

U.S. Fish & Wildlife Service

**Post-Delisting Monitoring Plan For
Maguire Daisy (*Erigeron maguirei*)**



Photo taken by: Michelle Dela-cruz, National Park Service

U.S. Fish & Wildlife Service

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Anti-Deficiency Act Disclaimer

Post-delisting monitoring is a cooperative effort between the Service, State, and Tribal governments; other Federal agencies; and nongovernmental partners. Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of the Maguire Daisy (*Erigeron maguirei*) following removal of Endangered Species Act protections. To the extent feasible, the Service and our partners intend to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention to the Anti-Deficiency Act, 31, U.S.C. 1341, or any other law or regulation.

Table of Contents

I.	Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort	1
II.	Summary of Species Status at Time of Delisting	1
A.	Demographic Parameters	1
B.	Residual Threats.....	5
C.	Legal and/or Management Commitments for Post-Delisting Conservation.....	5
III.	Public Review and Comment.....	7
IV.	Monitoring Design	7
A.	Population Trend Monitoring	7
B.	Human Impact Monitoring	14
V.	Definition of Thresholds/Triggers for Potential Monitoring Outcomes and Conclusions.....	15
VI.	Estimated Funding Requirements and Sources.....	16
VII.	Post-delisting Monitoring Implementation Schedule	19
VIII.	Literature Cited.....	20
IX.	Signature Approval	23
Appendix A.	Responses to Public Comments	25
Appendix B.	Data Collection Forms.....	29
Appendix C.	Protocols Used to Establish Monitoring Plots.....	39

I. Summary of the Roles of all Cooperators in the Post-delisting Monitoring Planning Effort

The Maguire daisy (*Erigeron maguirei*) is included in the Central Utah Navajo Sandstone Endemics Conservation Agreement and Conservation Strategy (herein after referred to as the Conservation Agreement and Strategy), a multi-year interagency effort of the Forest Service, Bureau of Land Management (BLM), Capitol Reef National Park (Capitol Reef NP), and the U.S. Fish and Wildlife Service (Service) (USDA et al. 2006). The purpose of this agreement is to identify and meet the goals for long-term conservation of five rare endemic plants that occur on the Navajo Sandstone in central Utah, including Maguire daisy (USDA et al. 2006).

The Conservation Agreement and Strategy, which this document is modeled after, outlines the procedural provisions under which the federal agencies will be held accountable for future management of the Maguire daisy (USDA et al. 2006). In addition, the Conservation Agreement and Strategy documents the conservation actions needed to reduce or eliminate threats and to promote the conservation and perpetuation of the Maguire daisy (USDA et al. 2006). The specific actions required by each federal agency are described in further detail in **Section II. C. Legal and/or Management Commitments for Post-Delisting Conservation**.

II. Summary of Species Status at Time of Delisting

A. Demographic Parameters

The range of the species is estimated at 390 square miles (mi) (1,010 square kilometers (km)) and extends from the San Rafael Swell south through the Waterpocket Fold of Capitol Reef NP (Figure 1) (Heil 1987, Heil 1989, Kass 1990, Harper and Van Buren 1998, Clark 2001, Clark 2002, Clark et al. 2005, Clark et al. 2006). Maguire daisy has been located from 1,585 to 2,621 meters (m) (5,200 to 8,600 feet (ft)) in elevation (Clark et al. 2006). The highest plant densities occur on mesa tops between 1,829 and 2,134 m (6,000 and 7,000 ft) in elevation (Kass 1990, Service 1995, Clark 2001, Clark et al. 2006). Demographic monitoring studies suggest that the species is long lived, has a low mortality rate, and has the ability to replace individuals at a rate that compensates for mortality (Van Buren and Harper 2002). Overall, populations appear stable (Van Buren and Harper 2002).

Populations are defined as groups of occurrence records (sites) located in the same geographic vicinity. There are 9 known Maguire daisy populations (containing 120 sites) within 4 meta-populations (Clark et al. 2006). A meta-population is comprised of a number of individual populations linked by continuous suitable habitat. The general locations of known populations and

meta-populations are sparsely distributed across the species' range (Figure 1). Sites are defined as occurrence locations recorded by one or more researcher over time within an individual population. Every site is documented by at least one of the following: 1) a herbarium collection record, and/or, 2) field survey forms completed by researchers, and/or, 3) a record from the Utah Natural Heritage Program. Table 1 provides population size estimates, number of sites, and land ownership of each population.

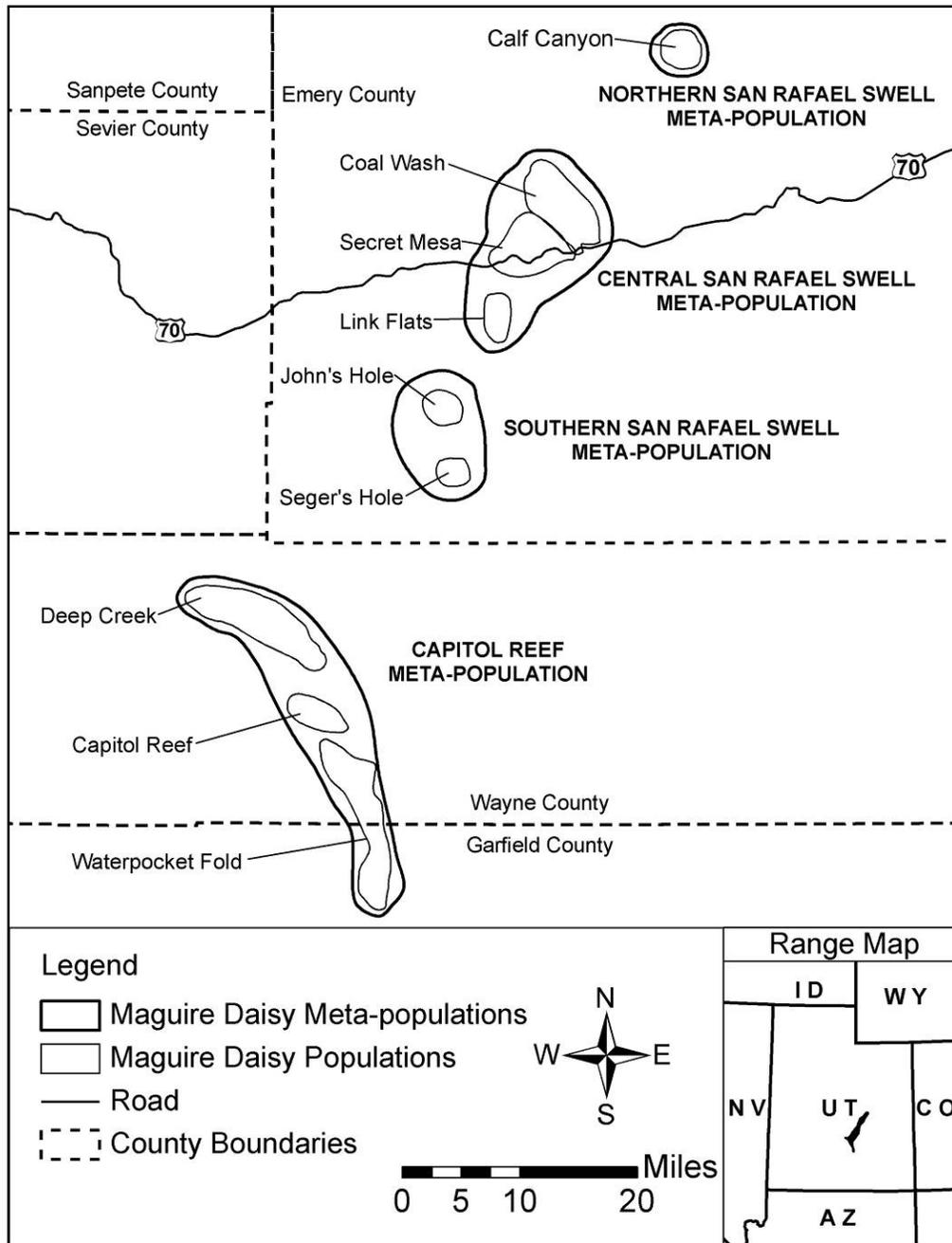


Figure 1. Maguire Daisy Range (Clark et al. 2006)

Table 1. Population estimates and land ownership (Clark et al. 2006, Ivory 2006, Ivory 2009).

Meta-Population	Population	Population Estimate	# of Sites	Land Ownership
Northern San Rafael Swell	Calf Canyon	3	3	BLM
		87	2	SITLA
Central San Rafael Swell	Coal Wash	100	6	BLM
	Secret Mesa	9,000	9	BLM
		1,000	2	SITLA
	Link Flats	200	4	BLM
50		1	SITLA	
Southern San Rafael Swell	John's Hole	300	3	BLM
	Seeger's Hole	100	2	BLM
Capitol Reef	Deep Creek	1,500	2	Fishlake National Forest
		100,000	29	Capitol Reef NP
	Capitol Reef	30,000	15	Capitol Reef NP
	Waterpocket Fold	20,000	42	Capitol Reef NP
Total		162,340	120	

Below is a description of each of the populations. This list was compiled by consulting existing databases, photo libraries, staff experts, and previous survey or inventory reports. This information provides baseline population numbers, approximate distribution and density of the population, habitat attributes, and other data that was used to locate monitoring plots:

1. The Calf Canyon population is the northern and eastern-most known population and contains the type locality. It is located on BLM and SITLA lands. The Calf Canyon population was first visited in 1932 by Cottam and then again in 1940 by Maguire (Clark et al. 2006). The original habitat description for the species came from the Calf Canyon population and included dry rocky sandy canyon bottoms (Cronquist 1947). When Harris relocated the population in 1980, only one individual was found (Harris 1980). The Calf Canyon population was next surveyed in 1982 by Anderson (Anderson 1982). Anderson located 7 individuals within Calf and Pine Canyons (Anderson 1982). At the time, Anderson searched the canyon bottoms and hypothesized that the species was negatively impacted by motorcycles and cows (Anderson 1982). However, since 1982, we have learned that populations within canyon bottoms are established from seeds dispersed by wind or overland flow from source populations on the mesa tops (Heil 1989; Kass 1990; Service 1995). These canyon populations are generally small compared with those on the mesa tops (Heil 1989; Kass 1990; Service 1995). In 2007 and 2008, two separate field investigations surveyed the area, including the 3 original sites, for individual plants without success (Clark 2008; Ivory 2008). More recent surveys in the area located a total of 3 plants in the wash bottom of Pine and Buckhorn canyons (Ivory 2009). The 2009 survey also located 87 plants on SITLA lands on a mesa top in the vicinity of the canyon bottom populations. A monitoring plot will be established on the mesa top site in 2010. Additional

presence/absence surveys are planned to determine the extent of the population in suitable habitat on mesa tops.

2. The Coal Wash population is located on BLM lands. The population occurs between 5,980 and 7,220 feet in elevation and contained about 100 plants from six sites in 1990 (Kass 1990). Ron Kass' site at Devil's Racetrack is the only site known in this population to contain more than 50 plants. This site is located at approximately 7,000 feet in elevation. The site has been monitored since 2006. The other five sites reported contained less than 25 plants at the time of the last visit.
3. The Secret Mesa population is located on BLM and SITLA lands. Van Buren and Harper (2002) had two demographic monitoring plots located in this population. The population occurs between 6,560 and 7,100 feet in elevation, and contained approximately 10,000 plants from 11 sites. The Arch Cove, Justensen Flats/Devil's Canyon, and South Fork Coal Wash sites each contained over 100 plants (Kass1990). A census monitoring plot was established at the Justensen Flats/Devil's Canyon site in 2006.
4. The Link Flats population is located on BLM and SITLA lands. The population occurs between 6,000 and 7,000 feet in elevation and contained about 250 plants from five sites in 1990 (Kass 1990). Ron Kass' Link Flats South site was selected for monitoring in 2006.
5. The John's Hole population is located on BLM lands. It was found in May 2001 by the Interagency Rare Plant Team. The population occurs between 6,238 and 6,275 feet in elevation, and contained about 300 plants from three sites. The John's Gateway site contained more than 50 plants and was selected for monitoring in 2007. The other two sites contained less than 50 plants.
6. The Seger's Hole population is located on BLM lands. It was found in May 2002 by the Interagency Rare Plant Team. The population occurs between 6,400 and 6,497 feet in elevation, and contained approximately 100 plants from 2 sites. The Below Seger's Overlook site contained more than 50 plants but is considered unsafe for monitoring. The other site contained less than 50 plants. If a safe site with more than 50 plants can be located, population trend with census monitoring will be initiated and a monitoring plot will be established.
7. The Deep Creek population is located on Capitol Reef NP and Fishlake National Forest lands. The population occurs between 5,875 and 8,600 feet in elevation, and contains approximately 101,500 plants from 31 sites. The following sites located by the Interagency Rare Plant Team contained over 100 plants: Lunch, Garden of Gilia, Above Paradise Flats, Between Dome, Voices Dome, Straight Flush, Rodney's Find, Nava Toes, Black Widow Pour Off, Hilltop Parsley, Little Sand Flat East and Above Little Sand Flat East. All sites are difficult to access. The Lunch site was selected for a census monitoring plot in 2006.

8. The Capitol Reef population is located in Capitol Reef NP. Van Buren and Harper (2002) had two demographic monitoring sites located in this population. The population occurs between 5,200 and 6,560 feet in elevation, and contained approximately 30,000 plants from 15 sites. Four sites located by the Interagency Rare Plant Team contained more than 50 plants; Navajo Knobs #1, Navajo Knobs #2, Longleaf Flats and 24 Karat Pass. Two other sites visited by multiple researchers contained over 50 plants; Grand Wash and Hickman Bridge. The Longleaf Flats site was selected for census monitoring in 2006.
9. The Waterpocket Fold population is located in Capitol Reef NP. The population occurs between 5,280 and 6,852 feet in elevation, and contained approximately 20,000 plants from 42 sites. The following Interagency Rare Plant Team sites contained over 50 plants: Fern's Route, Dance Floor, Blue Notch Overlook, Little Arches, Burroito Wash, Pool View, Bench Above Pools, Navajo Heaven, Five Mile Dome, Ponderosa Basin, Moose Marbles, North Oak Creek #1, and North Oak Creek #2. The Burroito Wash site was selected for census monitoring in 2006.

B. Residual Threats

Over ninety-nine percent of the species' populations occur on lands administered by Federal agencies. These populations have land designations (Wilderness Study Areas, Areas of Critical Environmental Concern, Instant Study Areas, Primitive and Threshold Management Zones, and Proposed Botanical Areas) that provide long-term protections for the plant. While potential future threats identified by the Interagency Rare Plant Team are present within the range of the species, our review during the de-listing process found that these threats are considered unlikely to materialize in a meaningful way in the foreseeable future, would be limited to individual plants, and would not reduce the long-term viability of any of the populations (USDA et al. 2006). All noteworthy foreseeable factors affecting the species status, including those previously not identified such as global climate change, are discussed in the final rule to remove the Maguire daisy from the Federal List of Endangered and Threatened Plants. To ensure impacts remain minor, Federal agencies will monitor a subset of the populations (as described in this plan) for a minimum of ten years. If threats increase, adaptive management strategies are in place to provide long-term protection for the species.

C. Legal and/or Management Commitments for Post-Delisting Conservation

The Conservation Agreement and Strategy outlines the procedural provisions under which the federal agencies will be held accountable for future management

of the Maguire daisy (USDA et al. 2006). In addition, the Conservation Agreement and Strategy documents conservation actions needed to reduce or eliminate threats and to promote the conservation and perpetuation of the Maguire daisy (USDA et al. 2006). The specific actions required by each federal agency are described in further detail below.

- All federal signatory agencies will develop and implement a survey plan for suitable habitats that have not yet been surveyed within the area covered by the Conservation Agreement and Strategy (USDA et al. 2006).
- The Price Field Office of the BLM (Price BLM), Capitol Reef NP and the Fishlake National Forest will establish and conduct population trend monitoring studies from fiscal year 2010 through fiscal year 2020 (USDA et al. 2006). If monitoring detects a decline of 40% or more in a two year period at any of the monitoring plots, then monitoring would shift to either a more intensive protocol for determining trend, or include additional monitoring plots of population trend monitoring for a minimum of three years to determine if the initial decline noted is accurate (USDA et al. 2006).
- The Price BLM, Capitol Reef NP and Fishlake National Forest will continue to implement management plans to conserve Maguire daisy and their habitats and to ensure that actions authorized, funded, or carried out by the agencies would not contribute to the listing of a species (USDA et al. 2006).
- The BLM and Fishlake National Forest will adjust surface disturbance locations to avoid the Navajo endemics, including Maguire daisy, for Discretionary and Leasable Minerals (USDA et al. 2006).
- The BLM and Fishlake National Forest will not identify lands containing Navajo endemics, including Maguire daisy, for disposal or exchange (USDA et al. 2006). If it becomes important for the long-term persistence of the species, all federal agencies will work towards acquiring private and state lands that contain Navajo endemics, including Maguire daisy (USDA et al. 2006).
- The federal agencies will work together to protect Maguire daisy from commercial exploitation and illegal collection (USDA et al. 2006). If illegal collection is identified as a recurring threat, the Price BLM and Capitol Reef NP may implement surveillance at potential collection sites for Maguire daisy (USDA et al. 2006).
- The Flagstaff Arboretum conducts collection and storage of Maguire daisy seeds (USDA et al. 2006). If deemed important for the long term perseverance of the species, Capitol Reef NP, Fishlake National Forest, and the BLM would pursue funding to establish a Center for Plant Conservation endowment for Maguire daisy (USDA et al. 2006). The endowment may include establishment of germination and propagation trials for the purpose of maintaining genetic conservation and research into techniques necessary for establishing additional occurrences in suitable habitat (USDA et al. 2006).

- The Service, Capitol Reef NP, Price BLM, and Fishlake National Forest will develop new partnerships and continue their educational programs to increase public awareness of Maguire daisy (USDA et al. 2006).

III. Public Review and Comment

On May 16, 2008, we announced the availability of the draft Post-Delisting Monitoring Plan for public review and comment. After the comment period closed on July 15, 2008, we reviewed each comment received and prepared responses to substantive comments (see Appendix A).

IV. Monitoring Design

This section outlines the monitoring design for Maguire daisy on Capitol Reef NP, Price BLM, and Fishlake National Forest. The monitoring protocols are based on the draft Northern Colorado Plateau Inventory and Monitoring Protocols (Fertig et al. 2005). There are two methods that will be used to monitor Maguire daisy populations post delisting: population trend monitoring and human impact monitoring.

A. Population Trend Monitoring

This section outlines a consistent procedure for conducting population trend monitoring using census methodologies (Fertig et al. 2005). These methods are used by the network of Natural Heritage Programs (under the umbrella of NatureServe, formerly a subsidiary of The Nature Conservancy) and the Interagency Rare Plant Team, and are based on the draft Northern Colorado Plateau Inventory and Monitoring Protocols (Fertig et al. 2005).

Plot selection

Seven monitoring plots were selected within each population and will be monitored annually for ten years. One additional monitoring plot will be established in 2010 at the Calf Canyon population. A ninth monitoring plot will be established at the Seger's Hole population if a suitable plot location is found. A monitoring plot contains a subset of individuals within a site (see section II.A. Demographic Parameters for a description of "site").

Appendix C outlines the detailed protocols we used to establish the initial monitoring plots. The initial monitoring plots contain a minimum of 50 plants. Five of the populations (Johns Hole, Seger's Hole, Link Flats, Calf Canyon and Coal Wash) contain only one or two known sites with more than 50 plants. The following is a discussion of each population and the sites known to contain more than 50 plants (Figure 2). This list was used to select the initial monitoring

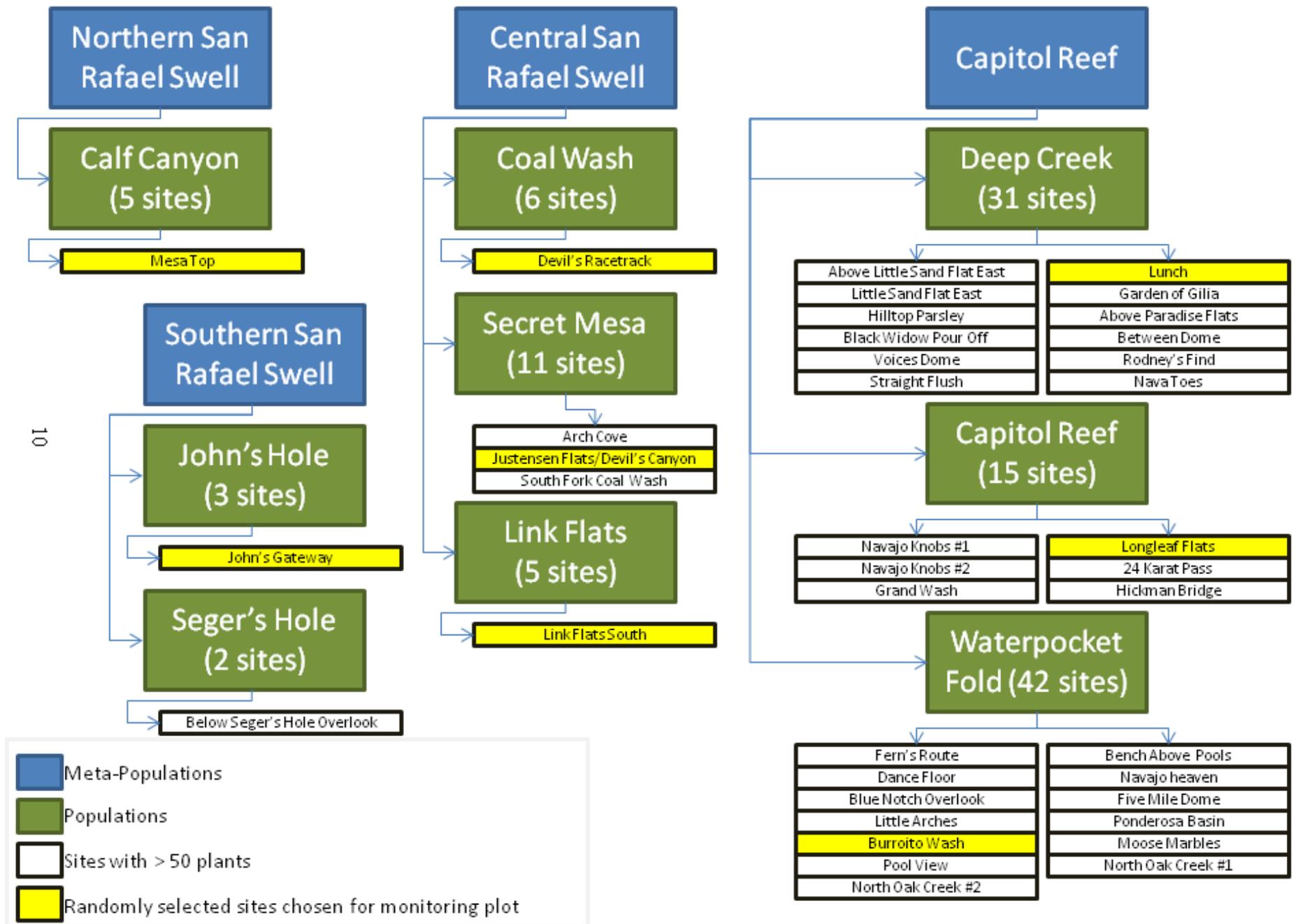
locations within each population. For populations with more than one suitable site with 50 plants available, site selection was random within that population.

1. Calf Canyon population: The mesa top site located in 2009 contained more than 50 plants. A monitoring plot will be established in 2010.
2. Coal Wash population: Devil's Racetrack is the only site known in this population to contain more than 50 plants and is located at approximately 7,000 feet elevation.
3. Secret Mesa population: The Arch Cove site contains over 100 plants. The Justensen Flats/Devil's Canyon site contains over 100 plants, and his South Fork Coal Wash site contains 100-1000 plants. The Justensen Flats/Devil's Canyon site was randomly selected for the establishment of a census monitoring plot.
4. Link Flats population: R. Kass' Link Flats South, Sagebrush Bench and Lucky Strike Mine sites are the only sites with approximately 50 plants reported. The Link Flats South site was chosen for the establishment of a census monitoring plot.
5. John's Hole population: Only the Interagency Rare Plant Teams' John's Gateway site contained more than 50 plants and was therefore selected for the establishment of a census monitoring plot.
6. Seger's Hole population: The Interagency Rare Plant Teams' Below Seger's Overlook site contained more than 50 plants. Monitoring this site is considered dangerous due to the difficulty of the terrain. If additional presence/absence surveys identify a suitable site for population trend monitoring, we will establish a monitoring plot within this population.
7. Deep Creek population: The following sites located by the Interagency Rare Plant Team contained over 100 plants: Lunch, Garden of Gilia, Above Paradise Flats, Between Dome, Voices Dome, Straight Flush, Rodney's Find, Nava Toes, Black widow Pour Off, Hilltop Parsley, Little Sand Flat East and Above Little Sand Flat East. The Lunch site was chosen randomly for the establishment of a census monitoring plot.
8. Capitol Reef population: Four of the Interagency Rare Plant Teams sites contained more than 50 plants; Navajo Knobs #1, Navajo Knobs #2, Longleaf Flats and 24 Karat Pass. Two other sites visited by multiple researchers contained over 50 plants; Grand Wash and Hickman Bridge. The Longleaf Flats site was chosen randomly for the establishment of a census monitoring plot.

9. Waterpocket Fold population: The following Interagency Rare Plant Team sites contained over 50 plants: Fern's Route, Dance Floor, Blue Notch Overlook, Little Arches, Burroito Wash, Pool View, Bench Above Pools, Navajo Heaven, Five Mile Dome, Ponderosa Basin, Moose Marbles, North Oak Creek #1, and North Oak Creek #2. The Burroito Wash site was chosen randomly for the establishment of a census monitoring plot.

If data analysis (see Data Analysis section below) shows a 40% or greater decline, additional monitoring plots will be established within the population. These plots will be randomly selected from the entire list of known sites. If there are not enough suitable sites with 50 plants available, the monitoring plots may be established in sites that contain fewer than 50 plants. See the Data Analysis section below.

Figure 2. Sites selected for monitoring plots containing more than 50 plants.



Methodology

Close-up photographs of plants in each of the four life history stage classes will be provided to the field staff prior to field monitoring. Life history stage classes are:

Seedling- Juvenile – First year plant with no branching stems; basal rosette of leaves without a woody base

Vegetative Mature –Individual without buds, flowers, or fruits; plant has a woody taproot, but may be only a basal rosette or it may have multiple stems

Reproductive Mature –Individual with buds, flowers, or fruits

Dead Plants – non-living individual in any life history stage class

When the monitoring plots were established, surveyors completed a Site Visit Account (SVA) Form and Monitoring Plot Photo Documentation (MPPD) Form (Appendices B and C). For each successive year of monitoring, the field staff will take completed SVA and MPPD forms into the field for reference.

Once surveyors arrive at a monitoring plot, the surveyors will walk transect lines through the monitoring plot to collect population trend monitoring data. Teams will walk parallel lines spaced approximately one meter apart. Pin flagging should be placed along parallel transect lines as surveyors walk the polygon. Surveyors will use this line of pin flags to orient and follow a parallel transect back in the opposite direction to ensure all habitat is systematically surveyed. Flags will be picked up after a “round trip” of transects and replaced for the next parallel transect. Using grids, belts or flagging helps ensure that field surveyors do not miss plants or do not count the same ones twice. Natural barriers can also be used to designate subunits for recording plants.

Information will be collected and recorded on the Population Trend Monitoring Form (PTM Form) and the PTM Human Disturbance Form (Appendix B).

1. Target Species: Surveyors will identify the target species (Maguire daisy) and note whether or not the species is still within the monitoring plot.
2. Site Data: Surveyors will record monitoring plot attributes on the PTM Form, such as date surveyed, the total time spent surveying and the number of people on the team.
3. Population Size: Surveyors will record number of individuals by life history stage class with electronic tally counters that allow each class to be recorded separately. Simultaneously, surveyors will use a Global Positioning System (GPS) for recording individual plant locations. This dual recording system will be repeated every year. On the PTM Form, enter the actual number of plants counted by life history stage class and total number of plants in the monitoring plot. Care must be

taken to ensure that dead and smaller plants (especially seedlings) are not under-counted. In addition, surveyors need to be sure that individual plants can be distinguished, especially in situations where plants are clustered. To determine the number of plants within a cluster, feel between stems and determine which stems are connected. Plants will be considered individuals if they do not have obvious connecting roots or stems and measure at least 10 centimeters apart. If necessary, accuracy of census counts can be increased by subdividing the site into smaller grids or belts.

4. Other Data: Plant vigor, herbivory and human impacts noted, among other qualitative data regarding the monitoring plot, will be recorded on the PTM Form. Should human impacts be noted, Human Impact Monitoring (section IV.B.) will be initiated.
5. The PTM Human Disturbance Form keeps track of disturbances and threats observed, conservation actions in the area, as well as provides the surveyor an opportunity to assess whether the site is vulnerable to human impacts.

After surveys have been completed, GPS files from the field will be downloaded into a GIS database or geodatabase. A map from the downloaded GPS waypoints points overlain onto a 1:24,000 scale topographic map to depict site size, location, and areas of highest individual plant occurrences will be generated and attached to the field forms. Accurate acreage of monitoring plots will be determined and recorded on the field forms. These maps will help surveyors relocate monitoring plots in subsequent years as well as will help illustrate the monitoring plot boundary.

Due to the difficulty in accessing many of these sites, it will take approximately 2 to 2 ½ weeks to complete population trend with census monitoring and determine what sites have human impacts at each of the seven to nine monitoring plots. Currently seven monitoring plots are already established, one monitoring plot per population with the exception of the Seger's Hole population where a suitable site has not been found. The Calf Canyon monitoring site will be established in 2010. This time estimate does not include time required to conduct Human Impact Monitoring (see section **IV. B.**) at the any of the selected sites. Monitoring will be conducted in June when plants are in full bloom. Monitoring plots located at lower elevations will be monitored first to ensure that the majority of plants are in full bloom at time of monitoring.

Data analysis

The data collected will be analyzed annually to determine trends. Each year, the Population Trend Monitoring data collected on the PTM Form will be entered into an existing database stored at Capitol Reef National Park.

1. For each monitoring plot, the total number of individuals in each life stage class will be recorded. Calculate density and percentage by life history stage class for the entire monitoring plot.

After collecting annual data (from the second year onward), determine the total number of mature live individuals for each monitoring plot. If the number of mature live individuals present within a monitoring plot is reduced by more than 40% within a two year period, two randomly selected additional plots within the affected population will be added to the monitoring scheme (following protocol in Appendix C). Maguire daisy is a relatively long-lived species and populations are fairly stable (Van Buren and Harper 2002). Mortality rates fluctuated between 7% and 13% over an average of three years at four sites, with the highest annual mortality at one site being over 20% (Van Buren and Harper 2002).

The two new monitoring plots will be monitored for at least two years to determine if the decline is site specific or if there are other factors that could be influencing the entire population. If additional monitoring shows the decline within that population is continuing, then more intensive investigations such as demographic monitoring and research to determine cause of decline would be initiated.

2. After five years of data are available, plot the number of plants in each life history stage class by monitoring plot and population to create a graph depicting population change. Review the graph for large fluctuations in estimated population size, especially for significant decreases in total numbers or in the numbers of individual life history stage classes. If levels of change appear and raise concerns, consider developing more specific monitoring questions and applying more rigorous monitoring methods, such as demographic monitoring.
3. If population trends appear stable or increasing over the initial 10 year monitoring period, monitoring methods may be continued but monitoring frequency may be reduced. After ten years of monitoring following protocols stated in this report, all available data on this species will be reviewed to determine whether there are any data gaps that need to be addressed. If significant data gaps are found, the interagency rare plant team will recommend to management whether demographic monitoring or additional population trend monitoring would be valuable.
 - i. If deemed necessary, new demographic monitoring plots would be established or Van Buren's plots would be reestablished (see section **II.A. Demographic Parameters** for Van Buren's plot locations).
 - ii. If additional trend monitoring is warranted to address potential impacts from climate change, monitoring frequency may be

adjusted to census only 20% of the sites annually, rotating on a 5 year cycle.

B. Human Impact Monitoring

No direct human impacts have been documented on Maguire daisy populations in the past. However, there is always the possibility that as the human population continues to increase, there will be increased pressure on our wildlands.

Therefore, during annual population trend monitoring, we will also pay attention to whether or not human related disturbances are occurring.

This section describes monitoring methods for measuring human impacts to occupied rare plant habitat. Early detection of changes in habitat quality can be critical for implementing appropriate management changes in a timely fashion. Habitat management through manipulation of land uses may be the best tool managers have at their disposal to promote the survival or recovery of rare plant species.

Methodology

If surveyors note human impacts within 50ft of a monitoring plot during Population Trend Monitoring (PTM Form), then Human Impact Monitoring will be conducted. Human Impact Monitoring will include establishing permanent photo points that will be monitored annually.

Human Impact Monitoring, once determined necessary, will probably take one day per site (including travel time to site). If combined with the Population Trend Monitoring efforts, the final estimate of time for all monitoring will be approximately three weeks for two people per year.

Data collected will include a subjective assessment of the level of impact to the populations from human induced causes (e.g. garbage, camping, off highway vehicles (OHV), cattle, footprints) (Appendix B). Photo point methods will be used to evaluate the level of impact to the populations from human induced causes (e.g. garbage, camping, OHVs, cattle, footprints).

Permanent photo points provide a visual record of environmental conditions (e.g., amount of vegetative cover, bare soil, degree of herbivory, proliferation of roads) that can depict gross changes when repeated at the same location over many years. Photo points are useful for documenting the location of permanent transects and monitoring plots (Elzinga et al. 1998).

Information will be collected and recorded on the Human Impact Photo Point Monitoring (HIPPM) Form (Appendix B).

1. If human caused disturbances are observed within 50ft of a monitoring plot, take a GPS point from where you take the photos depicting human impacts. Record the orientation of the photo (e.g., degrees from North).
2. Use a standard height from which photos would be taken at each return visit. A tripod (if used) will ensure a standard height and reduce blurriness resulting from an unsteady photographer (especially critical in low-light situations).
3. Use a photo board to document the location and subject of the photo (Appendix B).
4. Take multiple frames of the same view using different exposures to ensure at least one will come out.
5. For landscape shots, include enough horizon and distinguishing features to ensure the disturbed site can be relocated.
6. Take photos from previous years' inventory to compare changes in habitat. Make note of any changes on field form.
7. Make note of the nature and extent of the human impact observed. For example, if there is an OHV track running through the monitoring plot, use a GPS unit to mark its location and the extent of the track through the monitoring plot. Note on forms whether the track is recent or old, well used or a onetime pass over the landscape. If an old campsite or trash piles are found within the monitoring plot, GPS a point marking their location, and note extent of these disturbances on the forms. If there are human footpaths or cattle trails, GPS their location and record the extent and time frame (recent or old) of these disturbances on forms. Record and GPS any other unnatural disturbances found at the monitoring plot.

Data Assessment

We will monitor the level and extent of human impacts to the sites. The photos will be reviewed and assessed to determine if adverse effects to Maguire daisy plants and habitat are occurring. The data will be used to determine if potential declines noted at the population trend monitoring sites can be linked with human activity.

V. Definition of Thresholds/Triggers for Potential Monitoring Outcomes and Conclusions

Annual reports summarizing the activities, data collected, and results of each component of the PDM plan should be submitted by the cooperators to the Utah Field Office of the Service by the 1st of December each year. These reports must be prepared and reviewed

in a timely manner to ensure that adequate data are being collected, to allow evaluation of the efficacy of the monitoring programs and their modification, if necessary, and to allow periodic assessment of the status of the Maguire daisy. Each annual report will synthesize all monitoring data including population trend and comment on the status of the Maguire daisy. The annual reports will be reviewed and discussed during annual meetings with interested stakeholders.

A monitoring program and its methodologies are described in the section **IV**.

Monitoring Design. Sites are to be monitored for population trend, census, and human impacts on a yearly basis. Land managers agree that a decrease in the number of plants at any monitored site by 40 percent within a 2 year period will result in the cooperators reviewing all available monitoring data, evaluating possible causes of the apparent decline, and determining the most appropriate response.

After five years of data are available, we will review the field collection data and determine overall population change. If large fluctuations in estimated population size, especially for significant decreases in total numbers or in the numbers of individual life history stage classes are detected, the multi-agency team will consider developing more specific monitoring questions and applying more rigorous monitoring methods, such as demographic monitoring. If population trends appear stable or are increasing over a period of ten years, the multi-agency team will consider continuing population trend with census monitoring but the frequency of monitoring will be adjusted and sites will be monitored on a rotating basis with 2 sites visited every year. Therefore all sites will be visited at least once every 5 years.

If monitoring data indicate that the range of the Maguire daisy is declining due to land management decisions, then actions should be taken to ensure that continued habitat loss does not threaten the Maguire daisy with extinction. Such actions include, but are not limited to, removing or reducing cattle grazing, relocating trails, installing fencing, reducing or eliminating off-highway vehicle use in the area, etc.

The Maguire daisy population could decline for a number of reasons other than loss of habitat and it will be important to consider the effects of potentially confounding factors, such as drought and global climate change as well as pollinator populations. Any areas identified as having a population decline will be targeted for more intensive investigation of Maguire daisy demography to determine the cause of decline. If a significant decline in abundance or survival persists for 2 consecutive years, then relisting the Maguire daisy may be considered, even if the cause of decline has not been determined.

VI. Estimated Funding Requirements and Sources

An Interagency Rare Plant Agreement established in 1999 between BLM, Capitol Reef NP, Dixie National Forest and Fishlake National Forest enabled the agencies to create an Interagency Rare Plant Team. This team works throughout the range of target species regardless of agency boundaries conducting surveys for the Maguire daisy and other rare

plant species. Having an interagency team available to accomplish actions listed below is far more cost effective than having each agency hire or contract with individual botanists to complete required tasks. Therefore, costs by action (Table 2) are based on having an Interagency Rare Plant Team accomplish many of these actions. If an Interagency Rare Plant Team is not available, or utilized, to accomplish the actions listed below, cost per agency could be much greater.

Funding of post-delisting monitoring presents a challenge for all partners committed to ensuring the continued viability of the Maguire daisy following removal of protections afforded to the species under the Endangered Species Act. To the extent feasible, all partners intend to provide funding for post-delisting monitoring efforts through the annual appropriations process. Nonetheless, nothing in this PDM Plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Actions will be completed as funds become available. These actions have not been prioritized since priorities will undoubtedly change over the ten year planning period.

Table 2. Estimated Costs for Monitoring Activities. Total by agency for the first 10 years of monitoring.

Conservation Action	BLM Price	NPS Capitol Reef NP	Fishlake National Forest	FWS
Inventory Remaining Suitable Habitat	\$8,600			
Conduct Population Trend Monitoring Studies	\$23,650	\$23,650	\$13,975	
Conduct Impact Monitoring Studies	\$13,975			
Coordination with Center for Plant Conservation ¹	\$4,300	\$15,050	\$2,150	
Develop Public Awareness brochures and programs ²	\$1,075	\$1,075	\$1,075	\$1,075
Estimated Database Maintenance and Report Writing	\$10,320	\$23,650	\$9,245	\$4,300
TOTAL BY AGENCY	\$61,920	\$63,425	\$26,445	\$5,375
TOTAL FOR PDM				\$157,165

¹ Agencies would pursue funding to establish a Center for Plant Conservation (CPC) endowment for Maguire daisy. Maguire daisy is currently covered by the Flagstaff Arboretum for seed collection and storage only; however, it is not covered by a CPC endowment at this time. The endowment includes seed collection, creation of seed storage banks, and establishment of germination and propagation trials for the purpose of maintaining genetic conservation. This also may include research into techniques necessary for establishing additional occurrences in suitable habitat.

² The agencies would develop new partnerships with non-governmental organizations, such as native plant societies, botanical gardens, and academic institutions, etc. and continue their educational programs to increase public awareness of these and other rare plant species.

VII. Post-delisting Monitoring Implementation Schedule

Actions will be completed as funds become available and may not be completed in the years presented (Table 3).

Table 3. Monitoring Implementation Timeline.

Conservation Action	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Inventory Remaining Suitable Habitat											
Conduct Population Trend Monitoring Studies											
Establish & Conduct Impact Monitoring Studies (includes monitoring protocol development)											
Coordination with Center for Plant Conservation											
Develop Public Awareness brochures and programs											
Database Maintenance and Report Writing											

VIII. Literature Cited

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IX. Signature Approval

In Witness Whereof, the parties have caused this Post Delisting Monitoring Plan to be executed as of the date of last signature below:

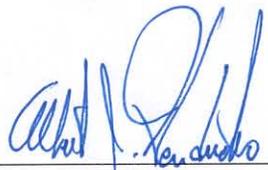
APPROVED:



Allen Rowley, Forest Supervisor
USDA, Fishlake National Forest
Richfield, Utah

2/23/2010

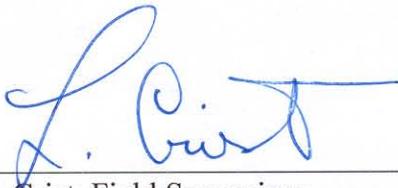
Date



Albert J. Hendricks, Superintendent
USDOI, Capitol Reef National Park
Torrey, Utah

2/24/2010

Date



Larry Crist, Field Supervisor
USDOI, Utah Field Office, Fish and Wildlife Service
West Valley City, Utah

2/22/10

Date



Selma Sierra, Utah State Director
USDOI, State Office, Bureau of Land Management
Salt Lake City, Utah

2-18-10

Date

Appendix A. Responses to Public Comments

on the

**Post-Delisting Monitoring Plan For
Maguire Daisy (*Erigeron maguirei*)**

February 2010

Introduction

On May 16, 2008, the U.S. Fish and Wildlife Service (Service) announced the availability of our draft Post-Delisting Monitoring Plan for public review and comment. The comment period closed on July 15, 2007. The plan is intended to fulfill the Service's responsibility under the Endangered Species Act of 1973, as amended, to monitor the status of *Erigeron maguirei* for five years after its removal from the Federal List of Threatened and Endangered Wildlife and Plants. We announced our proposal to delist *Erigeron maguirei* on May 16, 2008.

After the comment period closed, we reviewed each comment received and prepared comments in response to any substantive comments. Those comments and the Service's responses are summarized below.

Comment: One comment was to include in the post-delisting monitoring plan a specific due date for the data call, such as December 1 of each year as well as a request for the Service to provide a brief and concise follow-up review back to the agencies (National Park Service, Bureau of Land Management, and the U.S. Forest Service).

Response: We have incorporated the recommendations into the post-delisting monitoring plan.

Comment: Two comments were received stating the monitoring methodologies we are proposing in this PDM are currently being carried out. Both commenters believed the monitoring methodologies were sufficient and the methodologies were easily implemented in the field.

Response: We concur with the reviewers. The Interagency Rare Plant Team has spent a lot of time and effort developing a meaningful monitoring plan that is robust enough to adjust for negative changes to the population. The information gained from the monitoring effort should allow for enough time for land management agencies to adjust management prescriptions to counteract any negative impacts to the species thereby precluding the need to relist the species.

Comment: The post-delisting monitoring plan for the Maguire daisy makes alarming remarks about the status of several of the remote populations on pages 13 and 14. These small remote sites have not been properly evaluated as they will be likely the most seriously impacted by delisting.

Response: The draft PDM plan on pages 13 and 14 contained information regarding a number of monitoring sites within populations. We believe that the draft PDM plan may have been confusing with regard to the definitions and use of the words population, site, and element occurrence. We have now provided clear

definitions of these terms and have thoroughly reviewed the document to ensure we used the terms properly and consistently throughout. While sites may contain less than 50 plants, many sites might be contained within one population. Sites are identified for long-term monitoring use only and do not contain all individuals within a population.

Comment: The Calf Canyon population of some 50 plants was last visited apparently in 1982 and there is indication that it is unknown whether it still exists. The Link Flats population contains only two sites with more than 50 plants and three sites with less than ten.

Response: The Calf Canyon population, the type location for this species, was documented within the canyon bottoms. Over the last couple of decades, through recovery efforts, we have a better understanding of the species habitat characteristics and requirements. Those individuals that were originally found within Calf Canyon now appear to be overland dispersers of much larger populations that occur on mesa tops. The Calf Canyon population was surveyed in 2008 and again, during three separate field investigations in 2009. The total known population within Calf Canyon is 90 plants from 5 sites (Ivory 2009). One site on a mesa top contained more than 50 plants. The BLM will establish a monitoring plot within Calf Canyon in 2010.

The Link Flats population contains at least 250 individuals from 5 sites. We have a monitoring site, Link Flats South, within this population. The PDM plan has contingencies in place that should monitoring identify a reduction in individuals within a monitoring site, additional monitoring and human impact investigations will occur to determine the actual population trend.

Comment: The members of the Interagency Rare Plant Team provided new information, management guidance recommendations, and editorial changes to the PDM.

Response: As appropriate, we have incorporated the recommendations into the post-delisting monitoring plan.

Appendix B. Data Collection Forms

Site Visit Account (SVA) Form

SITE VISIT ACCOUNT (SVA) FORM DB# _____ entered into database on _____ by _____

Verified DB on _____ by _____

New Site? yes no
 Revisit? yes no
 If revisit, plants found again? yes no

Entered into GIS on _____ by _____
 Verified GIS on _____ by _____
 Photo files renamed on _____ by _____

Site Name: _____ Date: _____ Time: _____

Source of lead: _____

Species Found: _____ Species Code: _____

Surveyor(s): _____

Quad Name(s): _____ State: _____ County(ies): _____

Township(s): _____ Range(s): _____ Section(s): _____

UTM North: _____ UTM East: _____ UTM Zone: _____ Datum: _____

UTM Precision (Circle one): Corrected GPS Field Recorded GPS Determined from map

GPS unit(s) used: _____ GPS File Name(s): _____

Site Location/Directions to site: Start directions from a specific known location and describe in detail the roads, trails, and routes taken to get to general area, then refer to nearby landmarks to concisely describe the site's location. Also describe the location of plants within the site, especially if plants would be difficult for someone not familiar with the site to relocate using only attached maps.

Written Description (Describe the site, including such things as vegetation, significant species, aquatic features, notable landforms, natural disturbances, natural hazards, etc):

Landowner (Circle one): BLM USFS NPS State of Utah Private Other: _____

Owner unit (Circle one): CARE Dixie NF Fishlake NF Richfield BLM Price BLM Other: _____

USFS subunit (Circle one): Beaver RD Escalante RD FillmoreRD Fremont River RD Richfield RD

Current use of site: _____

Surrounding land use (Describe physical structures and land use practices in the surrounding area, such as housing, agricultural, recreational, etc.): _____

Site Visit Account (SVA) Form

HABITAT

(Circle appropriate categories)

ASPECT	SLOPE (degrees)	LIGHT	TOPOGRAPHIC POSITION	MOISTURE
W NW	flat	Open	Crest	Inundated (hydric)
E NE	0-10	Partial	Upper slope	Intermittently flooded
S SW	10-35	Filtered	Mid-slope	Saturated (wet-mesic)
N SE	35+	Shade	Lower slope	Moist (mesic)
none	vertical		Bottom	Dry-mesic
multiple			All	Dry (xeric)

Elevation Range: _____ ft m to _____ ft m Elevation at GPS Point: _____ ft m

Associated plant community: _____

Associated plant species (list in order of dominance): _____

Soil/Geologic Formation: _____

Full extent of occurrence mapped? (Circle one): yes no

Estimated # of acres of potential habitat in the immediate area: (check only one category)

< 1 acre	6 – 20 acres	41 – 80 acres	121-160 acres
1 - 5 acres	21- 40 acres	81 – 120 acres	> 160 acres

BIOLOGY

PHENOLOGY (must sum to 100%)	POPULATION ESTIMATE (check one)	ACTUAL PLANT COUNT	
%in leaf	1-10	At Site:	
%in bud	11-50		
%in flower	51-100	In Polygon:	
%immature fruit	101-1000		
%mature fruit	1001-10,000	Note: The count within the survey polygon includes the site count.	
%seed dispersing	10,000-50,000		
%dormant	> 50,000		

AGE STRUCTURE (must sum to 100%)	VIGOR (check one)
%seedlings	very feeble
%immature	feeble
%mature	normal
%senescent	vigorous
%unknown	exceptionally vigorous

Comments on biology: _____

Evidence of reproduction: yes no Explain: _____

Evidence of disease, predation, etc: yes no Explain: _____

Site Visit Account (SVA) Form

IDENTIFICATION

Do other members of the same genus occur at this site? If yes, list species, any hybridization, etc.?

Identification problems? If yes, explain: _____

Specimen(s) collected? (Circle one): yes no

PHOTOGRAPHS

Photograph(s) taken? (Circle one): yes no Camera(s) used: _____

Describe photographs (Use photo #s. State if it's a close-up or habitat view, direction or bearing faced, etc.):

CONSERVATION

Evidence of disturbances (describe any unnatural on-site disturbances): _____

Threats: (check all appropriate categories, then note any specifics)

Grazing Allotment – active use on site	<input type="checkbox"/>	Powerlines	<input type="checkbox"/>	Pack trail	<input type="checkbox"/>
ATV use: Recent Past	<input type="checkbox"/>	Houses nearby	<input type="checkbox"/>	Exotic weed encroachment	<input type="checkbox"/>
Urbanization, Roads	<input type="checkbox"/>	Visitor use, general	<input type="checkbox"/>	High potential for Flooding	<input type="checkbox"/>
		Hikers	<input type="checkbox"/>	High potential for Erosion	<input type="checkbox"/>

Other:

Notes about threats:

Conservation/management needs:

Vulnerability Rating: (Assign a # to site from the categories listed below): _____

- 1) High Risk - plants may be trampled, flowers picked, AND in an area frequently used by visitors or within 1/4 mile of maintained primary road.
- 2) Moderate Risk - plants may be trampled or flowers picked, but in an area not frequented by visitors to date (plants not located on established hiking trail, or well-used hiking route) or within 1/2 from unmaintained dirt road.
- 3) Low Risk - plants growing in an area accessible to visitors (but not frequently visited to date) AND/OR plants growing where they can't be stepped on, but flowers or seeds are easily within reach to be collected.
- 4) Very Low Risk - plants located in an area inaccessible to human reach or greater than 1/2 mile any road.

NUMBER OF SURVEYORS: _____ SURVEY TIME FOR SITE: _____ hours

SURVEY TIME FOR ENTIRE SURVEY AREA (including time at site): _____ hours

You **MUST** attach a map showing the site location, the area occupied by the plants (if able to determine this), and the area surveyed. Use some facsimile (copy machine or GIS-generated) of the appropriate portion of the standard USGS topographic quadrangle as your base. The site name, date, species name, and number of plants found should be indicated on the map. You may also draw a sketch of the site on the back of this sheet to show finer detail.

Population Trend Monitoring (PTM) Form

Field Definitions

Target Species

Field Name	Definition/Notes
Species Name	Enter scientific name of the target species being monitored
Plants Present?	Was the target species documented during this visit?

Site and Event Data

Field Name	Definition/Notes
Site ID #	Unique identification code for each known site. This number is generated automatically in the NCPN Rare Plant Database when a new record is created. Leave blank for newly discovered plant locations
Site Name	Enter a unique descriptive name for the site, ideally from a local place name
Visit Date	Record the date of visit as month/day/year
Time required (by person hour) to census polygon	Record number of people counting plants and how long it takes

Population Size

Field Name	Definition/Notes
Life history stage class	Seedling/Juvenile – First year plant less than 1/4 expected diameter or height of mature plants and without buds, flowers, or fruits; basal rosette of leaves without a woody base Vegetative mature – Full or nearly full-sized individual without buds, flowers, or fruits; plant has a woody taproot; may be only a basal rosette or have multiple stems Reproductive mature – Full or nearly full-sized individual with buds, flowers, or fruits Dead – non-living individual in any life history stage class
Number of Plants	Record the actual number of plants observed by stage class

Other Data

Field Name	Definition/Notes
Plant vigor	Describe the overall health and robustness of plants in the population.
Hybrids?	Indicate whether any hybrid plants are suspected within the population. Note occurrence of any other species in the same genus as the target plant.
Biology and Herbivory Comments	Indicate approximate percentage of plants being grazed or browsed; Include other observations that are noteworthy
Human Impacts	List type and extent of impact: garbage, camping, OHV's, cattle, footprints. GPS location of each, record GPS name on field form.

Population Trend Monitoring (PTM) Form

Target Species

Species Name:	Plants Present? Y / N
----------------------	------------------------------

Site Data

Site ID#	Site Name:	Visit Date:
SVA DB#	Agency:	Quadrangle:
Time For Census:	minutes	# people counting

SVA = Site Visit Account

Population Size (Indicate actual number of plants counted by stage class)

Life History Stage Class	Number of Plants
Seedling/Juvenile	
Vegetative Mature	
Reproductive Mature	
Dead Plants	
Total # of Live Plants	

Other Data

Plant Vigor:	Hybrids Present? Y/ N
Biology and Herbivory Comments: 	
Human Impacts Noted: (list type and extent of impact: garbage, camping, OHV's, cattle, footprints) 	
Human Impacts GPSed? Y/ N	GPS File Name:

PTM Human Disturbance Form

Target Species

Species Name:	Plants Present? Y / N
----------------------	------------------------------

Site Data

Site ID#	Site Name:	Visit Date:
SVA DB#	Agency:	Quadrangle:
Time For Census:	minutes	# people counting

SVA = Site Visit Account

Evidence of disturbances (describe any unnatural on-site disturbances):

Threats: (check all appropriate categories, then note any specifics)

Grazing Allotment – active use on site <input type="checkbox"/>	Powerlines <input type="checkbox"/>	Pack trail <input type="checkbox"/>
OHV use: Recent Past <input type="checkbox"/>	Houses nearby <input type="checkbox"/>	Exotic weed encroachment <input type="checkbox"/>
Urbanization, Roads <input type="checkbox"/>	Visitor use, general <input type="checkbox"/>	High potential for Flooding <input type="checkbox"/>
	Hikers <input type="checkbox"/>	High potential for Erosion <input type="checkbox"/>

Other:
Notes about threats:

Conservation/management needs:

Vulnerability Rating: (Assign a # to site from the categories listed below): _____

- 1) High Risk - plants may be trampled, flowers picked, AND in an area frequently used by visitors or within 1/4 mile of maintained primary road.
- 2) Moderate Risk - plants may be trampled or flowers picked, but in an area not frequented by visitors to date (plants not located on established hiking trail, or well-used hiking route) or within 1/2 from unmaintained dirt road.
- 3) Low Risk - plants growing in an area accessible to visitors (but not frequently visited to date) AND/OR plants growing where they can't be stepped on, but flowers or seeds are easily within reach to be collected.
- 4) Very Low Risk - plants located in an area inaccessible to human reach or greater than 1/2 mile any road.

Monitoring Plot Photo Documentation (MPPD) Form

Target Species

Species Name:	Plants Present? y/n
----------------------	----------------------------

Site and Event Data

Site ID#	Site Name:	Visit Date:
SVA DB#	Agency:	Quadrangle:

Photo Notes: Include description (note human impacts) and bearing (deg).

Photo Type:	Camera:	Photographer:
UTM coordinates at permanent marker:		Northing:
		Easting:
Photo 1		
Photo 2		
Photo 3		
Photo 4		
Photo 5		
Photo 6		
Photo 7		
Photo 8		
Photo 9		
Photo 10		
Photo 11		
Photo 12		
Photo Comments:		

Attach map of site showing area surveyed, the permanent rebar marker, location of tracking transects and waypoints of plant locations.

Human Impact Photo Point Monitoring (HIPPM) Form

Photo Monitoring Plot	Species Name	Date	Survey Site	Notes/Photo #
------------------------------	---------------------	-------------	--------------------	----------------------

**Appendix C. Protocols Used to Establish
Monitoring Plots**

The following protocol was used to establish the initial monitoring plots for Maguire daisy. We will use this protocol to establish additional monitoring plots if needed. During the monitoring plot selection process, it is recommended that two plots be randomly selected from each population. One monitoring plot will be the first choice for monitoring, and the second monitoring plot will be considered a “backup” to be used only if for some reason the first plot is not acceptable. Reasons that a monitoring plot is deemed not acceptable include: too difficult to access on a regular basis; or habitat too fragile for repeated monitoring visits.

1. A list of suitable sites available to establish monitoring plots was compiled by consulting existing databases, photo libraries, staff experts, and previous survey or inventory reports (see section II.A for a complete list). The data we compiled included location information, baseline population numbers, approximate distribution and density of the population, habitat attributes, and other data that will be useful to establish monitoring plots. This list of suitable sites will be used to establish new monitoring plots if needed.
2. Once a site is relocated in the field, we will confirm that the target plant species is present. We will take photographs of the plant for documentation. When possible, we will include a laminated photo board in the photo indicating the species name, date, survey site (site ID #), and other relevant notes.
3. We will spend time investigating the site by hiking through the area to determine a reasonable monitoring plot boundary containing at least 50 plants, potential for habitat impacts due to trampling by surveyors, and to get a sense of population density and distribution. We will use the tracking function in our GPS as we walk through the area and use the waypoint feature to mark where individual plants occur. While at the site, we will determine a realistic number of person hours required to adequately walk parallel transect lines spaced approximately one to two meters apart through a selected monitoring plot. Note this time on the field form as the standard survey time to be used at each site.
4. After exploring the site, complete a Site Visit Account (SVA) Form (Appendix B). Determine the best size, shape and location of a monitoring plot for monitoring based on at least 50 plants, habitat and obvious boundaries (e.g. soil type, geologic formation, vegetation community, topographic features, etc.). Navajo sandstone outcrops tend to have very easily defined boundaries where the stone ends and sandy wash or bottom land begins. Therefore, delineating boundaries for these monitoring sites has been very straight forward. Describe monitoring plot boundaries on field forms and select a permanent relocation point (rebar or a permanent or easily-recognizable physical landmark for a reference point) for the monitoring plot. If possible, at the appropriate easily relocated point, hammer an 18 inch rebar into the ground, leaving approximately 8-10 inches visible above ground. An aluminum tag with the monitoring plot number should be wired to the rebar (or other permanent reference point).

5. On the Monitoring Plot Photo Documentation Form (MPPD) (Appendix B), record the GPS location (UTM, NAD 83, zone 12) and photograph the location of this permanent rebar marker. At least two photos should be taken while standing at the permanent reference point. Record the compass orientation of each photo from the permanent relocation point and other pertinent information on the MPPD Form. To help clarify monitoring plot boundary, take numerous photographs and describe them on the field form very specifically. Erect small rock cairns along the boundary if there could be any question as to the exact location of the monitoring site boundary. This will ensure future surveyors can precisely relocate the monitoring site boundary.

6. The Interagency Rare Plant Team Site Visit Account (SVA) (Appendix B) field form will be completed to establish the monitoring plots. This form requires detailed information on habitat, biology, individual plant vigor, presence of herbivory, identification, hybridization (if present), and conservation.