

MacFarlane's Four-o'clock
(Mirabilis macfarlanei)

5-Year Review
Summary and Evaluation

U.S. Fish and Wildlife Service
Idaho Fish and Wildlife Office
Boise, Idaho

January 2009

5-YEAR REVIEW
MacFarlane's Four-o'clock/*Mirabilis macfarlanei*

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Field Office: Ray Vizgirdas, IFWO, Boise, ID (208) 378-5249; Susan Burch (208) 378-5265

Cooperating Field Office(s): Gretchen Sausen, Oregon State Office - LaGrande, OR Field Office, (541) 962-8695

1.2 Methodology used to complete the review:

In preparing this draft status review, we used information contained in numerous technical reports, peer reviewed scientific studies related to the species; and monitoring and survey data conducted by Idaho Department of Fish and Game Natural Heritage Program (formerly Idaho Conservation Data Center (IDCDC)), Cottonwood Field Office of the Bureau of Land Management (BLM), and Wallowa-Whitman National Forest (Oregon). We also met with staff from the Wallowa-Whitman National Forest (Oregon), Cottonwood BLM (Idaho), and the Service in November 2007, to discuss current population status and estimates, threats, and implementation of conservation actions for the species.

All of the information that was gathered or provided to us was assimilated into a status review report for *Mirabilis macfarlanei* (MacFarlane's Four-o'clock). The draft status review was sent out for peer review to six professionals with familiarity with the species and/or the species habitat. Peer reviewers were given a list of questions to consider during the review process. Comments received from peer reviewers were incorporated into the status review document. A briefing, consisting of SRFWO managers and biologists, was held on November 19, 2008, to review information summarized in the status review as well as peer review comments. The SRFWO formalized a recommendation as part of the 5 year review process at that time.

1.3 Background:

1.3.1 FR Notice citation announcing initiation of this review:

April 24, 2006 - Scientific and Commercial Information Sought for MacFarlane's Four-o'clock - Submissions accepted until close of business June 23, 2006

1.3.2 Listing history

Original Listing

FR notice: 44 FR 61912

Date listed: October 1979

Entity listed: species - *Mirabilis macfarlanei*

Classification: Endangered

Revised Listing, if applicable

FR notice: 61 FR 10693

Date listed: March 1996

Entity listed: Species

Classification: Threatened

1.3.3 Associated rule-makings: NONE

1.3.4 Review History

2007 – Recovery Needs Assessment. This summarized and identified tasks from the Recovery Plan that need to be accomplished to delist the species.

1.3.5 Species' Recovery Priority Number at start of this 5-year review

RPN of 2 (high degree of threat/high potential for recovery)

1.3.6 Current Recovery Plan or Outline

Name of plan or outline: Revised Recovery Plan for MacFarlane's Four-o'clock (*Mirabilis macfarlanei*)

Date issued: June 30, 2000

Dates of previous revisions, if applicable: NA

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate?

Yes, go to section 2.1.2.

No, go to section 2.2.

2.1.2 Is the species under review listed as a DPS?

Yes, go to section 2.1.3.

No, go to section 2.1.4

2.1.3 Was the DPS listed prior to 1996?

Yes, give date and go to section 2.1.3.1.

No, go to section 2.1.4.

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

Yes, provide citation and go to section 2.1.4.

No, go to section 2.1.3.2.

2.1.3.2 Does the DPS listing meet the discreteness and significance elements of the 1996 DPS policy?

Yes, discuss how it meets the DPS policy, and go to section 2.1.4.

No, discuss how it is not consistent with the DPS policy and consider the 5-year review completed. Go to section 2.4., Synthesis.

2.1.4 Is there relevant new information for this species regarding the application of the DPS policy?

Yes, provide citation(s) and a brief summary of the new information; explain how this new information affects our understanding of the species and/or the need to list as DPSs. This may be reflected in section 4.0, Recommendations for Future Actions. If the DPS listing remains valid, go to section 2.2, Recovery Criteria. If the new information indicates the DPS listing is no longer valid, consider the 5-year review completed, and go to section 2.4, Synthesis.

No, go to section 2.2., Recovery Criteria.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan¹ containing objective, measurable criteria?

Yes, continue to section 2.2.2.

No, consider recommending development of a recovery plan or recovery criteria in section IV, Recommendations for Future Actions, and go to section 2.3., Updated Information and Current Species Status.

¹ Although the guidance generally directs the reviewer to consider criteria from final approved recovery plans, criteria in published draft recovery plans may be considered at the reviewer's discretion.

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

XX Yes, go to section 2.2.2.2.

 No, go to section 2.2.3, and note why these criteria do not reflect the best available information.

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

XX Yes, go to section 2.2.3.

 No, go to section 2.2.3, and note which factors do not have corresponding criteria. Consider developing recommendations for revising recovery criteria in section 4.0.

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information

In 2000, the revised Recovery Plan for *Mirabilis macfarlanei* identified the following criteria to recover the species (U.S. Fish and Wildlife Service 2000).

1. A minimum of 11 populations are secure from threats and naturally reproducing with stable or increasing population trends for at least 15 consecutive years.
 - Currently, the species occurs in 13 Element Occurrences (EOs), 9 in Idaho and 4 in Oregon. In general, monitoring data appear to indicate that *M. macfarlanei* annual ramet abundance, reproductive ramet abundance, and foliar cover has not changed significantly at Idaho EOs located on BLM lands since 1981 (Mancuso and Shepherd 2008).
 - Population estimates of *M. macfarlanei* in EOs in Oregon are about 3,500 ramets, covering about 90 acres (Yates 2007). There are estimated to be 3,000-4,000 ramets in Idaho, although it has been difficult to confirm these results. Estimates of population size for *Mirabilis macfarlanei* are complicated by its clonal nature, and the number of ramets may not accurately reflect the number of genetic individuals (genets) in the population (Barnes et al. 1994). Although the number of ramets per genet varies considerably for this species, Barnes (1996) estimated a mean of 4.88 ramets per genet.
 - Populations (EOs) are not secure from threats. The potential for wildfires is expected to increase due to the expansion of non-native plant species into currently occupied habitats. Currently, one or more species of non-native plants occur in all of Idaho's EOs, and in 2 of 4 EOs in Oregon.
2. Population sizes are above the minimum necessary to maintain the viability of the species. Because the minimum viable population size for *Mirabilis macfarlanei* is currently unknown, population viability analyses will be conducted to support the recovery criteria.

- In general, monitoring data appear to indicate that estimates of *M. macfarlanei* annual ramet abundance, reproductive ramet abundance, and foliar cover has not changed significantly at Idaho occurrences located on BLM lands since 1981 (Mancuso and Shepherd 2008).
 - Population estimates of *M. macfarlanei* in EOs in Oregon are about 3,500 ramets, covering about 90 acres (Yates 2007).
 - No minimum viable population size has been established for this species. Because of this species' life history (e.g., clonal growth), a determination of a minimum populations size may be difficult and may not be able to be completed. This recovery criterion may need to be adjusted.
3. Populations of this species occur throughout its current range in each of three geographic areas (i.e., Imnaha, Snake, and Salmon river areas).
- The species is currently documented to occur in EOs throughout its current range in each of three geographic areas – Salmon, Snake, and Imnaha river canyons.
4. Management practices reduce and control threats. On Federal land, habitat management plans are in place and monitoring is used to ensure implementation and effectiveness of conservation management practices. On non-Federal lands, *Mirabilis macfarlanei* populations are managed and conserved.
- Since *Mirabilis macfarlanei* was first listed as endangered in 1979, numerous conservation efforts have been implemented by Bureau of Land Management (BLM) and the Forest Service including focused surveys, population monitoring, fencing to exclude livestock grazing, and non-native plant control.
 - *Mirabilis macfarlanei* is considered to be a special status species by the BLM. Special status species are those species listed under the Endangered Species Act (Act), officially proposed for listing under the Act, or designated as BLM sensitive species.
 - The BLM is currently in the process of revising its Resource Management Plan (RMP) and has identified updating and/or developing habitat management plans with an anticipated completion in FY 2009.
 - In May 2006, the BLM released a draft of their revised RMP. This RMP will provide direction for managing public lands under the jurisdiction of the Cottonwood Field Office under the authority of the Federal Land Policy and Management Act of 1976. In this draft RMP, the BLM identified their Preferred Alternative (Alternative B) as well as other alternatives. Alternative B appears to emphasize a balanced level of protection, restoration, and commodity production to meet the needs for resource protection and resource use. Although a final decision has not been made on which alternative will be selected, all alternatives put some level of emphasis on managing special status species and maintaining and improving habitat to provide for species' continued presence and conservation.
 - In reviewing the description of alternatives within RMP, the goal for special status plant species is to maintain or restore special status species and their habitat to contribute to species recovery. The three objectives that support the stated goal include: 1) monitor specific listed species and implement specific actions needed to maintain or restore their

habitat; 2) support Recovery Plan actions for listed plants to contribute towards recovery and delisting; and 3) manage Idaho BLM sensitive plants and their habitats to contribute to conservation of the species and removal of the species from protective measures.

- The Forest Service, BLM, and the Service have initiated contacting private land owners with known EOs of *Mirabilis macfarlanei*, but to date no Conservation Agreements have been developed.
- Populations (EOs) are not secure from threats. The potential for wildfires is expected to increase due to the expansion of non-native plant species into currently occupied habitats. Currently, one or more species of non-native plants occur in all of Idaho's EOs, and in 2 of 4 EOs in Oregon.

5. A post-delisting monitoring program for the species is developed and implemented. This program will be developed through coordination with the Bureau of Land Management, U.S. Forest Service, the Service, and other interested parties.

- A post-delisting monitoring plan will be developed when recovery criteria have been met and a proposed rule to delist the species is written.

In summary, two of the five (40%) criteria identified (e.g., there are a minimum of 11 populations *Mirabilis macfarlanei* and the species occurs throughout its current range in each of three geographic areas) in the 2000 revised recovery plan have been met. Other actions to reduce threats such as reducing/excluding grazing by livestock, non-native plant (weed) control efforts, and monitoring extant populations have been on-going by both the Forest Service and BLM. Currently, populations (EOs) are not secure from threats. The potential for wildfires is expected to increase due to the expansion of non-native plant species into currently occupied habitats. One or more species of non-native plants occur in all of Idaho's EOs, and in 2 of 4 EOs in Oregon. Actions to address the remaining recovery criteria will be a focus as part of the Spotlight Species programs that will be initiated in FY2009.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history: There is no new information regarding the species' biology and life history since 2000.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends: Analysis of monitoring data suggest that the species "population size" has neither increased nor decreased on BLM lands in Idaho or Forest Service lands in Oregon since 1981 (Mancuso and Shepherd 2008).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.): *Mirabilis macfarlanei* exhibits low genetic diversity among the populations due to the clonal nature of the species and the distance between the populations (Barnes et al. 1996, page 27). Populations within a given river canyon (e.g., Snake River) are more closely related to one another than to populations in other river canyons (e.g., Salmon or Imnaha). Currently, little gene flow is evident between the populations – thus isolation and small population size may be perpetuating low levels of genetic diversity observed in *M. macfarlanei* populations (Yates 2007, page 3). The greatest level of gene flow occurred between populations that were 0.5 kilometer (slightly more than 0.25 mile) apart (Barnes 1996, page 81). No new genetic studies have been conducted on the species since the late 1990s.

2.3.1.4 Taxonomic classification or changes in nomenclature: No changes in the species taxonomic status have been suggested, nor is there any change in its nomenclature.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.): The species occurs within the geographic area identified in the 2000 Recovery Plan: the Salmon, Snake, and Imnaha river canyons in Idaho and Oregon. The species is highly localized and has not been found outside this range, although surveys in recent years have identified additional colonies that are adjacent to existing EOs.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem): The primary concern for this species continues to be the invasion of noxious non-native plants into its habitat, and the potential for increase in wildfires due the non-native species.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

Invasive Non-native Plant Species

The invasion of non-native plant species continues to be a major threat to *Mirabilis macfarlanei*. In their analysis of the BLM monitoring data, Mancuso and Shepherd (2008, page 21) indicate that monitoring forms have noted weed species presence and abundance in many EOs, but this information was not collected in any standardized or quantifiable manner and limits the data's utility. Colket et al. (2006, pages 1-23) documented that all EOs in Idaho have one or more species of invasive non-native plants, including *Bromus tectorum*. While these descriptive notes may be helpful in interpreting or comparing photographs taken over time or at different

monitoring sites, or documenting management issues at a site, the lack of quantitative monitoring data makes it difficult to evaluate or document the success of weed control, presently one of the main *M. macfarlanei* management efforts (Mancuso and Shepherd 2008, page 21).

Invasive non-native plants alter various attributes of ecosystems including geomorphology, fire regime, hydrology, microclimate, nutrient cycle, and productivity (Pyke and Novak 1994, page 12). Additionally, invasive non-native plants can negatively affect native plants, including *Mirabilis macfarlanei*, through competitive exclusion, niche displacement, competition for pollinators, and changes in insect predation (Monsen 1994, page 43). Non-native plants that co-occur with *M. macfarlanei* at most EOs include: *Bromus tectorum* (cheatgrass), *Hypericum perforatum* (St. John's wort), *Convolvulus arvensis* (field bindweed), *Linaria genistifolia* ssp. *dalmatica* (Dalmatian toadflax), and *Centaurea solstitialis* (yellow starthistle) (Mancuso and Shepherd 2008, page 21; Yates 2007, page 4; Colket et al. 2006, pages 3-23). Currently, at least ten of the thirteen EOs for *Mirabilis macfarlanei* have *B. tectorum* and other non-native plants documented (Colket et al. 2006, pages 3-23; Vrillakas, in litt. 2007, pages 1-8; Mancuso and Shepherd 2008, page 21; Yates 2007, page 4).

In summary, the threat from non-native weed invasions into *Mirabilis macfarlanei* sites continues to adversely impact the species and its recovery. There are many negative ecological impacts associated with non-native plants which include, but are not limited to: displacement of native plants, reduced biodiversity, altered normal ecological processes (e.g., nutrient cycling, water cycles), a decrease in wildlife habitat value, and increased soil erosion.

Wildfires

The effects of wildfire on the habitat of *Mirabilis macfarlanei* encompass several categories, most of which are interrelated and often difficult to isolate from each other and likely equate to the loss of habitat for *M. macfarlanei* and other native species (Billings 1994, page 26). For example, the invasion and establishment on non-native annual grasses and forbs following wildfire increases the amount and continuity of fine fuels across the landscape, which in turn increases the likelihood of frequent and intense wildfires in habitats that support *M. macfarlanei*. While some researchers have proposed livestock grazing as a means to reduce fines fuels loads (Pellant 1996, page 6), the Forest Service and BLM are not proponents of this management approach in areas with known sites of *M. macfarlanei*.

Organisms adapt to disturbances such as historical wildfire regimes (fire frequency, intensity, and seasonality) with which they have evolved (Landres et al. 1999, page 1180), and rare species respond differently to wildfires (Hessel and Spackman 1995, pages 1-90). In general, fire regimes within forest and steppe habitats in the western United States have been highly disrupted (Whisenant 1990, page 4-10). In some instances, fire suppression has allowed grasslands to be invaded by trees (Lesica and Martin 2003, page 516). At the same time, in many grassland and shrub habitats fire frequencies have increased due to the expansion and invasion of annual nonnative grasses (Whisenant 1990, page 4-10). These invasive annual nonnative grasses fill gaps that would naturally occur between native vegetation, dramatically increasing the ability of wildfire to spread.

At least six *Mirabilis macfarlanei* EOs have been burned since 1990 (Idaho EO#1, EO#2, EO#6, and EO#7; in Oregon EO#1 and EO#5) and almost all of the EOs have become infested with non-native plants such as *Bromus tectorum* and *Centaurea solstitialis*, making them more vulnerable to wildfires (Mancuso and Shepherd 2008, pages 16-18; Colket et al. 2006, pages 1-23). With *M. macfarlanei*, the primary concern from wildfires is during the active growing period (April through June) when the aboveground plants would be susceptible to fire kill or injury (U.S. Fish and Wildlife Service 2000, page 14). Wildfires that occur during summer and fall months when *M. macfarlanei* plants are dormant may have minimal direct effects on this species since the underground rhizomes will be largely insulated from fire (U.S. Fish and Wildlife Service 2000, page 14). However, the effects of wildfires often result in adverse changes in the ecological conditions of the species habitat that can lead to the subsequent invasion of non-native plant species, or reduction of suitable habitat due to changes in soil chemistry, and disturbance. Additionally, there is no information available about seed production and set in a post-wildfire setting.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

Other species of *Mirabilis* are cultivated and prized as garden ornamentals and *Mirabilis macfarlanei* is described as an attractive plant with a very showy magenta flower. While the collecting of federally listed plants on Federal lands is prohibited, there is a possibility that collecting pressure could become a problem if the sites become known. Collecting could easily cause extirpation from many localities, especially those with small numbers of plants. A search of the internet identified several sites indicating *M. macfarlanei* may be available for gardeners; it is uncertain the source of these plants.

One *Mirabilis macfarlanei* population (Oregon EO#1 - Cottonwood Landing) occurs adjacent to a popular hiking trail along the Snake River in Hells Canyon. Access to the population is not restricted and there has been no apparent decline of the species at this location. In summary, overutilization is not known or assumed to be a threat to the continued existence of the species. Most EOs on public land occur on moderate to steep slopes that are difficult to reach, especially in the Snake River Canyon area.

2.3.2.3 Disease or predation:

Grazing by Native Herbivores and Domestic Livestock

Herbivory on *Mirabilis macfarlanei* plants by native herbivores and domestic livestock was identified as a potential threat to the species in the 1996 reclassification from endangered to threatened (U.S. Fish and Wildlife Service 1996, page 10695). *M. macfarlanei* has been able to persist in areas in poor ecological condition, and that have historically been grazed by livestock since the 1870's. Preliminary data suggests grazing may have a negative effect on plant height, but additional research is needed (Johnson 1984, page 17; Kaye and Meinke 1992, page 15). Currently, the most serious impacts from livestock grazing are likely indirect, most notably related to habitat degradation. Browsing of *M. macfarlanei* by mule deer and other native

herbivores (e.g., elk, rabbits and hares) has been detected in many localities, but it remains unclear whether this comprises a significant threat (Mancuso and Shepherd 2008, page 20).

Native and introduced ungulate species, including Rocky Mountain bighorn sheep (*Ovis canadensis*), elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), and mountain goats (*Oreamnos americanus*), are found in the vicinity of *Mirabilis macfarlanei* habitat in Hells Canyon National Recreation Area and the Salmon River Canyon (Oregon EO#1 – Tyron Bar/Snake River and EO#5 – Pleasant Valley Creek) (U.S. Fish and Wildlife Service 2000, page 13). Mule deer occur at all Salmon River EOs and elk have been documented at EO#2, EO#3, EO#8, and EO#9 (Lowry, 2008, personal communications). These ungulates can impact plant habitat by trampling or consuming plants and exposing mineral soil (U.S. Fish and Wildlife Service 2000, page 14). Potential introductions of additional Rocky Mountain bighorn sheep or mountain goats by State or Federal agencies could threaten *M. macfarlanei* habitat (U.S. Fish and Wildlife Service 2000, page 14). Although not tested statistically, Mancuso and Shepherd (2008, page 20) report that BLM monitoring data identified deer use was greater than elk use, and both were generally greater than cattle use.

Although it is uncertain whether most or all *Mirabilis macfarlanei* populations were grazed by domestic livestock in the past, livestock grazing still occurs at some sites (U.S. Fish and Wildlife Service 2000, page 13). Livestock impacts this species directly by trampling or consuming plants (Kaye 1995, page 8), and can result in reduced reproduction (i.e., seed set) for *M. macfarlanei* plants. All known *M. macfarlanei* EOs in Idaho and Oregon have had some level of sheep and/or cattle grazing in the past (Craig Johnson, BLM, 2008, personal communications). In Oregon, the Forest Service has excluded grazing with fencing in Hells Canyon (EO#6) and at one Forest Service administrative site (EO#5) in the Imnaha River Canyon (Yates 2007, page 6). The Forest Service fenced off Idaho EO#6 (Pittsburg Allotment) and Oregon EO#5 from grazing during the 1990s. These allotments have been vacant (not stocked) since 2003 (Gene Yates, Forest Service, 2008, personal communication).

In Idaho, the Cottonwood BLM conducted studies in 1981-1983 to determine the effects of livestock grazing on *Mirabilis macfarlanei* in EO# 2 - Long Gulch/John Day Creek site of Idaho (Johnson 1984, page 1). This study included both “cattle grazing” and “no cattle grazing” treatments, with the no cattle grazing treatment utilizing a 45-acre enclosure at Long Gulch. Based on the plant’s phenology and the grazing schedule, the study indicated that *M. macfarlanei* could be adversely affected by high grazing pressures and concentrations of domestic livestock (Johnson 1984, page 1). The BLM has reduced stocking rates over the years and livestock use is now considered moderate to light at these sites (Mancuso and Shepherd 2008, page 19).

Within the Salmon River Canyon (Idaho side of Hells Canyon), the direct effect of grazing is no longer a threat to populations of *Mirabilis macfarlanei*. The Cottonwood BLM has reduced grazing on their lands. However, there is uncertainty about persistent long-term effects due to past grazing in this area. In EO#3 (Long Gulch), one private landowner has reduced grazing in a cooperative effort to protect *M. macfarlanei* plants and habitat (U.S. Fish and Wildlife Service 1996, page 10695). Within the Salmon River drainage, the BLM has restricted livestock grazing of public lands with occurrences of *M. macfarlanei* in Skookumchuck (EO#1), Long Gulch (EO#2), and Lucile Caves (EO#7). The BLM has authorized livestock grazing in the Horseshoe

Bend (EO#3), Rhett Creek (EO#8), and Box Canyon (EO#9) (Craig Johnson, BLM, 2008, personal communications).

Since 1996, the Forest Service in Oregon has modified domestic livestock grazing to protect known *Mirabilis macfarlanei* populations. The Forest Service has taken actions that include measures to remove domestic livestock from *M. macfarlanei* sites before the plant starts to grow in April (U.S. Fish and Wildlife Service 1996, page 10695). Additionally, general range improvements have taken place within the Snake River Canyon area where *M. macfarlanei* occurs due primarily to improved livestock grazing management (Yates 2007, page 6). The Forest Service portion of Oregon EO#3 has been fenced to exclude grazing. EO#1 and EO#5 (Oregon side of the Snake River) have not been grazed in over 20 years because these allotments are closed (Gene Yates, Forest Service, 2008, personal communications).

In summary, livestock grazing was moderate to heavy at several *Mirabilis macfarlanei* sites when monitoring first began in the early 1980s. Stocking rates have been greatly reduced over the years, with overall use now rated moderate to light at most sites (Mancuso and Shepherd 2008, page 21). Although direct impacts from livestock can occur, the indirect impacts that adversely affect habitat conditions and ecological integrity are likely more problematic for the long-term persistence of *M. macfarlanei* (Mancuso and Shepherd 2008, page 21).

Fungal Diseases and Insect Damage

The potential of fungal infections as a threat to *Mirabilis macfarlanei* was identified in the 1979 listing of the species as endangered (U.S. Fish and Wildlife Service 1996, page 10695), however, current information neither mentions nor references fungi species affecting *M. macfarlanei*. In summary, damage from fungal diseases do not currently appear to be a significant threat to *M. macfarlanei* populations, but should continue to be monitored.

Mirabilis macfarlanei plants have been damaged by insects, including spittle bugs (Order Homoptera, Family Cercopidae) and lepidopterans (moths) (Baker 1983, page 9). Spittlebugs (*Aphrophora* sp. and *Philaenus* sp.) are significant pests in certain years as the feeding nymphs can cause shoot death and floral abortion. In some cases, there was significant plant stunting where sizeable numbers of spittle bugs were observed (Baker 1983, page 10); however, these effects have not been observed consistently at all EOs.

Certain lepidopterans (moth and butterfly order) utilize various *Mirabilis* and *Abronia* species (both members of the Nyctaginaceae) as larval food plants. This includes *Lithariapteryx* of the family Heliodontidae, a genus limited to the western United States and parts of Mexico (Powell 1991, page 89). *Lithariapteryx* is not known to pollinate or otherwise benefit *M. macfarlanei* (Yates 2007, page 6). In summary, impacts from insects do not appear to be a significant threat to *M. macfarlanei* populations, but should continue to be monitored.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Management plans for three *Mirabilis macfarlanei* EOs on Federal lands in Idaho were developed by the Cottonwood BLM in 1981 to 1985. These three sites are located at

Skookumchuck (EO#1), Long Gulch (EO#2), and Lucile Caves (EO#7). The implementation of these management plans has reduced threats to some *M. macfarlanei* sites from livestock use and herbicide spraying along the Salmon River Canyon (Parenti and Johnson 1989, page 11). Management plans for the other EOs have not been developed by the Forest Service or BLM. The BLM has identified development of new plans, or updating the original Habitat Management Plans developed in the 1980s in their draft Revised Resource Management Plan (Clay Fletcher, U.S. Fish and Wildlife Service, 2008, personal communication).

Under the Oregon Endangered Species Act (Oregon Revised Statutes 564.100–564.135) and pursuant regulations (Oregon Administrative Rule [OAR] 603, Division 73), the Oregon Department of Agriculture has listed *Mirabilis macfarlanei* as endangered (OAR 603–73–070). The Oregon statute contains prohibitions against the “take” of State-listed plants on State lands. No *M. macfarlanei* plants are currently found on State lands in Oregon. Currently, Idaho does not have regulations protecting endangered or threatened plants.

Mirabilis macfarlanei is on the Forest Service Region 6 Sensitive Species List. At least three EOs (EO#1, EO#3, and EO#5) occur on the Wallowa-Whitman National Forest in Oregon, with the other two EOs (EO#2 and a portion of EO#3) occurring on private land. Nevertheless, *M. macfarlanei* has received considerable attention and population monitoring plots were established within EO#3 (Fall Creek) in the early 1990s as part of a cooperative project between the Forest Service and Oregon Department of Agriculture, but were discontinued after a few years. The Forest Service has excluded grazing with fences around EO#3 (Fall Creek) in the Innaha River canyon, thus providing protection to the species from livestock use.

In summary, all populations of *Mirabilis macfarlanei* occurring on lands managed by the Forest Service and BLM are, to a certain extent, protected and subject to section 7 consultation under the Act. The Cottonwood BLM has identified the development of new management plans, or updating the original habitat management plans for *M. macfarlanei* in their process of revising their Resource Management Plan. *M. macfarlanei* has benefited from previous habitat management plans as well as those conservation actions being developed during the current planning process.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

The 1996 reclassification of *Mirabilis macfarlanei* identified several threats under the section of other natural or man-made factors affecting its continued existence. These include: a) recreation and off-road vehicles, trampling of plants by cattle, and soil erosion; b) inhibition of *M. macfarlanei* growth and development due to alien species invasion; c) allelopathic (interference) effects of invasive species on *M. macfarlanei*; d) low seed viability leading to a reduction in genetic variability within the species; e) indiscriminate herbicide spraying on *M. macfarlanei* plants within the Salmon River canyon downslope from Highway 95; f) use of insecticides for insect control and adverse effects to *M. macfarlanei* pollinators; g) loss of plants due to stochastic events; and h) small population size leading to poor genetic viability (U.S. Fish and Wildlife Service 1996, page 10696). Several of these threats continue to be a concern and are discussed in further detail below.

Recreation and Soil Disturbance

The threat of recreational activities, like other disturbances, encompasses non-native plant invasions, increased potential for wildfires, damage to individual plants, and direct soil disturbances. Off-road vehicles erode and compact soils, destroy vegetation, and disturb the flow of the water and nutrients on which living things depend. Many *Mirabilis macfarlanei* EOs are found within 0.25 mile (0.5 kilometer) of existing roads or highways in Idaho and Oregon (EOs in Idaho: EO#1 – Skookumchuck, EO#2 – Long Gulch/John Day, EO#4 – Slicker Bar, EO#6 – Lower Pittsburgh Landing, EO#7 - Lucile Caves; in Oregon: EO#2 – Buck Creek and EO#3 – Fall Creek (Colket et al. 2006, pages 1-23; Vrilakas, in litt, pages 1-7). Most of these EOs are on steep slopes that are particularly vulnerable to erosion, but are not very accessible to off-road vehicle use. In the Hells Canyon National Recreation Area, vehicular travel is restricted to open roads although this has not been actively enforced in the past (U.S. Fish and Wildlife Service 2000, page 15). In Idaho, EO#6 (Lower Pittsburg) has seen minor impacts from unauthorized off-road vehicle use.

In summary, recreation and off-road vehicle use are not considered serious or immediate threat to *Mirabilis macfarlanei*. Continued monitoring of the populations by the BLM and Forest Service will identify any future recreational impacts.

Fragmentation and Small Populations

The scientific literature indicates that small populations of species can be vulnerable to environmental disturbances such as herbicide drift, fires, and non-native plant invasions; and are subject to the loss of genetic diversity from genetic drift and inbreeding (Lienert and Fischer 2003, page 44; Lennartsson 2002, page 3060; Ellstrand and Elam 1993, page 217; Linhart and Grant, page 237; Gray 1996, pages 71-73; Ingvarsson 2002, pages 2368-2369). The Revised Recovery Plan for *Mirabilis macfarlanei* identified seedling recruitment as a rare phenomenon and that gene flow among populations is limited (U.S. Fish and Wildlife Service 2000, page 16). Populations with lowered genetic diversity are known to be more prone to local extinction. Smaller populations generally have lower genetic diversity, and lower genetic diversity may in turn lead to smaller populations by decreasing the species' ability to adapt – a negative feedback loop (Cruzan 2001, page 2). However, relatively low levels of genetic exchange (one migrant per generation) may, in some instances, be considered sufficient to counteract the effects of genetic drift (Cruzan 2001, page 2; Ellstrand and Elam 1993, pages 218-237).

Mirabilis macfarlanei populations are generally restricted to small, remnant patches of native habitat that are disjunct from each other (Mancuso and Shepherd 2008, page 2). Most sites are less than an acre in size, ranging from a few square meters to about seven acres (U.S. Fish and Wildlife Service 2007, page 3). Population size ranges from approximately 3,000 ramets on one 50 acre site (20 hectares) in EO#1 (Tyron Bar/Snake River in Oregon), to 400 ramets on 175 square feet (16 square meters) at EO#3 (Horseshoe Bend in Idaho). A genetic study for *M. macfarlanei* in EO#2 – Buck Creek (Oregon) found low genetic diversity among the populations, and that genetic differences increased as the distance between the populations increased (Barnes 1996, page 80).

Similarly, *Mirabilis macfarlanei* populations in the Snake River Canyon are more closely related to one another than to populations occurring in the Salmon or Imnaha river canyons (Barnes et al. 1997, page 26). The greatest level of gene flow occurred between populations that were approximately 0.5 kilometer (0.25 mile) apart (Barnes 1996, page 80). There is little evidence of gene flow between the populations – thus isolation and small population size may be contributing to the low levels of genetic diversity observed in *M. macfarlanei* across its range (Yates 2007, page 3). Habitat fragmentation likely contributes to the loss of genetic diversity through genetic drift and inbreeding and the long-term viability of *M. macfarlanei* (Barnes 1996, page 81; Smith 1996, pages 467-470).

Seed Viability and Stochasticity

The primary method of reproduction of *Mirabilis macfarlanei* is through rhizomes and plants are long-lived (U.S. Fish and Wildlife Service 2000, page 3). To date, low seed viability for *M. macfarlanei* has been reported; therefore, sexual propagation may be very low (Yates 2007, page 4). Low seed viability reduces genetic variability within the species.

Many *Mirabilis macfarlanei* populations contain a small numbers of plants and are subject to elimination from stochastic events. Small numbers may reduce the ability of *M. macfarlanei* to adapt to environmental changes or events that may cause their extirpation. Although recent surveys reported the smaller populations at several localities have been characterized as “vigorous to extremely vigorous” (Colket et al. 2006, pages 2-6), it is still uncertain whether these populations are comprised of a few ramets exhibiting extensive clonal growth, or are distinct individuals. Long term monitoring conducted by the BLM has identified that no apparent expansion of *M. macfarlanei* into unoccupied habitats is occurring, which may be a result of poor seed viability (Craig Johnson, BLM, 2008, personal communications). Fluctuations in ramet monitoring (i.e., cover, number, vigor, flowering), appears to be attributed to annual variances which may occur from climatic conditions (e.g., precipitation, temperature, drought, etc.) (Craig Johnson, BLM, 2008, personal communications).

Other Factors

Landslides and Flood Damage: The Revised Recovery Plan (Plan) for *Mirabilis macfarlanei* (U.S. Fish and Wildlife Service 2000, page 11) identified landslides and flooding as a threat to the species habitat. In November 1996 and May 1997, landslides occurred approximately 24 kilometers (15 miles) north of Riggins in Idaho County, Idaho, within an area occupied by *M. macfarlanei* in EO#2 – Long Gulch. As a result of these landslides, Highway 95, the only major north-south transportation route in west-central Idaho, was completely blocked by debris and a temporary detour route was constructed. A road was constructed by the Idaho Transportation Department (ITD) adjacent to the slide within *M. macfarlanei* habitat to evaluate the landslide. This area continues to be unstable.

To compensate for the loss of *M. macfarlanei* plants associated with past highway repair and landslide stabilization activities, the BLM cooperated with ITD to transplant approximately 400 *M. macfarlanei* rhizomes to the Lucile Caves Research Natural Area (EO#7) in 1998 and 1999. Specifically, monitoring data revealed rhizomes failing to show evidence of above-ground

growth one year, and then producing ramets the following year. In a few instances, two or three years passed before ramets were again recorded (Mancuso and Shepherd 2008, page 19).

Herbicide and Insecticide Spraying: The use of herbicides in the vicinity of *Mirabilis macfarlanei* could have an adverse effect on the species if weed control activities are not carefully implemented and monitored. Populations of *M. macfarlanei* occur adjacent to a major highway within the Salmon River corridor in Idaho where herbicide spraying is conducted by the local transportation department or county weed management board. In one event in 1997, at least 2,750 stems on BLM land (known as the Blackhawk site within EO #2 – Long Gulch/John Day Creek) exhibited foliar kill as a result of the spraying (Craig Johnson, BLM, personal communications as cited in U.S. Fish and Wildlife Service 2000, page 11). Subsequent surveys by BLM in 1998 found that most of these *M. macfarlanei* plants at the Blackhawk site survived. Past indiscriminate herbicide spraying by State highway road crews has had adverse effects on the small number of *M. macfarlanei* plants located within the Salmon River unit downslope from Highway 95 (EO#1 – Skookumchuck) (Colket et al. 2007, pages 1-23; U.S. Fish and Wildlife Service 2000, page 11).

Using insecticides for insect control may be detrimental to many of the known pollinators of this species, including several genera of bees. Species of the *Bombus* genus are apparently the most effective pollinators (Barnes 1996, page 7). However, there are no reports that insecticides have been used in any EOs occurring on Forest Service or BLM lands. On Federally managed lands such as the BLM and Forest Service, specific application criteria have been developed in an attempt to reduce the effects of herbicide damage to the species (Clay Fletcher, U.S. Fish and Wildlife Service, 2008, personal communication).

Mining: The 2000 Revised Recovery Plan identified mining as a possible threat because of an existing gravel mining operation along the Salmon River corridor in Idaho County, Idaho. Currently, there are no proposed mine activities within the occupied *Mirabilis macfarlanei* sites; and mining is not considered to be a threat to the species.

Synthesis

In summary, 2 of the 5 recovery criteria identified in the 2000 Recovery Plan appear to have been achieved: 1) the species occurs in 13 Element Occurrences (EOs), 9 in Idaho and 4 in Oregon and, in general, populations have not changed significantly at 8 of 9 Idaho EOs located on BLM lands since 1981 (Mancuso and Shepherd 2008); and 2) the species is currently documented to occur in EOs throughout its current range in each of three geographic areas – Salmon, Snake, and Imnaha river canyons. These EOs are highly fragmented and most are less than 1 acre in size with a small number of individuals. The two primary threats at EOs are non-native invasive species and wildfires. Six of the 13 EOs have had wildfires and one or more non-native plants have been reported at most EOs.

A number of conservation actions have been implemented to protect the species from threats including reduction of livestock grazing and restriction of recreational use. The BLM is currently updating their Land Use Plans which will likely afford additional conservation measures, however, non-native species and wildfire are pervasive and difficult to alleviate and

will require intensive management with an uncertain probability of success. Additionally, the habitat where this species occurs is found on generally steep slopes, and accessibility to control non-native species and wildfire will be difficult. For these reasons, we believe *Mirabilis macfarlanei* remains in danger of extinction throughout its range and recommend it be retained as threatened.

3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened
- Uplist to Endangered
- Delist (*Indicate reasons for delisting per 50 CFR 424.11*):
 - Extinction
 - Recovery
 - Original data for classification in error
- No change is needed

3.2 New Recovery Priority Number: 11

Brief Rationale: Using definitions from 48 FR 43099 – Endangered and Threatened Species Listing and Recovery Priority Guidelines, we have determined that the *Mirabilis macfarlanei* is currently not in certain and immediate threat of extinction because of a rapid population decline or habitat destruction and does not warrant a high priority number. The species faces a moderate degree of threat, and threats to its habitat are primarily from non-native species and fire. Additionally, using the definitions in 48 FR 43099 for the recovery potential of *Mirabilis macfarlanei*, the biological and ecological limiting factors for the species are not well understood, and threats to the species existence i.e., non-native species and wildfire, are pervasive and difficult to alleviate. Addressing some threats (e.g., non-native species) will require intensive management with an uncertain probability of success.

3.3 Listing and Reclassification Priority Number, if reclassification is recommended

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (regardless of current classification) Priority Number: ____

Brief Rationale:

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

In our Recovery Needs Assessment for *Mirabilis macfarlanei* (U.S. Fish and Wildlife Service 2007), we identified six actions that would contribute to the species recovery and delisting. These include:

- Establish an interagency technical working group.
- Develop recovery management agreements with FS and BLM for the control of non-native invasive plant species. Additionally, there may be a need to develop site specific management and monitoring plans because each EO has unique threats associated with them.
- Develop and implement a range-wide monitoring strategy. Mancuso and Shepherd (2008) recommend that any modification to the existing BLM *Mirabilis macfarlanei* monitoring program must be compatible with the long-term quantitative dataset already in place as much as possible. Monitoring information collected the past 20+ years is too valuable to discard or use in only a minimal fashion. Any modifications to the Forest Service monitoring program should also be able to integrate the pre-existing dataset as much as possible.
- Construct fences at EOs: Specific fencing needs to be determined as site specific plans are developed.
- Develop and implement studies to assess general life history and ecological needs.
- Conduct a population viability analysis for *Mirabilis macfarlanei* only if it is feasible given the clonal nature of the species and if the technical working group recommends and supports it.

Additionally, habitat restoration and maintenance activities should be monitored on a yearly basis to control identified threats to the species including non-native plant invasion, trampling, grazing, road/trail use and development, and others. It is anticipated that an aggressive invasive non-native plant control and habitat restoration program will need to be implemented in perpetuity to ensure its control within and among *Mirabilis macfarlanei* EOs. To date, there are no known treatments to reduce or eliminate *Bromus tectorum*, *Centaurea solstitialis*, and other non-native plant species where they have been well established.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of *Mirabilis macfarlanei*

Current Classification: Threatened

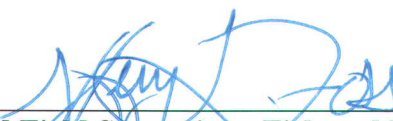
Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

Review Conducted By: Ray Vizgirdas, Susan Burch

FIELD OFFICE APPROVAL:


_____ Date 1-30-09

Lead Field Supervisor, Fish and Wildlife Service

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record and should add a signature line for the cooperating Field Office supervisor.


_____ Date 2/23/09
Field Supervisor, Fish and Wildlife Service