permanent conservation seed bank (Priority 2)

- 6.1. Seed should be collected from all extant La Graciosa thistle occurrences when it is available and practicable to collect.
- 6.2. Seed accessions should be deposited in a facility (or facilities) that are certified by the Center for Plant Conservation (CPC). Certified affiliates are part of a national network that follow stringent guidelines for seed conservation banking set by the International Board for Plant Genetic Resources and in consultation with the National Laboratory for Genetic Resource Preservation.
- 6.3. Once deposited, seed will be stored and curated for perpetuity to serve as emergency back-up, in the event of catastrophic loss or if the species becomes extinct in the wild.

USFWS will facilitate the La Graciosa thistle seed collecting efforts and will coordinate as needed with the appropriate partnering agencies and stakeholders for site access and other logistics. USFWS will also secure an appropriate funding source to establish the permanent conservation seed bank at an appropriate CPC-certified facility. Once the conservation seed bank is established, USFWS will continue to work with the facility to actively manage the conservation seed bank to maximize the overall recovery benefit, make subsequent seed accessions into the bank periodically, and facilitate any further use of the seed stored in the bank for future outplanting efforts and other research projects.

7. Conduct ex situ seed viability studies and bulk the seed from the conservation seed bank accessions (Priority 3)

7.1. Once there is enough seed stored in the conservation seed bank, conduct research to evaluate and quantify the viability of La Graciosa thistle seed and efforts to bulk the seed will be pursued. These activities are designed to ensure that an abundant amount of seed is readily available for subsequent outplanting and recovery projects.

USFWS will obtain funding for a seed viability study and contract with an appropriate research partner for the project. This is a key area of research identified for the species because little is known about the persistence and viability of the species in seed form. Recent observations have led us to conclude that La Graciosa thistle frequently completes its life

cycle annually, as opposed to it being a biennial or short-lived perennial, as previously thought. Other recent observations include a flush of many individuals at a location where the species had not been seen for several consecutive years and another instance in which seed germinated at a site five years after it was planted. These new observations warrant further investigation of seed viability, which will help inform future management and recovery decisions.

7.2. Bulk the banked seed. This is a deliberate way to increase the total amount of seed in possession, within a controlled nursery setting. For species like La Graciosa thistle that face such a high risk of extinction and that are exhibiting extremely poor recruitment in the wild, ex situ seed bulking is one of the most prudent and effective ways to increase the amount of seed available. Bulking endeavors include careful tracking of the maternal lines, measures to ensure preservation of all the genetic information, and controlling for potentially adverse genetic effects by keeping the ex situ population isolated. When feasible, USFWS will obtain funding for seed bulking and contract with an appropriate partner for the project. Once this activity is complete, bulked seed can be allocated to stock various outplanting project efforts within the framework of the recovery strategy.

8. Systematically re-establish several extirpated occurrences (Priority 2)

- 8.1. This action includes facilitation of outplanting projects at numerous sites that are likely to have cooperative recovery partners based on the current land ownership and land use practices and/or that would be conducive for these purposes because appropriate conservation easements are already established. All of the sites listed are high priority, but are presented in numeric order based on the California Department of Fish and Wildlife's Natural Diversity Database (CNDDB) Occurrence Number:
 - 8.1.1. Vandenberg Air Force Base extirpated Occurrence No. 1 is within the Vandenberg South Population Unit and re-introduction of the species at this site would re-establish it in the southwestern portion of the range and back into Santa Barbara County.
 - 8.1.2. Oso Flaco Lake within the ODSVRA extirpated Occurrence No. 13 is within the Sand Dune Complex Population Unit and re-introduction of the species at this site would increase its overall resiliency and redundancy.
 - 8.1.3. Pismo State Beach, also managed by the ODSVRA extirpated Occurrence No. 14 is within the Sand Dune Complex Population Unit and re-introduction of the species at this site would increase its overall resiliency and redundancy. This site has the Oceano Dunes District Visitor Center, which could provide an important opportunity for public education and outreach for La Graciosa thistle recovery.
 - 8.1.4. Black Lake Ecological Reserve is owned by the LC-SLO extirpated Occurrence No. 16 is within the Sand Dune Complex Population Unit and re-introduction of the species at this site would increase its overall resiliency and redundancy.

To implement outplanting projects at each of these extirpated sites, USFWS will partner with VAFB, ODSVRA, and LC-SLO to develop cooperative agreements, grants, and other funding opportunities for this purpose. Re-establishment of the species within these locations will require habitat restoration, propagation of the species from seed, outplanting, and ongoing maintenance and monitoring. The exact number of individuals for outplanting will

depend on the amount of suitable habitat available and other site logistics. However, we anticipate that these endeavors would likely install between 200 and 300 plants at a given location with maintenance and monitoring for five consecutive years.

9. Establish cooperative relationships with other landowners (Priority 2)

Engage potential partners with the goal of surveying parcels not previously surveyed for additional occurrence or suitable habitat. Also pursue other survey and assessment activities throughout the historical range at sites that are likely to have suitable habitat that could potentially support outplanting efforts.

- 9.1. Pursue access to sites with the following CNDDB occurrences: No. 2, 3, 4, 8, 19, 20, 28, 30, 32, 33, and 34.
- 9.2. Use spatial and analytical tools to identify other potentially suitable habitat throughout the historical range and pursue access to these sites to survey for the species and find additional sites that may be conducive for outplanting efforts.
- 9.3. Continue to explore opportunities to develop new conservation partnerships for the species.

USFWS will lead and coordinate these activities under Action 9.

10. Fulfill research needs (Priority 2)

- 10.1. Conduct research into best management practices and methods for the various life stages of the species;
- 10.2. Conduct research into species response to disturbance from grazing, thatch removal, and other vegetation management techniques;
- 10.3. Conduct demographic studies to determine what is needed for self-sustaining occurrences;
- 10.4. Conduct research into pollination ecology to determine what is needed for selfsustaining occurrences;
- 10.5. Conduct research into genetics to inform outplanting efforts;
- 10.6. Conduct habitat suitability modeling and analyses to inform outplanting efforts;
- 10.7. Conduct groundwater testing and mapping to inform restoration planning at extant occurrences and outplanting efforts;
- 10.8. Conduct hydrologic modeling that can be used for evaluating variable climate change scenarios for restoration and outplanting efforts.

USFWS will develop grant proposals and partnering opportunities for research-related projects and data focused activities. New areas for research and other experimental avenues will be directed as the body of La Graciosa thistle knowledge expands and the current gaps are filled. We will collaborate with universities, botanic gardens, and other joint funding collaborators to fulfill these and other research needs of the species.

Implementation Schedule

The La Graciosa thistle recovery implementation schedule provided below in Table 2 further

outlines the recovery activities and includes the estimated costs required to complete all of the recovery actions from the Recovery Plan. Costs are estimated at the principle numbered action level. As discussed within the Recovery Plan, the entire La Graciosa thistle recovery period is anticipated to be 30 years. The estimated durations provided in the recovery implementation schedule are for the first five years of the recovery period. After the first five years of the recovery implementation schedule, and completion of the associated activities, the SSA and the RIS will be updated. Then the next, consecutive five-year implementation schedule time period will be developed and finalized.

Activity Number	Action Priority Number	Action Description	Agency/ Partners	Anticipated Total Cost of Activity	Comments
	1	Habitat restoration and enhancement efforts	GNDNWR, ODSVRA, CCG, DLL	\$385,000	More or less money may be spent in any given year for these activities at any given site, and the actual annual costs of these endeavors will depend on the specific factors at each particular restoration site. Estimate to restore habitat, propagate, and outplant 200 individuals at a single location is approximately \$77,000.
1.1.		Conduct invasive weed treatments with herbicides, and abatement and removal activities to prevent re-infestations			
1.2		Conduct woody debris removal to clear out dead and downed trees and tree limb debris			
1.3		Conduct thinning and trimming of excessive riparian vegetative growth			
1.4		Conduct thatch removal and sedimentation management			
1.5		Conduct dredging and re-contouring of wetland features to maximize hydrologic function and renovate local hydrologic regimes			
2	1	Supplemental watering	GNDNWR, ODSVRA, CCG, DLL	\$154,000	Assumes watering at all extant sites for five consecutive years allocated to the sites as follows: \$15,800 to GNDNWR/year; \$9,000/year ODSVRA; \$5,500 to CCG/year; and \$500 to DLL/year. \$30,800 for watering annually.
2.1		Conduct hand watering with bottles			
2.2		Conduct water trucks with tanks			
2.3		Conduct installation of solar pumped, submersible/temporary and sustainable irrigation infrastructure			

Table 2: La Graciosa thistle Implementation Schedule

Activity Number	Action Priority Number	Action Description	Agency/ Partners	Anticipated Total Cost of Activity	Comments
3	1	Install exclusionary fencing and/or cages	GNDNWR, ODSVRA	\$79,000	Fencing at GNDNWR already exists but needs upgrading and repair. There is no fencing at ODSVRA. Once the first year of repairs and installation occurs, the remaining activities will be maintenance only.
3.1		Install exclusionary devices to prevent trampling from feral pigs (<i>Sus scrofa</i>)			
3.2		Install exclusionary devices to prevent herbivory from deer (Odocoileus hemionus)			
3.3		Install exclusionary devices to prevent other small mammals, such as mice (<i>Peromyscus</i> spp.) and rabbit (<i>Sylvilagus</i> spp.).			
3.4		Use fencing to restrict cattle grazing or for particular studies to evaluate the role of disturbance associated with seasonal grazing regimes.			
4	1	Propagation of the species for supplemental outplanting at extant occurrences	USFWS, LC-SLO, CCG, GNDNWR, ODSVRA	\$317,000	These activities will focus on outplanting at one site per year and will be conducted in the following order: GNDNWR, ODSVRA, LC- SLO (Black Lake Canyon), and CCG. The funding allocated in the last year will be split at each of the sites for monitoring and reporting of each outplanting.
4.1		Collect seed from La Graciosa thistle occurrences when and if it is readily available for the purposes of producing viable seedlings from tracked maternal lines.			
4.2		Outplant seedlings produced from these activities at locations that face a high risk of extirpation to augment them and at other sites in close proximity to extant occurrences.			

Activity Number	Action Priority Number	Action Description	Agency/ Partners	Anticipated Total Cost of Activity	Comments
5	2	Annual monitoring and reporting program	USFWS, GNDNWR, ODSVRA, DLL, CCG, LC-SLO	\$185,000	\$7,400 (to each of 5 sites) will be made available to each partner annually to help sponsor the annual monitoring and reporting program for five consecutive years.
5.1		Develop a standardized monitoring and reporting program			
5.2		Conduct annual monitoring at eight extant occurrences and newly outplanted sites			
6	2	Establish and maintain a permanent conservation seed bank	USFWS	\$50,000	The first year of funding will be used to collect seed in cooperation with partners and to establish the permanent conservation seed bank. Remaining funds will be allocated annually to maintain the primary accessions. Additional seed will be collected in subsequent years and deposited into the seed bank. Funds for this purpose are not included under this activity.
6.1		Collect seed from all extant La Graciosa thistle occurrences when it is available and practicable to collect.			
6.2		Deposit seed accessions in a facility (or facilities) that are certified by the Center for Plant Conservation (CPC).			
6.3		Store and curate seed for perpetuity to serve as emergency back-up			
7	3	Conduct ex situ viability studies and bulk the seed from the seed bank accessions	USFWS	\$127,000	We assume that the ex situ seed viability studies and a year of bulking efforts will be funded during the first year of these activities and that subsequent bulking efforts will occur during each of the four following years.

Activity Number	Action Priority Number	Action Description	Agency/ Partners	Anticipated Total Cost of Activity	Comments
7.1		Once there is enough seed stored in the conservation seed bank, conduct research to evaluate and quantify the viability of La Graciosa thistle seed and efforts to bulk the seed will be pursued.			
8	2	Systematically re-establish several extirpated occurrences	USFWS, VAFB, ODSVRA, LC-SLO	\$1,000,985	These activities are unlikely to be initiated within the first five years of the recovery implementation schedule.
8.1		Facilitate outplanting projects at numerous sites that are likely to have cooperative recovery partners based on the current land ownership and land use practices and/or that would be conducive for these purposes			
8.1.1		Vandenberg Air Force Base			
8.1.2		Oso Flaco Lake within the ODSVRA			
8.1.3		Pismo State Beach, also managed the ODSVRA			
8.1.4		Black Lake Ecological Reserve is owned by the LC-SLO			
9	2	Pursue access to other properties throughout the historical range of the species	USFWS	\$20,000	These activities are unlikely to be initiated within the first five years of the recovery implementation schedule.
9.1		Pursue access to sites with the following CNDDB occurrences: No. 2, 3, 4, 8, 19, 20, 28, 30, 32, 33, and 34.			
9.2		Use spatial and analytical tools to identify other potentially suitable habitat throughout the historical range and pursue access to these sites to survey for the species and find additional sites that may be conducive for outplanting efforts.			
9.3		Continue to explore opportunities to develop new conservation partnerships for the species.			
10	2	Fulfill research needs	USFWS	\$890,000	These activities are unlikely to be initiated within the first five years of the recovery implementation schedule.

Activity Number	Action Priority Number	Action Description	Agency/ Partners	Anticipated Total Cost of Activity	Comments
10.1		Conduct research into best management practices and methods for the various life stages of the species			
10.2		Conduct research into species response to disturbance from grazing, thatch removal, and other vegetation management techniques			
10.3		Conduct demographic studies to determine what is needed for self-sustaining occurrences			
10.4		Conduct research into pollination ecology to determine what is needed for self-sustaining occurrecnes			
10.5		Conduct research into genetics to inform outplanting efforts			
10.6		Conduct habitat suitability modeling and analyses to inform outplanting efforts			
10.7		Conduct groundwater testing and mapping to inform restoration planning and inform outplanting efforts			
10.8		Conduct hydrologic modeling that can be used for evaluating variable climate change scenarios to inform restoration planning and inform outplanting efforts			

Priority 1 activities: \$935,000

Priority 2 activities: \$2,145,985

Priority 3 activities: \$127,000

Total Estimate: \$3,207,985

Literature Cited

- U.S. Fish and Wildlife Service. (USFWS) 2021. Recovery Plan for La Graciosa thistle (*Cirsium scariosum* var. *loncholepis* [*C. loncholepis*]). Ventura, California.
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