RECOVERY IMPLEMENTATION STRATEGY FOR PAGOSA SKYROCKET (Ipomposis Polyantha)



Photo by Ellen Mayo



U.S. Fish and Wildlife Service Upper Colorado Basin Region Denver, Colorado

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PAGOSA SKYROCKET RECOVERY IMPLEMENTATION STRATEGY

This Recovery Implementation Strategy (RIS) supplements the Final Recovery Plan for the Pagosa skyrocket (*Ipomopsis polyantha*) (Service 2022) and describes in greater detail how the site-specific, prioritized actions outlined in the recovery plan will be implemented, and estimates the time and costs to complete recovery under the Endangered Species Act (Act). The RIS may be revised at any time during the recovery process, whenever experience or additional information call for a change in tactics, therefore maximizing flexibility of recovery implementation. Recovery actions are broad measures that clearly describe what needs to be done to accomplish the recovery goal of long-term viability of the species. Recovery activities are the detailed, on-the-ground steps needed to implement the higher-level recovery activities in varying degrees, from providing supporting information or tools to leading organization and implementation of recovery activities. Recovery partners may vary by species population and throughout the life of an activity; we have not yet specified who may take lead of any given activity.

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List of Acronyms and Abbreviations:

Act	Endangered Species Act
CDOT	Colorado Department of Transportation
CNAP	Colorado Natural Areas Program
CNHP	Colorado Natural Heritage Program
DBG	Denver Botanic Gardens
UNC	University of Northern Colorado
USGS	U.S. Geological Survey
USFS	U.S. Forest Service
RIS	Recovery Implementation Strategy
Service	U.S. Fish and Wildlife Service

1. RECOVERY ACTIONS AND ACTIVITIES

In this section, we define each of the activities associated with the prioritized recovery actions from the Pagosa skyrocket final recovery plan. Priority 1 actions are defined as those actions that currently available information suggests, must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 actions are those that must be taken to prevent a significant decline in population size or habitat quality or some other significant negative impact. Priority 3 actions are all other actions necessary to provide for full recovery of the species. The assignment of priorities does not imply that some recovery actions are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented. Please refer to Table 1 for a clear association among recovery actions and the threats addressed by these actions.

PRIORITY 1 ACTIONS AND ACTIVITIES

- 1. Maintain or expand all known Pagosa skyrocket populations, and maintain a new population, either newly discovered or introduced (Criteria 1, 2, and 3).
 - 1.1 Conduct research and develop biologically-relevant avoidance buffers and surface disturbance caps to protect plants, populations, habitat function, and seedbanks. Work with partners to research and develop avoidance buffers and surface disturbance caps to avoid or minimize effects to individual plants, population-and species-level processes (population growth, reproduction, and gene flow), habitat loss, and habitat quality.
 - **1.1.1** Research species disturbance requirements and thresholds.
 - **1.1.2** Research critical life history and habitat components.
 - **1.1.3** Develop avoidance buffers and caps based on literature and other best available information.
 - **1.2 Develop or improve conservation measures, regulatory mechanisms, and protective measures to reduce habitat loss and fragmentation.** Work with partners to develop conservation measures, such as stipulations and designations, and incorporate them into land use planning or other agreement documents.
 - **1.2.1** Manage development to limit habitat loss and negative impacts to Pagosa skyrocket. Submit requests to land managers, as appropriate, requesting stipulations and designations for Pagosa skyrocket populations and habitat.
 - **1.2.2** Acquire conservation easement for habitat protection. Partner with landowners to designate one or more conservation easements that provides long-term protection to Pagosa skyrocket and its habitat from species stressors.

- **1.2.3** Engage in collaborative, proactive planning and conservation programs.
- **1.2.4** Design and implement landowner outreach and education programs.
- **1.3 Restore habitats or establish new habitats.** For populations that are disturbed or contain degraded habitat conditions, habitat restoration techniques should be implemented to restore habitat condition and function. Best management practices should be developed and implemented to control invasive plants and restore with native plant materials. New sites may be prioritized as pilot introduction sites to support resiliency or redundancy.
 - **1.3.1** Research reproductive biology and specific habitat requirements.
 - **1.3.2** Identify high priority areas for restoration. Coordinate with partners to identify priority areas and best practices for restoration efforts. Develop and implement rigorous monitoring and adaptive management to ensure restoration methods are effective.
 - **1.3.3** Identify high priority areas for new sites. Coordinate with partners to identify priority areas and best practices for pilot introduction efforts. Use available datasets and acquire new data to evaluate the similarity of pilot introduction sites to occupied habitat. Prioritize these areas for population augmentations and introductions, as necessary (Recovery Action 6).

2. Monitor all Pagosa skyrocket populations (Criteria 1 and 2).

- **2.1 Determine population abundance and population trends.** Coordinate with partners to identify and implement consistent range-wide monitoring methods to measure plant abundance and population trend. Use population modeling to develop projections of the future demographic status of populations.
 - **2.1.1** Identify existing methods and use best available science and technology to improve data collection and analysis.
 - **2.1.2** Develop and implement trainings to ensure that data collection is consistent across the range of the species.
 - **2.1.3** Use databases, such as the Colorado Natural Heritage Program database, to track populations and data collection efforts.
- **2.2 Monitor quantity and quality of available habitat.** Coordinate with partners to monitor the quantity and quality of habitat in populations and population areas.
 - **2.2.1** Identify existing methods and use best available science to monitor habitat metrics.

- **2.3 Evaluate stressors.** Develop and implement rigorous monitoring to ensure successful evaluation of species stressors and better understand impacts of stressors to the species.
 - **2.3.1** Prioritize suitable and occupied habitat with potential for commercial, residential, agricultural, and municipal development; associated road and utility improvements and maintenance; heavy livestock use; and invasive plants.
 - **2.3.2** Map invasive plant infestations and sensitive areas of Pagosa skyrocket habitat where no herbicide use or mowing should occur.
 - **2.3.3** Research climate variables at the appropriate scale. Conduct primary research on Pagosa skyrocket and pollinator responses to changing climate. Model potential habitat and range shifts in response to projected climate change and prepare adaptation plan to define *in-situ* and *ex-situ* conservation needs.
 - **2.3.4** Research genetic variability of the species to evaluate the influence of small population sizes and guide recovery efforts such as population augmentation, introductions, and *ex-situ* seed collection.

PRIORITY 2 ACTIONS AND ACTIVITIES

- 3. Develop *ex-situ* (off-site) collections of seeds and tissues to preserve Pagosa skyrocket's genetic diversity (representation) and provide the capability to augment existing populations or introduce new populations in the wild, if necessary (Criterion 4).
 - **3.1 Select and contract with organizations to collect and preserve seeds and tissues.** Select organizations who follow the latest Center for Plant Conservation guidance.
 - **3.2 Investigate seed viability, germination requirements, and tissue propagation.** Research storage requirements of an *ex-situ* collection. Research germination and propagation techniques.
 - **3.2.1** Select and contract with organizations who maintain high standards and follow best management practices for this work.
- 4. Survey for additional populations of Pagosa skyrocket (Criteria 1 and 2). Locate and conserve additional populations of Pagosa skyrocket, if any. This will contribute to a better understanding of the species and support progress toward recovery.
 - **4.1 Identify suitable habitat and perform surveys to inform land management, project planning, and recovery efforts.** Surveys should be performed to determine occupancy.

4.1.1 Develop a model of potentially suitable habitat using best available science to inform potential survey locations.

PRIORITY 3 ACTIONS AND ACTIVITIES

- 5. Maintain consistency and momentum of conservation efforts for Pagosa skyrocket across the occupied range by communicating and collaborating across jurisdictions and agencies with partners and stakeholders (Criteria 1, 2, 3, and 4).
 - **5.1 Conduct meetings at least twice per year.** Conduct virtual or in-person meetings to review RIS progress, monitoring data, and threats to incorporate any necessary updates. Updates to the RIS will be uploaded to the Service's Pagosa skyrocket Environmental Conservation Online System (ECOS), or equivalent, webpage.
 - **5.2 Complete and share annual status report with partners.** The report should include a summary of the meeting notes from recovery meetings and relevant status updates, such as surveys and monitoring.
- 6. If a third population is not discovered or established, or if there is a population decline or loss, develop and implement a range-wide strategy for population augmentation and/or introductions, if necessary (Criteria 1 and 2).
 - **6.1. Coordinate with partners.** Develop and implement rigorous study design, monitoring, and adaptive management to ensure efforts are effective.

Listing Factors under the Act	Threats Description	Recovery Criteria	Recovery Actions	
Factor A The present or threatened destruction, modification, or curtailment of its habitat or range	Commercial, residential, agricultural, and municipal development; associated road and utility improvements and maintenance; heavy livestock use; invasive plants	1, 2, 3, 4	All	
Factor D The inadequacy of regulatory mechanisms	Regulatory mechanisms and conservation measures that reduce habitat loss and degradation	3	All	
Factor E Other factors: Climate change	Warmer temperatures, less precipitation	1, 2	1, 2, 3, 6	

Table 1. Factors affecting the survival of Pagosa skyrocket (76 FR 45054, July 27, 2011; Service 2020) and associated recovery actions and criteria.

2. RECOVERY IMPLEMENTATION SCHEDULE

The Implementation Schedule outlines actions and estimated costs for the recovery of Pagosa skyrocket over the next 20 years (Table 2). Parties with authority, responsibility, or expressed interest in implementing a specific recovery action are identified in the table; however, this neither obligates nor implies a requirement for the identified party to implement the action(s) or secure funding for implementing the action(s). The Implementation Schedule will be updated as recovery actions are accomplished.

Action Priority	Action Number	Action Description	Recovery Criterion Number(s)	Potential Activity Partner(s)	Total Cost in \$1,000s	FY1	FY2	FY3	FY4	FY5	FY 6-10	FY 11-20
1	1	Maintain or expand all known Pagosa skyrocket populations, and maintain a new population, either newly discovered or introduced	1, 2, 3	Service, CNHP, CNAP, USFS, DBG, Town of Pagosa Springs, Archuleta County, private landowners, land trust, CDOT, Fort Lewis College	550	27.5	27.5	27.5	27.5	27.5	137.5	275
1	2	Monitor all Pagosa skyrocket populations	1, 2	Service, CNHP, CNAP, USFS, Town of Pagosa Springs, private landowners, USGS, DBG, UNC, Fort Lewis College	990	49.5	49.5	49.5	49.5	49.5	247.5	495
2	3	Develop <i>ex-situ</i> (off- site) collections of seeds and tissues to preserve Pagosa skyrocket's genetic diversity (representation) and provide the capability to augment existing populations or introduce new populations in the wild, if necessary	4	Service, DBG, CNAP, USFS, Fort Lewis College	50	2.5	2.5	2.5	2.5	2.5	12.5	25

Table 2. Recovery Implementation Schedule: estimated recovery cost by recovery action and fiscal year (in thousands of dollars).

Recovery Implementation Strategy for Pagosa Skyrocket

Action Priority	Action Number	Action Description	Recovery Criterion Number(s)	Potential Activity Partner(s)	Total Cost in \$1,000s	FY1	FY2	FY3	FY4	FY5	FY 6-10	FY 11-20
2	4	Survey for additional populations of Pagosa skyrocket	1, 2	Service, CNHP, CNAP, USFS, USGS	350	17.5	17.5	17.5	17.5	17.5	87.5	175
3	5	Maintain consistency and momentum of conservation efforts for Pagosa skyrocket across the occupied range by communicating and collaborating across jurisdictions and agencies with partners and stakeholders	1, 2, 3, 4	Service, CNHP, CNAP, USFS	75	3.75	3.75	3.75	3.75	3.75	18.75	37.5
3	6	If a third population is not discovered or established, or if there is a population decline or loss, develop and implement a range-wide strategy for population augmentation and/or introductions, if necessary	1, 2	Service, DBG, CNAP, USFS, Fort Lewis College	350	17.5	17.5	17.5	17.5	17.5	87.5	175
Totals					2,365	118.25	118.25	118.25	118.25	118.25	591.25	1,182.5

LITERATURE CITED

U.S. Fish and Wildlife Service. 2022. Final recovery plan for Pagosa Skyrocket (*Ipomopsis polyantha*). April 2022. U.S. Fish and Wildlife Service, Upper Colorado River Region, Denver, Colorado. 19 pages.