# 5-YEAR REVIEW

## Spalding's catchfly *(Silene spaldingii)*
## Current Classification: Threatened

Photo credit: Kendrick Moholt

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

**September 2020**

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# Spalding's catchfly *(Silene spaldingii)*

## 1.0 GENERAL INFORMATION

### 1.1 Reviewers

**Lead Region/Field Office:**
Region 9 / Idaho Fish and Wildlife Office, Boise, Idaho

**Cooperating Field Offices:**
La Grande Field Office, Oregon
Washington Fish and Wildlife Office, Eastern WA Field Office, Washington
Montana Fish and Wildlife Office, Helena Ecological Services Office, Montana

**Name of Reviewer(s):**
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Karen Newlon, Biologist, (406) 449-5225

### 1.2 Methodology used to complete the review:

This review was conducted by staff of the Idaho Fish and Wildlife Office (IFWO) of the U.S. Fish and Wildlife Service (USFWS) beginning on January 1, 2018 and reviewed by the Oregon, Washington, and Montana Field Offices. The review was based on current, available information since the last 5-year review for Spalding's catchfly (*Silene spaldingii*) (USFWS 2009). We have also considered information provided by individuals of an interagency Spalding's catchfly Technical Team. This Team includes individuals from multiple agencies and organizations. The document was also reviewed by the Chief of Classification and Recovery before submission to the Field Supervisor for approval.

### 1.3 Background:

**1.3.1 FR Notice citation announcing initiation of this review:** February 12, 2016. Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 76 Species in Hawaii, Oregon, Washington, Montana, and Idaho. 81 FR 7571.

**1.3.2 Listing history**

**FR notice:** Spalding's catchfly was listed as threatened (66 FR 51598), under the Endangered Species Act of 1973, as amended (16 U.S. C. 1531 *et seq.*).

**Date listed:** October 10, 2001

**Entity listed:** Spalding's catchfly (*Silene spaldingii*)

**Classification:** Threatened

**1.3.3 Associated rulemakings**: NA

**1.3.4 Review History:** January 30, 2009. Spalding's catchfly (*Silene spaldingii*), 5-Year Review: Short Form Summary. Recommendation: No change in classification needed.

**1.3.5 Species' Recovery Priority Number at start of 5-year review:** Spalding's catchfly have been assigned a recovery priority number of 8C on a scale of 1C (highest) to 18 (lowest), indicating a moderate degree of threats or impacts, high potential for recovery, potential conflict with economic activities, and its taxonomic status as a full species.

**1.3.6 Recovery Plan or Outline**

**Name of plan or outline**: Recovery Plan for Spalding's catchfly (*Silene spaldingii*)

**Date issued**: September 6, 2007

**Dates of previous revisions, if applicable**: NA

## 2.0 REVIEW ANALYSIS

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

Not applicable as the DPS policy only applies to vertebrates.

### 2.2 Recovery Criteria

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

_X_ **Yes**

___ **No**

**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?**

_X_ **Yes**

___ **No**

**2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?**

_X_ **Yes**

___ **No**

**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:**

The Recovery Plan for Spalding's catchfly (Recovery Plan) outlines objective criteria and recovery measures considered necessary for recovery and/or protection of this species. In this 5-year review, we will focus our analysis on the best available data as they relate to the eight delisting criteria (see below for a full description of each delisting criteria). This approach was chosen based on the results of the Review Analysis. Identified threats at the time of listing included invasive nonnative plants, problems associated with small geographically isolated populations, changes in the wildfire regime and wildfire effects, land conversion associated with urban and agricultural development, adverse grazing and trampling by domestic livestock and native herbivores, herbicide and insecticide spraying, off-road vehicle use, insect damage and disease, impacts from prolonged drought and climate change, and inadequacy of existing regulatory mechanisms.

No new threats and no significant new information regarding the species' biological status have become available since the last 5-year review conducted in January 2009 (USFWS 2009).

The intent of the Recovery Plan is to guide implementation of the recovery of Spalding's catchfly. The ultimate goal of the Recovery Program as a whole is to eliminate or eradicate threats to the persistence of, and restore populations of threatened or endangered species to the point at which the protections of the Endangered Species Act are no longer necessary and the species may be delisted. The Recovery Plan for Spalding's catchfly, published in September of 2007, guides recovery efforts for this species (USFWS 2007). The Recovery Plan identifies eight delisting criteria (discussed below) and numerous associated recovery actions designed to

help meet the delisting criteria (see Section III. Recovery Program, pp. 67-72 in the Recovery Plan for a full list of the recovery actions).

The goal of the recovery program is to recover Spalding's catchfly to the point where it can be delisted, *i.e.,* to remove the species from threatened status. The primary objectives of the Recovery Plan are to reduce or eliminate the threats to the species, and protect and maintain multiple reproducing, self-sustaining populations distributed across the species range sufficient to ensure the long-term persistence of the species (USFWS 2007). The Recovery Plan divides occupied habitat into five physiographic regions: (1) the Palouse Grasslands in west-central Idaho and southeastern Washington; (2) the Channeled Scablands in eastern Washington; (3) the Blue Mountain Basins in northeastern Oregon; (4) the Canyon Grasslands of the Snake River and its tributaries in Idaho, Oregon, and Washington; and (5) the Intermontane Valleys of northwestern Montana. These regions are distinctive from one another in climate, vegetation, historical fire frequencies, and soil characteristics.

The Recovery Plan emphasizes conservation of larger populations of Spalding's catchfly, which are referred to as Key Conservation Areas (KCA) (USFWS 2007). Key Conservation Areas are defined in the Recovery Plan as significant populations and habitats of Spalding's catchfly that have been identified as the primary areas for recovery actions, protection, and conservation by members of the Spalding's catchfly Technical Team. A KCA possesses the following qualities:

- Composed of intact habitat (not fragmented), preferably 40 acres in size or greater (in some regions, such as the already severely fragmented Palouse Grasslands, reaching a minimum size of 40 acres of contiguous habitat may not be feasible)
- Native plants comprise at least 80 percent of the canopy cover of the vegetation community
- Adjacent habitat is sufficient to support pollinating insects
- Habitat is of the quality and quantity necessary to support at least 500 reproducing individuals of Spalding's catchfly

The protection and management of the KCAs forms the foundation of the recovery strategy for Spalding's catchfly, since Spalding's catchfly cannot be recovered and delisted if its habitat is not conserved and restored. In general, the delisting targets include the establishment and/or maintenance of 27 KCAs, with at least 500 reproducing Spalding's catchfly individuals in each, and those populations showing stable or increasing trends for at least 20 years, in intact habitat throughout its historical range. The number of KCAs for each physiographic region was set at a minimum of 3 to preserve genetic diversity. Some regions have more KCAs to reflect the number of populations needed to maintain connectivity and, to the extent possible, preserve historical distribution across the estimated remaining available potential habitat. The number of KCAs in each physiographic region, as determined in the Recovery Plan, are as follows: 5 within the Blue Mountain Basins, 7 within the Canyon Grasslands, 8 within the Channeled Scablands, 4 within the Intermontane Valleys, and 3 within the Palouse Grasslands.

The Spalding's catchfly Technical Team (Technical Team) is the driving force behind implementation of the Recovery Plan. The Technical Team is composed of over 40 individuals across the four states where Spalding's catchfly is known to occur within the United States, with

representatives from State, Federal and local agencies; Tribes; nonprofits; universities; species experts; private landowners, and private industry. Recovery of this species is not possible without the commitment and conservation efforts of the individuals and associated organizations and agencies that make up this Technical Team.

Convening annual meetings of the Spalding's catchfly Technical Team is an Action Item in the Recovery Plan (Action Number 2.12). The Technical Team meets in person annually for a two-day meeting which serves as a forum to discuss, coordinate, evaluate, and prioritize recovery actions at the KCAs, and share data, experiences, and other information among team members. In addition, annual interim statewide conference calls are conducted as needed for state partners to check in and discuss progress toward current conservation actions, identify potential funding opportunities for future actions, and for general annual statewide coordination. Since development of the Recovery Plan, the Technical Team has been actively implementing recovery actions identified in the Plan, which are highlighted in this review. One of the primary efforts of the Technical Team has been fostering support for, gathering information at, and initiating conservation actions within the potential KCAs already identified in the Recovery Plan (Action Numbers 1.1.1-1.5.5) and working with partners to identify new potential KCAs through survey efforts and collaboration (Action Numbers 1.1.2-1.4.2), which will be discussed further under Delisting Criteria 1.

Below are the delisting criteria as identified in the Recovery Plan (USFWS 2007) with a summary of the status of each criterion:

***Criterion 1*: Twenty-seven populations, with at least 500 reproducing *Silene spaldingii* individuals in each with intact habitat, range-wide at key conservation areas distributed throughout the 5 identified physiographic provinces as follows: 5 within the Blue Mountain Basins, 7 within the Canyon Grasslands, 8 within the Channeled Scablands, 4 within the Intermontane Valleys, and 3 within the Palouse Grasslands.**

*Status*: Twenty-two areas were identified in the Recovery Plan as having the potential to serve as KCAs (4 in the Blue Mountain Basins, 7 in the Channeled Scablands, 5 in the Canyon Grasslands, 3 in the Palouse Grasslands, and 3 in the Intermontane Valleys). Since the Recovery Plan was signed in 2007, the Spalding's catchfly Technical Team has been working together to: 1. secure partnerships at each of these potential KCAs in order to work toward meeting the KCA criteria, 2. identify or create additional large populations to help reach the goal of having 27 KCAs, and 3. implement conservation measures at these KCAs.

During this time, partnerships were established for 20 of the 22 potential KCAs identified in the Recovery Plan (two of the areas identified for the Palouse Grasslands, Pitt Cemetery and the Kramer Palouse Natural Area, are not included at this time due to a combination of factors including low Spalding's catchfly populations numbers, ownership questions, and habitat quality and quantity). In addition, 9 new areas were identified as potential KCAs. These include Timber Pasture in the Blue Mountain Basins; Warner Gulch, Lower Imnaha, and Mud Springs in the Canyon Grasslands; South Sprague, Philleo Lake, and Turnbull in the Channeled Scablands; Sullivan Gulch in the Intermontane Valleys; and Steptoe Butte in the Palouse Grasslands.

This would bring the current number of KCAs to 29. However, survey efforts since 2009 have located additional Spalding's catchfly occurrences (see Section 2.3.1.2) and in some cases, the discovery of additional plants between KCAs enabled us to merge multiple KCAs into single larger KCA (if the occurrences are within 1.6 kilometers (1 mile) of one another) and/or expand the boundaries of KCAs. After looking at population locations and considering multiple other factors including land ownership and management, the Technical Team decided to merge 10 of the KCAs, which reduced those 10 KCAs to only 5 KCAs. These include:

1. The Telford KCA (located in the Channeled Scablands physiographic region in Washington) which now includes the previously individual KCAs referred to as Telford, Swanson Lake, and Twin Lakes in the Recovery Plan;
2. The Crab Creek KCA (also located in the Channeled Scablands physiographic region in Washington) which now includes the previously individual KCAs referred to as Crab Creek and Rocky Ford in the Recovery Plan;
3. The Turnbull KCA (also located in the Channeled Scablands physiographic region in Washington) which includes the previously individual KCAs referred to as Turnbull and Philleo Lake (both of which were identified subsequent to the Recovery Plan being signed);
4. The Craig Mountain KCA (located in the Canyon Grasslands physiographic region in Idaho) which now includes the previously individual KCAs referred to as Craig Mountain and Garden Creek in the Recovery Plan;
5. The Center Ridge KCA (also located in the Canyon Grasslands physiographic region in Idaho) which now includes the previously individual KCAs referred to as Center Ridge in the Recovery Plan and Mud Springs, which was identified subsequent to the Recovery Plan being signed.

Consequently, the number of KCAs was reduced from 29 to 23. However, we still feel this is adequate for recovery given the merging of KCAs ultimately results in larger, more robust KCAs as more extensive populations are generally more secure and less prone to extirpation than those that are smaller (Shaffer 1981). While the Recovery Plan emphasizes protection and management of all existing Spalding's catchfly populations, these 23 KCAs are where the Technical Team has and will be focusing our recovery actions, protection, and conservation. Each of these KCAs has a lead identified that is an active member of the Technical Team and is working toward meeting the recovery criterial at their respective KCAs.

It should be noted that the Technical Team has identified 4 additional populations that could potentially serve as KCAs. These include one potential area in the Intermontane Valleys, one in the Palouse Grasslands, one in the Channeled Scablands, and one in the Canyon Grasslands. With the exception of the population in the Intermontane Valleys, none of these populations currently has 500 or more Spalding's catchfly plants. We are currently pursuing options to work with partners at these locations, which includes taking into consideration factors such as long term conservation potential for the site; potential for the site to support a larger population size and feasibility of increasing the populations through survey and/or augmentation; and evaluation of habitat quality and potential to control threats, such as presence of invasive nonnative plant species.

The 23 KCAs currently identified are distributed throughout the 5 physiographic regions as follows (the numbers in parentheses are the amount of KCAs required as per the Recovery Plan for each physiographic region):

- 4 (of 4) in the Intermontane Valleys
- 5 (of 5) within the Blue Mountain Basins
- 6 (of 7) in the Canyon Grasslands

  This reduction in KCAs (compared to the number identified in the Recovery Plan) is the result of merging 4 individual KCAs into 2 KCAs.

- 6 (of 8) in the Channeled Scablands

  This reduction in KCAs (compared to the number identified in the Recovery Plan) is the result of merging 7 individual KCAs into 3 KCAs.

- 2 (of 3) in the Palouse Grasslands

As discussed previously, the Recovery Plan calls for 3 populations in the Palouse Grasslands physiographic region with at least 500 Spalding catchfly plants in a matrix of native grassland vegetation. We have currently only identified 2 out of 3. However, locating another large, intact area in the Palouse Grasslands physiographic region that can potentially support a third Spalding's catchfly KCA might be a challenge due to the existing conversion and fragmentation of the Palouse Grasslands. The Recovery Plan recognized the potential challenges of securing 3 KCAs in the Palouse due to the limited availability of habitat within this region. Of the 5 physiographic regions, the Palouse Grasslands have been the most heavily impacted by agricultural development with few large intact parcels of lands remaining. The Recovery Plan (p. viii) stated "Given the uncertainty associated with creating new key conservation areas (*i.e.* transplanting) and the limited available habitat within the Palouse physiographic region, the delisting criteria of the 3 key conservation areas within the Palouse Grasslands will be re-evaluated within 10 years (by the year 2017) based on new information." In part to help reevaluate this criterion, two primary actions were undertaken: the Palouse Grassland inventories (recovery task 1.5.2.) and a range-wide genetic analysis (recovery task 2.5.8).

The Palouse Grassland Inventory projects are described in detail in Section 2.3.1.6. These efforts were designed to find, document, and conserve Palouse Grasslands remnants. As discussed in that section, the Latah County project (Hill et al. 2012) has been completed and two similar projects modeled after the Latah project are currently underway: a prairie mapping project in Nez Perce County (Pekas et al. 2020) and a prairie remnants project in the Southern Palouse that focused on the Nez Perce tribal land (Sondenaa and McClarin, 2019). The Latah inventory effort has both helped provide the information needed to initiate conservation of the Paradise Ridge KCA and garner partner and private landowner support for these efforts. However, the Latah inventory did not identify any additional KCAs. It is unknown at this time if

the results of the Nez Perce County project will result in the identification of any more Palouse Grasslands KCAs. However, the Southern Palouse project has identified an additional potential Palouse Grasslands KCA (See Section 2.3.1.6).

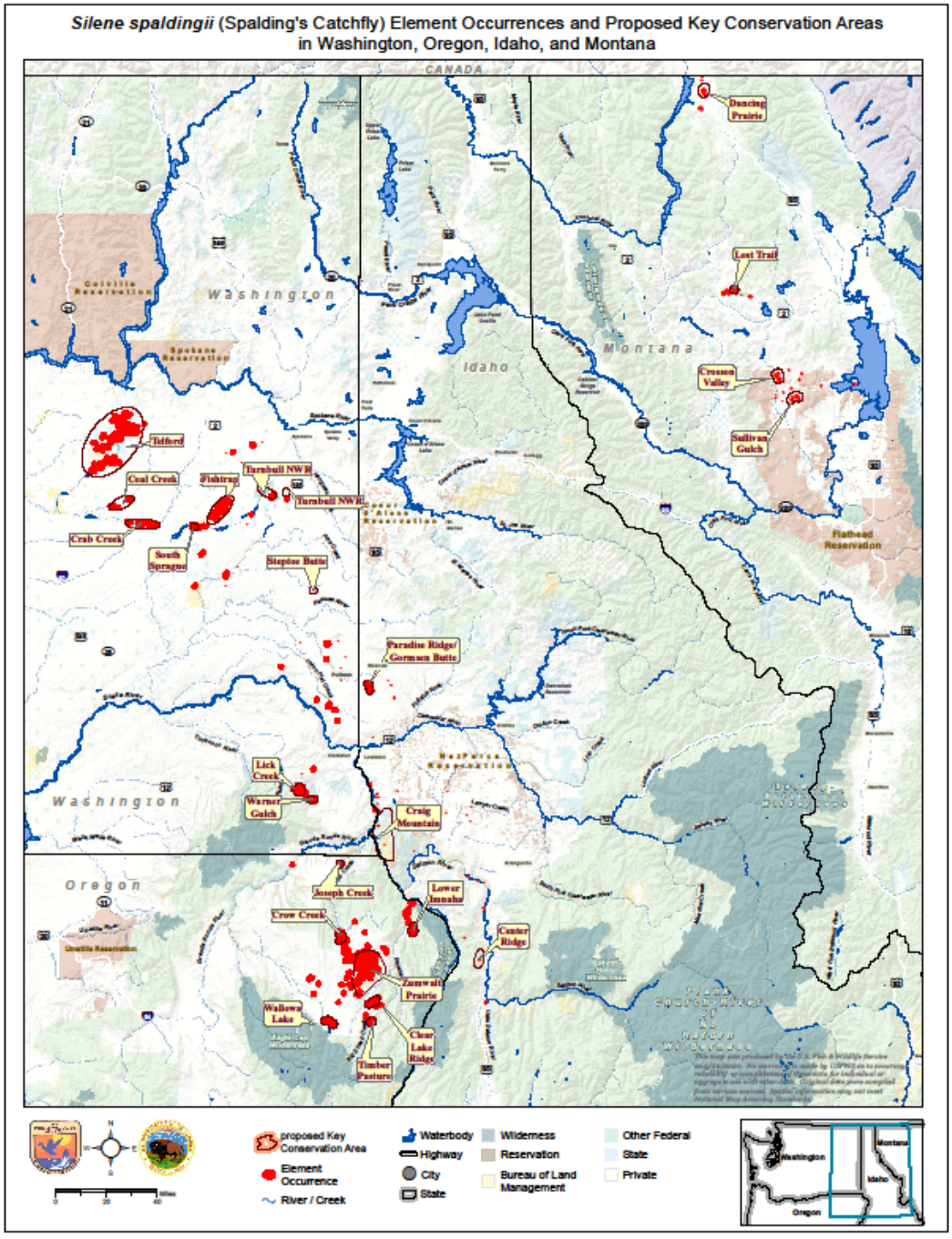


Figure 1: Spalding's catchfly Element Occurrences and proposed Key Conservation Areas.

The range-wide genetic analysis is discussed in detail in Section 2.3.1.3. Results of this study suggest that there is little evidence for genetic differentiation among the Channeled Scablands, Palouse Grasslands, Blue Mountain Basins and the Canyon Grasslands physiographic regions.

These results could have implications for recovery planning for the Palouse Grasslands physiographic region. Protecting existing large populations throughout as much of the range of the species is critical to recovery of this species and remains a priority of the Technical Team. However, results of this study did not reveal unique genetic diversity in the Palouse Grasslands physiographic region, suggesting that from a genetic standpoint Spalding's catchfly plants remaining in this area are just as closely related to those in other parts of the main range as they are to each other (Lesica et al. 2016). Recognizing the challenges of finding an additional large Spalding's catchfly population in the Palouse and given the results of the genetic study, recovery can likely be achieved with less than 3 KCAs in the Palouse (as recognized in the Recovery Plan), given an adequate number of KCAs are distributed throughout the entire range of the species as identified in the Recovery Plan and in this 5-year review.

As mentioned above, the Recovery Plan calls for KCAs to have populations with greater than 500 plants. Of the 23 KCAs, 18 currently have at least 500 Spalding's catchfly individuals, with 13 of these having over 1,000 plants. Two of these, Dancing Prairie and Zumwalt, have over 10,000 plants each. In order to fully meet this criteria population numbers will have to increase on the remaining KCAs with less than 500 plants. Additional survey and inventory efforts may result in documentation of more plants within some of these KCAs, although many of them have already been extensively surveyed. Therefore, population increases will likely have to be through population growth. Population growth can occur through natural or human-mediated recruitment. Human-mediated population enhancement can potentially result in more rapid population growth than natural recruitment. Opportunities to either supplement or develop populations in areas with good habitat have been and are currently being pursued.

Of the 5 KCAs with less than 500 plants, 4 have active efforts to reintroduce or augment Spalding's catchfly to increase population numbers. These include Paradise Ridge, Steptoe Butte, South Sprague, and Turnbull. The fifth KCA with less than 500 plants is the Joseph Creek KCA located on Nez Perce tribal land in Oregon. This KCA currently has 258 plants. Due to the remoteness and extreme terrain, outplanting Spalding's catchfly plants in this area is not feasible. Abundant surveys have been completed at the Joseph Creek KCA; however, surveys are still being done and it is possible that these efforts could document additional plants and increase population numbers at this KCA. The four outplanting areas are summarized in Section 2.3.1.2.

*Criterion 1 Status Summary*: The recovery strategy for this species relies heavily on conserving larger Spalding's catchfly populations, increasing connectivity of the populations, and preserving representative populations from across the range of the species. Although we currently have less than the 27 KCAs originally called for in the Recovery Plan, many of our KCAs are now larger (boundaries have expanded and/or plant numbers have increased) and are presumably more resistant and resilient while still being adequately distributed throughout the range of the species. However, of the 23 KCAs only 17 have 500 or more Spalding's catchfly plants at this time. Therefore, this delisting criterion has not yet been met. As described above in Section 2.2.3, KCAs must meet additional requirements in addition to the minimum number of plants, which include various habitat requirements. The status of those additional requirements will be discussed below under their specific delisting criteria. See Table 1 for a summary of the status of all KCAs.

Table 1: Spalding's catchfly KCA Summary.

| Name & Location | Ownership | # of Plants | KCA acreage[1] | Monitoring Established | Trend Data Available | HMP | Invasives Treated | Prescribed Fire |
|---|---|---|---|---|---|---|---|---|
| **Idaho** | | | | | | | | |
| Craig Mountain | BLM, IDFG, TNC | 4,774 to 15,000[2] | 3,500 | Yes | Down | No | No | No<br>Natural fire 2001, 2007, 2014, 2017 |
| Paradise Ridge | Private | Reintroduction Site | 35 | No | No | Draft | Limited | No |
| Center Ridge | Nez Perce NF | >3,000 | 75 | Yes | No | No | Yes | No<br>Natural fire 2015 |
| **Montana** | | | | | | | | |
| Sullivan Gulch | Confederated Salish and Kootenai Tribes | 749 | 2,000 | Yes | No | No | No | No |
| Crosson Valley | Confederated Salish and Kootenai Tribes | 527 | 2,900 | Yes | No | No | No | No |
| Dancing Prairie | TNC | >10,000 | 680 | Yes | Down | Yes | Yes | Yes |
| Lost Trail | USFWS, MT State Trust Lands | ~1,000 | 9,225 | Yes | No | Drafting | No | Yes |
| **Oregon** | | | | | | | | |
| Zumwalt | TNC | >46,000 | 32,792 | Yes | Stable | No | Yes | Yes |
| Clear Lake Ridge | TNC, Private | 648 | 812 | Yes | Stable | No | Yes | No |
| Joseph Creek | Nez Perce tribal land | 258 | 10 | Yes | Stable | Yes | Limited | No |
| Crow Creek | Wallowa-Whitman NF, Private | 2,385 | 2,213 | Yes | Stable | No | Yes | No |
| Wallowa Lake | Private, National Park Service | 1,509 | 3,776 | Yes | No | Draft | General area | No |
| Timber Pasture | Wallowa-Whitman NF, Private | >500 | 114 | Yes | No | No | Yes | No |
| Lower Imnaha | Wallowa-Whitman NF, Private | 2,385 | 10,000 | No | No | No | No | No |
| **Washington** | | | | | | | | |
| Warner Gulch | WA State DFW, DNR | >1,000 | 2,000 | Yes | No | Drafting | Yes | No<br>Natural Fire 2008 |
| Turnbull | USFWS | ~200 Outplanting Site | 9,500 | Yes | Stable | Needs update | Yes | Yes |
| Lick Creek | Umatilla NF | 1,200 | 114 | Yes | No | No | General area | Experimental burn planned |
| Steptoe Butte | Private, WA State Park | Reintroduction Site | 608 | No | No | No | Limited | No |
| Greater Telford | Spokane District BLM, WDFW | >5,000 | 40,000 | Yes | No | No | No | No<br>Natural Fire 2020 |
| Coal Creek | Spokane District BLM | >1,000 | 1,170 | Yes | No | No | No | No |
| Crab Creek | Spokane District BLM | 2,200 | 6,519 | No | No | No | No | No<br>Natural fire 2016 |
| Fishtrap | Spokane District BLM | 600 | 9,230 | Yes | No | No | No | No |
| South Sprague | Spokane District BLM | 400 Outplanting Site | 809 | Yes | No | No | No | No |

[1] KCA acreages are estimates.

[2] 4,774 is an actual count of a portion of the population; 15,000 is an upper estimate of the population which includes suitable, unsurveyed areas.

***Criterion 2*: All 27 key conservation areas of *Silene spaldingii* are composed of at least 80 percent native vegetation (by canopy cover), have adjacent habitat sufficient to support pollinating insects, and are not fragmented.**

*Status:* Quantitative vegetation data is not yet available at the KCAs, therefore this delisting criteria has not yet been met. Data collection to confirm these requirements should be included in the individual KCA Habitat Management Plans (HMPs). See HMP criterion below.

***Criterion 3*: Populations of *Silene spaldingii* at key conservation areas demonstrate stable or increasing population trends (less than a 10 percent chance that the population is declining) for at least 20 years using consistent range-wide long-term monitoring methodologies.**

*Status:* Currently 19 of the 23 KCAs have monitoring programs in place. Funding is in place for the remaining 3 additional KCAs to establish monitoring; however, the timing of the initiation will depend on the success of the outplantings at those KCAs. Most of the monitoring has only recently been initiated (within the last 2-5 years), and therefore trend data is currently limited. Of the 6 KCAs with analyzed trend data, preliminary results suggest that 4 have stable trends and 2 have downward trends. See Section 2.3.1.2 for a description of the range-wide monitoring guidelines. Because 20 years of trend data have not been collected at all KCAs, this criterion has not yet been met.

***Criterion 4*: Habitat management plans have been developed and implemented for all key conservation areas. These management plans will provide for the protection of *Silene spaldingii* habitat, and will also protect the ecosystem by addressing conservation of other rare species, reducing the identified threats (*e.g.*, off-road vehicle use, adverse grazing and trampling by wildlife and domestic stock, herbicide application, etc.), protecting pollinators, enacting monitoring strategies, incorporating integrated pest management strategies, and incorporating appropriate fire management activities.**

*Status:* It is anticipated that each individual HMP will include site-specific conservation actions that will be designed to address the individual needs and threats at each unique KCA. Best available information and an adaptive management approach will be used to develop conservation actions. Currently, only 7 KCAs have draft or final HMPs or conservation plans in place that adequately address long-term conservation measures for Spalding's catchfly as required per the Recovery Plan. Therefore, this delisting criterion has not been met.

***Criterion 5*: Invasive nonnative plants with the potential to displace *Silene spaldingii* have been continually controlled or eradicated within a 100-meter (328- foot) radius of all *S. spaldingii* populations within key conservation areas (certain invasive plants that are established and difficult to eradicate, as detailed for each physiographic province may be controlled within 25 meters (82 feet) of *S. spaldingii* populations).**

*Status:* Invasive nonnative plant species are in or adjacent to all of the KCAs. Efforts to control invasive nonnative plants are occurring at varying degrees at 12 KCAs across the range of the species, although quantitative effectiveness monitoring data are not available at the majority of these KCAs. Therefore, this delisting criterion has not yet been met. Data collection to confirm

these requirements should be included in the individual KCA HMPs. See HMP criterion above.

***Criterion 6*: Prescribed burning is conducted, whenever possible, to mimic historical fire regimes within a particular physiographic region in *Silene spaldingii* habitat.**

*Status:* It has been suggested that the reestablishment of a traditional fire regime may benefit Spalding's catchfly. The effect of fire (wildfire and prescribed fire) on Spalding's catchfly and its habitat has been studied in the Intermontane Valleys physiographic regions in Montana (Lesica 1999, Lesica and Martin 2003), where prescribed fire was conducted, and the Canyon Grasslands physiographic regions in Idaho (Menke 2003, Menke and Muir 2004, Hill 2012, Hill et al. 2014, Hill and Garton 2015, Hill and Garton 2017), which occurred as a result of natural wildfire. At both sites, fires did not kill Spalding's catchfly adults. At the Intermontane Valleys study site in Montana, Spalding's catchfly seedling recruitment was significantly higher after a fire-caused reduction of substantial litter accumulation (Lesica 1999). However, results from the Canyon Grasslands study showed no initial increase in germination or recruitment (Hill and Garton 2015), with recruitment declining in each of the three years following the fire. Fire reduced biomass and ground litter, caused mortality of mosses and lichens, and darkened the soil surface, which can increase soil temperature and evaporation and decrease soil moisture availability (de Jong and MacDonald 1975, Defossè and Robberecht 1996). Germination and recruitment did increase markedly as mosses and lichens began to re-establish three to four years post-fire. In a number of investigations, nonnative plant invasions have increased after fires and may deleteriously affect Spalding's catchfly (Lesica and Martin 2003, Hill et al. 2003, Hill and Weddell 2003, Menke 2003). As per the Recovery Plan, further research is needed to better determine when and where prescribed fire should occur outside of Montana.

No other studies of the effect of fire on Spalding's catchfly have been completed. Several prescribed fire projects have been initiated or planned. For example, a 35 acre prescribed fire was conducted in 2019 on the western most Spalding's catchfly population within the Lost Trail KCA in Montana, which is located in the Intermontane Valleys physiographic region. Monitoring will occur as part of that prescribed fire project. A study is being conducted at the plant increase sites within the Turnbull KCA, located with the Channeled Scablands physiographic region (See Section 2.3.1.2). In addition, pre and post fire monitoring will be conducted as part of the planned Asotin Prescribed Burn Project at the Lick Creek KCA, located on the Umatilla National Forest in the Canyon Grasslands physiographic region (P. Brooks, pers. comm. 2019). Natural fires also provide a monitoring opportunity. For example, on the Nez Perce National Forest, portions of the Center Ridge KCA (located in the Canyon Grasslands physiographic region in Idaho) burned in a wildfire in 2015 and because monitoring plots were already established, there is an opportunity for post-fire monitoring (M. Hays, *in litt.* 2018). Likewise, portions of the Telford KCA burned in a wildfire in 2020 (M. Eames, per. comm. 2020). This KCA also has existing monitoring sites established, potentially providing another opportunity to analyze pre and post fire data.

While we will continue to learn from these studies and we will continue to adaptively manage fire as appropriate for this species, this delisting criteria has not yet been met.

***Criterion 7*: Seed banking occurs *ex situ* first at all smaller *Silene spaldingii* populations (not key conservation areas or potential key conservation areas) and second at all larger *S. spaldingii* populations (key conservation areas or potential key conservation areas) to preserve the breadth of genetic material across the species' range.**

*Status:* At the time the Recovery Plan was signed, seed had been collected from 6 populations, all of which were relatively large. Since then, additional seeds have been collected at the Joseph Creek KCA and the Wallowa Lake KCA, both located in Oregon, and Asotin Creek populations located in Washington, all deposited at the Rae Selling Berry Seed Bank at Portland State University, Portland, Oregon. In addition, seed banking occurred at the Turnbull KCA in Washington, with seed stored at the University of Washington Miller Seed Vault. While progress is being made, this delisting criterion has not been met since seed has not been collected at enough occurrences to meet this delisting criteria. However, IFWO Recovery funding has been obligated to conduct additional rangewide seed collections at numerous additional Spalding's catchfly populations for seed banking to help meet this criterion, with seed collection scheduled to occur in 2020 and 2021.

***Criterion 8*: A post-delisting monitoring program for the species will be developed and ready for implementation.**

*Status:* A plan for monitoring the species for a minimum of 5 years after delisting will be developed at the time of delisting.

## 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:

Photo credit: Mike Hays, Spalding's catchfly habitat (Center Ridge KCA).

Spalding's catchfly is a long-lived, herbaceous perennial plant. It is a regional endemic found predominantly in bunchgrass grasslands and sagebrush-steppe, and occasionally in open pine communities in Idaho (Idaho, Latah, Lewis and Nez Perce counties), northeastern Oregon (Wallowa County), Montana (Lincoln, Flathead, Sanders, and Lake counties), Washington (Adams, Asotin, Lincoln, Spokane, and Whitman counties) and barely extending into British Columbia, Canada (see Figure 1 for current distribution). There are currently 139 known Spalding's catchfly occurrences rangewide (see Section 2.3.1.2 for a full description). The plant is found at elevations ranging from 365 to 1,615 meters (1,200 to 5,300 feet), usually in deep, productive loess soils (fine, windblown soils) and glacial soils (for example at the Dancing Prairie Preserve

in Montana). Plants are generally found in swales or on northwest- to northeast-facing slopes where soil moisture is relatively higher, but can occasionally be found on any aspect.

Photo credit: Kendrick Moholt, Spalding's catchfly flowers.

Spalding's catchfly is a member of the pink or carnation family, the Caryophyllaceae. It emerges in spring from a caudex (a persistent stem just beneath the soil surface) surmounting a taproot that can be up to 85 cm long (Menke 2003) and then withers to the ground every fall (USFWS 2007). Typically, Spalding's catchfly blooms from mid-July through August, but it can begin blooming in mid-June and continue into September and even October depending on location and seasonality. Flowers are inconspicuous, with a green calyx and predominately white petals nearly concealed by the calyx (Hitchcock et al. 1964). Stems may be up to 60 cm tall, with 4 to 7 pairs of opposite leaves that attach to the stem at swollen nodes (Lesica 1997, Hill and Gray 2004). The entire plant is covered in sticky gland-tipped hairs. Fruits mature from August to October and one plant may have flowers, fruits and mature capsules at the same time. Plants reproduce by seed only. Plants have been observed living as long as 25 years (Lescia 1997), and likely live longer, although no data beyond 25 years is available. Spalding's catchfly plants emerge in the spring as one of three different forms: 1) a rosette (having only basal leaves), 2) a vegetative (non-flowering) stemmed plant, or 3) a reproductive (flowering/fruiting) stemmed plant.

Photo credit: Janice Hill, Spalding's catchfly rosette.

Individuals of Spalding's catchfly can also remain dormant or appear aboveground only briefly for one or more consecutive years (Lesica and Steele 1994). Rates of dormancy appear to vary however. At the Dancing Prairie site in Montana, it has been shown that in any given growing season up to one-third of Spalding's catchfly plants will remain dormant or go undetected (Lesica and Crone 2007). Similarly, a substantial but highly variable number of dormant plants were documented at one site in Oregon on the Zumwalt Prairie preserve (Taylor et al. 2012). Rates of dormancy appear to be lower at the Craig Mountain site in Idaho, with rates averaging less than 10 percent over 10 years of study (Hill and Garton 2015). See further discussion on rates of dormancy and other demographic results under Section 2.3.1.2.

For detailed information regarding the species' listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=Q1P9). Please refer to the Recovery

Plan for *Silene spaldingii* (Spalding's catchfly) (USFWS 2007) and the previous 5-year review for *Silene spaldingii* (USFWS 2009), for additional review of the species' status, including biology and habitat, threats, and management efforts, both of which can also be found on ECOS.

**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**:

Abundance

Photo credit: Jannis Jocius, Population Census at Wallowa Lake KCA.

Inventories for Spalding's catchfly continue to be conducted on lands managed by the Federal government and some state, tribal and private lands across its range where the plant currently resides or where there is suitable habitat (Action Numbers 2.6.1-2.6.3). For example, in Wallowa County, Oregon extensive targeted surveys conducted from 2018 to 2019 formally documented known, but previously unreported Spalding's catchfly populations, as well as new populations on previously unsurveyed areas of suitable habitat on both public and private land. Through these efforts, a total of 778 plants on 33 sites were documented on private lands in Wallowa County, Oregon. Another effort conducted by the Nez Perce National Forest surveyed a total of 1,584 acres in Hells Canyon in 2017 and 2018. This resulted in documenting 4 new Spalding's catchfly occurrences with a total of 452 Spalding's catchfly plants and documentation of the habitat quality at these sites as poor with high weed cover (Hays 2019). Surveys were also conducted as part of the Palouse Grassland Remnant projects (Section 2.3.1.6). For example, during the Latah County remnants project in Idaho, 2 previously unknown occurrences of Spalding's catchfly were located, with 29 total individuals documented (Hill et al. 2012). As part of the Southern Palouse remnants project four new Spalding's catchfly occurrences were documented in 2017 and 2018 on Nez Perce tribal land. Surveys such as these have occurred throughout the range of the species since the last 5-year review (2009). Updated population information is presented below.

Plants are typically tracked as Element Occurrence records (EOs) by State or province Natural Heritage Programs or Conservation Data Centers and are determined by grouping together occurrences into a single population (or "Element Occurrence") if they occur within 1.6 kilometers (km; 1 mile [mi]) of one another (Idaho and Washington). However, as noted below Montana and Oregon delineate EOs at a finer scale. At the time the Recovery Plan was developed in 2007, 99 populations of Spalding's catchfly were reported (22 populations in Idaho, 11 in Montana, 17 in Oregon, 49 in Washington). The last 5-year review (2009) reported 10 new populations, adding 3 in Idaho, 2 in Oregon, and 5 in Washington, bringing the total number of populations to 109, with an estimated rangewide number of individual plants being just under 30,000. As noted above, Spalding's catchfly also barely extends in to British Columbia, Canada.

However, as this Recovery Plan applies only to populations within Idaho, Montana, Oregon and Washington, occurrences in British Columbia are not reported in this review.

The number of known occurrences of Spalding's catchfly has increased since 2009. We have evaluated new occurrences provided to us by the Idaho Fish and Wildlife Information System (IFWIS) database and additional reports from Idaho (Pekas et al. 2019 and Gray et al. 2010); the Montana Natural Heritage Program database; the Oregon Fish and Wildlife Office (OFWO) as adapted from the Oregon Biodiversity Information Center (ORBIC) database, and the Washington Natural Heritage Program database. Currently there are 139 occurrences in the United States: 49 in Idaho, 76 in Montana, 49 in Oregon, and 50 in Washington. The number of individual plants in each population ranged from one to thousands with the estimated total number of plants rangewide being approximately 110,313 individuals (8,142 in Idaho, 20,874 in Montana, 56,379 in Oregon, 24,918 in Washington). However, total plant counts are only rough estimates (unless noted otherwise). Exact plant counts are difficult because observed populations fluctuate drastically from one growing season to another, Spalding's catchfly individuals can remain dormant or appear aboveground only briefly for one or more consecutive years, some plant counts at EOs only represent a portion of the occurrence, not all occurrence data includes a population census count, and at some occurrences plant counts are fairly dated.

*Idaho*

In Idaho, there are currently 49 EOs. It should be noted that the current IFWIS database does not yet reflect the latest updates. Current information can be found in Pekas et al. (2019) and Gray et al. (2010), as well as, plant counts obtained by the INHP from BLM and USFS on 5 new EOs for which EO numbers have not been assigned yet. The total number of documented individual plants is 10,742. (J. Hill, *in litt.* 2020).

*Montana*

In Montana, there are 77 recorded EOs. However, 4 are extirpated or likely extirpated so only 73 extant EOs are recognized. Montana does not follow NatureServe's guidance for mapping EOs, and delineates occurrences at a finer scale that is more similar to Oregon; thus, the number of reported EOs may be an over-representation when compared to some other states or provinces. Total EO counts range from 1 plant to over 10,00 plants. Montana plant totals are estimated at approximately 20,874 plants (A. Pipp, *in litt.* 2020).

*Oregon*

In Oregon, there are currently 49 EOs. However, it should be noted that Oregon uses a 500 m separation distance so this EO number is likely an overestimate if the NatureServe's definition was applied. Plant numbers range from a low of 1 to a high of 46,171 (at TNC's Zumwalt Prairie Preserve). The total number of documented individuals is approximately 56,379 (G. Sausen, *in litt.* 2020).

*Washington*

In Washington 54 Spalding's catchfly EOs have been recorded; however, 4 are historical and likely extirpated (not seen since the 1950s); therefore, 50 EOs are currently recognized as extant. Of these 50 extant EOs, 36 have been discovered or relocated since 2000 (W. Fertig, pers. comm. 2020a), with 22 of these relocated between 2010-2019 (W. Fertig, pers. comm.

2020b). Based on the last counts for all the extant occurrences (1981-2019), it is estimated there are at least 24,918 Spalding's catchfly plants in Washington (W. Fertig, pers. comm. 2020a).

*Rangewide*

Across its range, new occurrences are likely a result of increased survey effort, and not an increase in actual plant distribution or vigor. Most of these new EOs were located near or in the general vicinity of existing EOs and therefore did not significantly expand the known range of the species.

In addition to locating new Spalding's catchfly EOs, surveys have also increased population estimates at several sites including The Nature Conservancy's Zumwalt Prairie Preserve in Oregon. The population at this KCA was documented in the Recovery Plan as having at least 1,917 individuals. The population is now estimated at over 46,000 individuals (Schmalz 2019), making it the largest known population range-wide. The second largest population is located at The Nature Conservancy's Dancing Prairie Preserve in Montana (Dancing Prairie KCA), with estimates of 16,686 individuals. The next largest populations are also KCAs and include Craig Mountain (in Idaho) that has been estimated at over 15,000 plants (Hill 2019), Greater Telford (in Washington) with over 5,000 plants, and Center Ridge (in Idaho) with over 3,000 plants respectively. See Table 1 for a list of KCAs, which represent the largest known populations throughout the range of the species. The rest of the known populations generally contain much fewer plants and much of the remaining habitat occupied by Spalding's catchfly is fragmented by roads, agricultural fields, and other developments.

Inventories for Spalding's catchfly continue to be conducted on all lands managed by the Federal government and some state, tribal and private lands across its range where the plant currently resides or where there is suitable habitat.

Population Reintroduction and Supplementation Studies

Because recovery of Spalding's catchfly relies on having numerous large (>500 plants) populations throughout the species range, recovery strategies include finding previously unknown large populations, supplementing Spalding's catchfly plants at smaller populations, or reintroducing plants to create new populations. However, at the time the Recovery Plan was developed, little was known about establishing nursery-grown stock of Spalding's catchfly, and therefore research was needed to test and develop appropriate techniques (Action Number 2.5.2.2 and 2.5.2.1).

A study to develop outplanting protocols for Spalding's catchfly in Montana and to help inform outplanting in other portions of the species range was initiated in 2008 (Lesica and Divoky 2014). The study was designed to determine how five factors affect survival and growth of nursery-grown stock in the field: 1) age of outplanted seedlings, 2) soil type used in culture, 3) watering in the field, 4) type of nursery container, and 5) season of outplanting. Results suggest that age of seedlings or subsequent watering had no effect, but plants grown in 25 cm cone-tainers (cone-shaped containers) had better survival than those grown in shallower pots (Lesica and Divoky 2014).

In addition, as part of the Palouse Remnants project (see Section 2.3.1.6), Thorn Creek Native Seed Farm (in partnership with the Latah Soil and Water Conservation District (Latah SWCD) and the IFWO) has been growing Spalding's catchfly seedlings as part of a seed increase project started in 2012. Currently there are 3 rows of Spalding's catchfly plants and over 500 plants growing on the Thorn Creek Native Seed Farm. In addition, the Thorn Creek Native Seed Farm is also conducting seed predation experiments to better understand and treat for seed predators in a production setting.

Photo credit: Jaci Jensen, Spalding's catchfly planting rows, Thorn Creek Native Seed Farm.

The seed obtained from the plants grown at the Thorn Creek Native Seed Farm were originally being used to grow and outplant Spalding's catchfly seedlings at KCAs in the Palouse prairie. Since 2013, over 2,500 Spalding's catchfly seedlings have been planted at the Paradise Ridge KCA. Monitoring has been conducted at the outplanting sites since planting began in order to determine success (B. Erhardt, pers. comm. 2020). Preliminary results (2013-2018) are mixed with success rates ranging from 30 to 50 percent (B. Erhardt, pers. comm. 2020). However, due to the life history of this species, particularly the potential for prolonged dormancy, long term monitoring is needed to fully understand effectiveness of these outplanting efforts.

In 2017, Latah SWCD began seeding Spalding's catchfly on prairie remnants and in adjacent Conservation Reserve Program (CRP) ground to determine if broadcast and/or drill-seeding are viable means of establishing Spalding's catchfly within the Paradise Ridge KCA. Seeding into remnants was conducted with broadcast seeding methods by hand due to the sensitivity of the areas. These efforts were conducted in fall 2017 and fall 2019 and revisited in the spring following the seeding events. Monitoring will continue to determine if seedlings progress to mature plants. On CRP ground, seed was installed with a no-till Truax drill or by hand broadcast seeding methods. These efforts were conducted in fall 2018 and fall 2019 at 2 areas. At the first, competition was high and in initial monitoring no Spalding's catchfly plants were detected. The second area received extensive site preparation, and this, coupled with favorable spring moisture may have resulted in the Spalding's catchfly seedlings growing larger than expected. Significant numbers of seedlings were detected. Both areas will continue to be monitored to determine best methods for achieving successful establishment of Spalding's catchfly by seed (B. Erhardt, *in litt.* 2020).

Photo credit: Brenda Erhardt, Seeded transect, photographed June 2020.

The Turnbull National Wildlife Refuge in Washington has also been testing site preparation techniques on the Turnbull KCA, as well as direct seeding trial (see below).

Conducting Spalding's catchfly outplantings

The Recovery Plan calls for KCAs to have populations with greater than 500 plants. As discussed in Section 2.2.3, approximately 78 percent of the KCAs identified have over 500 plants; however, in order to fully meet this criteria population numbers will have to increase on the remaining KCAs. Of the 5 KCAs with less than 500 plants, 4 have active efforts to reintroduce or augment Spalding's catchfly plants to increase population numbers (Paradise Ridge, Steptoe Butte, South Sprague, and Turnbull). These efforts (Action Numbers 1.5.3, 1.1.2, 1.3.2, 1.4.2, 2.5.2.1) are summarized below.

Turnbull KCA

The Turnbull KCA is located on the Turnbull National Wildlife Refuge, which is about 15 miles southwest of Spokane, Washington. This KCA is within the Channeled Scablands physiographic region. Restoration efforts at this KCA were largely enabled through the allocation of a Cooperative Recovery Initiative (CRI) grant, which are awarded to endangered species recovery projects associated with National Wildlife Refuges. This grant also provided funds to help support on-going restoration efforts at three other KCAs in east-central Washington and the Palouse prairies of Idaho: South Sprague, Paradise Ridge, and Steptoe Butte.

Although a total population count in a single year has not yet been completed for the Turnbull KCA, the sum of maximum counts at all known catchfly occurrences on the refuge from 2000 to present is greater than 500 individuals. Over 100 plants were counted at a single location in 2011 by University of Washington Rare Care Volunteers. Additional survey work in 2019 identified 100 more plants in a newly acquired addition to the refuge. It is suspected that the total population could be much larger.

Photo credit: Sandy Rancourt, Turnbull KCA
Spalding's catchfly outplanting conducted by refuge staff and RareCare Crew members.

Restoration work on the Turnbull KCA was initiated in 2016 with collection of seed for a contract to grow several thousand seedlings for plantings at Turnbull as part of a CRI project. In early October of 2017, the USFWS Inland Northwest Refuge Complex conducted the West Stubblefield prescribed burn for 180 acres at Turnbull NWR. The burn helped to remove excess litter and open bare soil for both planting of seedlings and direct seeding of Spalding's catchfly. In October of 2017, 224 Spalding's catchfly seedlings were planted with the help of refuge staff, volunteers and members of the Washington Rare Care program. Seedlings were split between burned and unburned habitat. All plantings were done adjacent to existing populations of Spalding's catchfly. In addition to planting seedlings, 56 plots also received direct seeding of Spalding's catchfly. Half of these plots were located in the burned area and the other half in unburned habitat. Monthly monitoring during the growing season in 2018 found that 81 percent of the seedlings survived through the spring and had well developed basal rosettes. The 22 plants that

did not survive the winter were either dug up or trampled by hooved animals. A greater percentage of the seedlings planted in the burned area survived into their first and second year. Several of the direct seeded plots also had some observed seed germination. An additional 1,492 and 600 seedlings were outplanted in fall 2018 and 2019 respectively. Direct seeding was also conducted in 56 plots in 2018 and 64 plots in 2019. A greater percentage of seedlings planted in 2018 in the burn area also survived their first year. An additional 600 Spalding's catchfly seedlings planted in October 2019 were placed in the area previously proposed as the Philleo Lake KCA. This area, due to it's proximity to the Turnbull KCA, has been included in that KCA. Prior to planting, the replanted grasslands of Philleo Lake site were mowed annually prior to seed set of most broad-leaved invasive plant species. Monitoring of all plantings will continue in 2020 and 2021. Seedlings surviving through this period will be considered additions to the KCA population (Rule et al. 2019; Rule et al. 2020).

Paradise Ridge KCA

The entirety of the 4,754 acre Paradise Ridge KCA is located on privately owned land in Idaho and is in the Palouse Grasslands physiographic region. At present, 11 percent of this KCA is in a permanent conservation easement or owned by a conservation organization for the purpose of Spalding's catchfly conservation of the KCA (B. Morlin, pers. comm. 2019). No Spalding's catchfly plants were originally present at this site. All currently occurring Spalding's catchfly plants in the KCA were planted from 2013 through 2019. A total of 2,500 Spalding's catchfly seedlings have been planted across seven different landowner sites within the KCA. Monitoring to date has resulted in a 30 to 50 percent average survival rate. This survival rate will be updated as more monitoring is accomplished over the next 3 years. Preparation of outplanting areas has involved control of annual grasses on 45 acres in a future planting location, selective weed control throughout the KCA, and re-seeding with native grasses and forbs as needed. Experiments to develop methods for establishing Spalding's catchfly by seed (direct seeding and broadcast seeding) are discussed above.

Steptoe Butte KCA

Steptoe Butte represents the other KCA identified in the Palouse Grasslands physiographic region. Steptoe Butte is one of the largest intact Palouse grassland remnants in the world and consists of 150 acres of state park land and 437 acres of land purchased by a group of concerned citizens in 2016. Although a complete survey has not been completed, it is estimated that there are likely over 100 Spalding's catchfly plants currently occurring on the butte (A. Hatcher, *in litt.* 2019).

In the fall of 2017, 2018, and 2020 a total of 1,700 Spalding's catchfly plugs were planted in an effort to increase these population numbers and meet the KCA criteria. Monitoring in October 2018 showed low first-year survivorship numbers of approximately 5 percent. Rodent herbivory and dry conditions appeared to have contributed to the low numbers. In 2018, Plantskydd®, a granular, non-toxic herbivory repellent, was applied at planting time and reapplied throughout the growing season in an effort to increase survival. In addition, non-native weeds growing in the immediate vicinity of the planting were removed though hand pulling (Hatcher 2019). The 2017 and 2018 planting sites were re-monitored in July 2019. No live plants were recorded at the 2017 planting sites. The locations that were planted in fall 2018 where Plantskydd® herbivory repellent was applied, showed one-year survivorship ranging from 15 to 44 percent. Rodent

herbivory was still present at the 2018 planting locations but far less prevalent than at the 2017 planting areas where herbivory repellent was not used. Extrapolation of the 2019 data shows an estimate of 180 live plants out of 1000 seedlings planted. This low survival rate was likely due in part to herbivory and competition from other plant species.

As a result, methods were revised to try to increase survival of the 2019 seedlings (which were grown out by BFI nursery in Moses Lake, WA and Pleasant Hills Farm in Troy, ID). These revised methods included choosing planting areas located on higher quality prairie sites on north facing aspects; using soils maps to ensure plugs were planted in similar soil types as the natural populations; laying plants out in a grid pattern to increase ease in relocating them; conducting minimal shallow scalping (~2 inches) at planting sites to reduce competition from weeds; adding granular Plantskydd® in each hole prior to planting and on the surface around the plants; and finally using small hydroponic pots placed upside down over some of the seedlings to prevent herbivory (a technique that has been used successfully to prevent herbivory on Spalding's catchfly seedlings in Montana, as presented by Peter Lesica at the 2019 Spalding's catchfly Technical Team Meeting).

In addition to planting seedlings in 2019, one ounce of Spalding's catchfly seed was also broadcast seeded. Future monitoring will document success of both the plantings and the seedings. In particular, the sites will be closely observed during maintenance and monitoring to ensure that weeds species, especially annual grasses, do not become established in the small areas of bare ground that resulted from scalping (Hatcher 2019).

Lost Trail KCA

In addition to supplementing populations to increase plant abundance, there is a growing consensus that assisted gene flow (i.e., genetic enhancement, genetic rescue) may be a tool which can be used to address the problem of genetically impoverished or inbred populations (which can predominate in small populations) of rare species (Heschel and Paige 1995, Richards 2000, Newman and Tallmon 2001). Assisted gene flow involves moving individuals from a donor population into the population to be enhanced to increase genetic variation in the recipient population.

Photo credit: Beverly Skinner, Planting Spalding's catchfly seedlings at the Lost Trail KCA.

The Lost Trail KCA, which is located on the Lost Trail National Wildlife Refuge in Montana, is located within the Intermontane physiographic region. While it currently has over 500 Spalding's catchfly plants, the range-wide genetic analysis identified the Lost Trail KCA population as having low levels of genetic variation and suggested it would likely benefit from assisted gene flow (Lesica et al. 2016). The genetic analysis indicated that Montana populations are genetically distinct from each other, with the Dancing Prairie population (located ca. 50 miles north of Lost Trail) being most similar to Lost Trail (Lesica et al. 2016). Therefore, Dancing Prairie was chosen as the most appropriate population to act as the donor population for Lost Trail in an effort to counter the effects of inbreeding.

As a result, 575 container-grown Spalding's catchfly plants were planted at Lost Trail between 2016 and 2018 (Lesica 2019). Fifty-five of the plants were from seed collected at Dancing Prairie while the remainder of the plants were from seed collected at Lost Trail (since approximately 10 percent immigration is thought to be large enough to counter the effects of inbreeding and small enough not to swamp locally adapted genes). The plants were monitored in early June of 2018, 2019 and 2020, which means that plantings from 2016 and 2017 were monitored for 3 years and the plantings in 2018 were monitored for only two years (Lesica 2020). Planting success was 52 percent (this does not include vole herbivory), although this percentage is likely high because plants observed in 2018 and 2019, but not observed in 2020, were assumed to be dormant survivors. However, additional monitoring data may have shown that some actually died instead. Vole herbivory accounted for a loss of 15 percent of the plantings. Vole herbivory aside, survival was 69 percent for plants from Dancing Prairie and 51 percent for plants from Lost Trail, indicating that Dancing Prairie plants had a significantly better chance of surviving compared to those from Lost Trail. In addition, Dancing Prairie seedlings were generally larger than those from Lost Trail seeds (Lesica 2020). Lesica suggests that this discrepancy in mortality was likely due to inbreeding depression given the Lost Trail population had the lowest genetic heterozygosity and allelic richness of the 19 populations sampled in the rangewide genetic study (Lesica et al. 2016, Lesica 2019, Lesica 2020).

The genetic impact of the transplants will depend on whether and to what extent they cross with existing local plants, and the degree to which their progeny survive and reproduce. While effectiveness monitoring provided information on the success of the transplanting, monitoring of the genetic impacts will need to be conducted in subsequent years. This will be done by collecting leaf samples from permanently located transplants and resident plants to act as a baseline, storing them at the USFWS Abernathy genetics lab and comparing the genetic makeup of future progeny to this baseline.

Additional Range-wide Outplanting Efforts

Additional outplantings for Spalding's catchfly are currently occurring or planned throughout the range of the species, including but not limited to: the Fairchild population in Washington (current project); the Fishtrap population (planned) of the Spokane District BLM (in order to re-establish some Spalding's catchfly micro-sites that disappeared after a 2015 fire in that area) (K. Frymire, pers. comm. 2020); and the Nez Perce tribal land site (planned). Long-term effectiveness monitoring of these efforts will help inform future restoration efforts.

Demographics

Another major recovery plan accomplishment was finalizing the 10-year demographic studies throughout the range of the species (Action Number 2.4.2). Knowledge of demographic patterns is essential to understanding population dynamics and life history, and for developing strategies to restore and maintain long-term viable populations (Menges 1990; Crone et al. 2011). To help understand how demographic patterns vary across the range of Spalding's catchfly, long-term demographic monitoring studies were conducted at a number of sites throughout the range of the species. Demographic monitoring involves marking and monitoring the fate of individuals through time. It is extremely labor-intensive as it uses rates of birth, growth, reproduction and

death to model population dynamics (Elzinga et al. 1998). Due to the potential for prolonged dormancy in individual plants of this species, an unbroken 10-year series of annual data collection was needed for accurate determination of demographic parameters.

The following demographic studies met this requirement:

- Lesica (2012) studied two sites in eastern Washington (Lamona located in Lincoln County, Washington and Lick Creek located in Garfield County, Washington located within the Channeled Scablands physiographic region) and two in northwest Montana (Dancing Prairie located in Lincoln County, Montana and Lost Trail located in Flathead County, Montana located in the Intermontane Valleys physiographic region).
- Hill (2012), primarily funded by the BLM, and Hill et al. (2014), primarily funded by the FWS, and were both located in the Canyon Grasslands of the Snake and Salmon Rivers on and near Craig Mountain, Idaho, within the Canyon Grasslands physiographic region.
- Luke (2013) conducted research throughout eastern Washington on BLM (Spokane district) land, within the Channeled Scablands physiographic region.
- Taylor et al. (2012) focused on a small portion (Harisin pasture) of The Nature Conservancy's Zumwalt Prairie Preserve, Spalding's catchfly population located in Wallowa County in northeastern Oregon, which is within the Blue Mountain Basins physiographic region. In this study, plants were followed for only six consecutive years; however, results have been included below where appropriate.

In general, these studies demonstrated that there is variability among sites and across years, indicating that site-specific management strategies must be considered for individual populations.

*Dormancy*

While these studies confirmed that individuals of Spalding's catchfly can remain dormant or go undetected (plants that appear above ground for only a couple weeks in early spring and then quickly die back and disappear) for one or more consecutive years (Lesica and Steele 1994), rates of dormancy appeared to vary depending on location. At the Dancing Prairie site in Montana, it has been shown that in any given growing season up to one-third of Spalding's catchfly plants will remain dormant or go undetected, with the mean number of catchfly plants dormant or undetected in a given year around 30 percent (Lesica and Crone 2007, Lesica 2012). High rates of dormancy, around 42 percent, were also documented at the Zumwalt Prairie Preserve site (Taylor et al. 2012). However, rates of dormancy appear to be lower at the Craig Mountain sites in Idaho, averaging approximately 10 percent (Hill and Garton 2015).

Of the 10 percent dormant plants identified in the Idaho studies, 90 percent (Hill et al. 2014) to 93 percent (Hill 2012) had one-year dormancies and 7 percent (Hill 2012) to 10 percent (Hill et al. 2014) had two-year dormancies. Likewise, in Montana, at the Dancing Prairie site, demographic monitoring indicated that Spalding's catchfly plants are rarely dormant for more than two consecutive years with 76 percent of the dormancy episodes lasting one year and 16 percent lasting two years (Lesica and Steele 1994, Lesica and Crone 2007). Similarly, in the Zumwalt Prairie Preserve site in Oregon, 75 percent of dormancy episodes lasted one year and 20 percent lasted two years (Taylor et al. 2012). In the Washington BLM demographic study (Luke 2013), rosette counts were likely not complete give they were constrained by the timing of

monitoring and therefore so was information about germination, establishment and prolonged dormancy. Determining the length of prolonged dormancy in a species can help determine how many consecutive years of monitoring are needed for accurate plant counts.

*Plant Detection Rates*

Other notable results include information related to plant detection rates. Results from the study sites in Montana and Washington suggested that Spalding's catchfly plants can go undetected by reading plots early (late May) or late (late July), with more plants being visible in mid-to late July compared to late May, although this was not always the case (Lesica 2008). These results suggest that error rates can vary among sites and years and probably cannot be avoided without two recordings per year at each site. However, both Idaho studies found that all aboveground plants are present early (the first couple of weeks in June), with 40 percent of aboveground plants, on average, disappearing by flowering (this value showed high annual variability ranging from approximately 20 percent to 60 percent). These results suggest that, in a given year, 50 percent of plants (40 percent aboveground plants and 10 percent dormant plants) are not detectable later in the season at flowering time.

It is also important to keep in mind when conducting surveys during the period when plants are flowering (and therefore most detectable) that plants in the rosette stage class may go uncounted; on average approximately 80 percent of plants in the rosette stage class disappeared by flowering time in the Idaho studies (Hill 2012, Hill et al. 2014). The rosette stage class can be difficult to detect because it is quite small and tends to senesce by flowering time, and detecting rosettes requires searching closely and systematically at ground level over the entire area soon after emergence in early June. At the Zumwalt Prairie Preserve site in Oregon, only 5.1 percent of plants were recorded as rosettes (Taylor et al. 2012). Conversely, at the Idaho site, on average over one-third (36 percent) of the plants emerging aboveground each spring were in the rosette stage class. Given the differing rates of detection throughout the active growing season, it is likely best to use site-specific data and knowledge of the area to determine optimal recording times for demographic or trend monitoring depending on your monitoring goals and objectives.

*Population Trends extrapolated from Demographic Monitoring*

Population trends varied across study sites as well. However, these results should be interpreted with caution depending on how plots were established. Individuals within a population can vary in space, and Spalding's catchfly is known to have a patchy distribution. In such cases, it is sometimes recommended that permanent plots for demographic studies are subjectively placed in parts of the population containing the most plants (Elzinga et al. 1998). While this may be appropriate for some demographic results, it might not be appropriate for trend monitoring as it could fail to incorporate the variability within a population since population dynamics in the densest part of the population will probably differ from those on the periphery. That being said, general information about population dynamics are summarized below.

In both Idaho demographic studies, the number of plants and proportions in each stage class, including the portion of the rosette stage class that were determined to be first-year recruits, varied annually. Both studies documented high mortality, 61 percent (Hill 2012) and 54 percent (Hill et al. 2014). Hill (2012), which was conducted from 2002 to 2011, showed a sharp decline between 2003 and 2004 and further decline by the end of the study. In Hill et al. (2014),

mortality was offset by higher recruitment, especially in the last 3 years. The high levels of rosette plants in 2005 and 2006 were likely due to a recruitment event in 2005.

In the Lesica (2012) study, 3 of the 4 study populations declined over the 6 years when true population size could be determined. There were significant declines at Dancing Prairie and Lost Trail (both Montana) and Lamona (Washington), while a significant increase was observed at Lick Creek (Washington). One of the main findings in this study was the variability in vital rates both among sites and across years. For example, 2008 was a year of high recruitment at the Lamona and Lost Trail study sites but low recruitment at the Dancing Prairie and Lick Creek sites, and in general, recruitment in Montana sites was more sporadic than in Washington sites. Mortality was high at Dancing Prairie and Lamona in 2006 but low at Lost Trail and Lick Creek that same year.

At the Zumwalt Prairie Preserve site, the estimate of the total number of recruits slightly exceeded the estimate of deaths (Taylor et al. 2012), although it is important to note that mortality could only be estimated for the 2007-2008 and 2008-2009 periods due to the short duration of the study. Some plants that were categorized as dormant in 2010 and 2011, with further documentation, may not have reemerged and therefore would be reclassified as mortalities instead of dormancies. Considering this, it appears the small population observed in this study probably declined slightly across the 2007-2011 period. However, the authors point out that the demographic analysis of Spalding's catchfly in this study was insufficient for a robust estimation of population viability due in part to the relatively short duration of the study (Taylor et al. 2012). It is also possible that the small patch of plants studied was not representative of the greater population located on the preserve, which has a population of over 40,000 Spalding's catchfly plants. In fact, an analysis of trend monitoring conducted on the preserve from 2009 to 2017 showed that population frequency appears to have remained relatively stable, with some annual fluctuation in density (Schmalz 2019).

Results from Luke (2013) indicate that total plant numbers at the Washington BLM study sites have been stable, suggesting that the whole population may be stable as well. However, the number of reproductive structures per plant and mean stem height on the long-term sites have been declining and there are fewer reproductive plants in dry years. Over time, this decrease in fecundity and photosynthetic area could be detrimental to the population and decrease total plant counts.

The combined results of these demographic studies suggest that Spalding's catchfly population trends depend on a complex suite of drivers, including but not limited to: weather, disturbance, herbivory, and previous reproductive performance, many of which we do not yet fully understand.

*Trend Monitoring*

One of the delisting criteria requires that populations of Spalding's catchfly at KCAs demonstrate stable or increasing population trends for at least 20 years using consistent range-wide long-term monitoring methodologies. In 2012, range-wide monitoring guidelines for monitoring the long-term trend of Spalding's catchfly populations in KCAs were developed (USFWS 2012).

The long-lived nature of Spalding's catchfly, in conjunction with limited detection caused by prolonged or early dormancy, difficulties identifying seedlings, and the dispersed nature of plants within a population make it challenging to measure changes in numbers of individuals of this species (USFWS 2007). The range-wide monitoring guidelines discuss these challenges and provide guidance for a method that is relatively easy to set up and replicate.

The range-wide monitoring guidelines were informed by the demographic studies discussed above. For example, determining the length of prolonged dormancy in a species can help determine how many consecutive years of monitoring are needed for accurate plant counts. Based on the results of the demographic studies, it is recommended in the guidelines that the number of plants in each sample plot be counted for 3 consecutive years every 5-10 years for the length of the study.

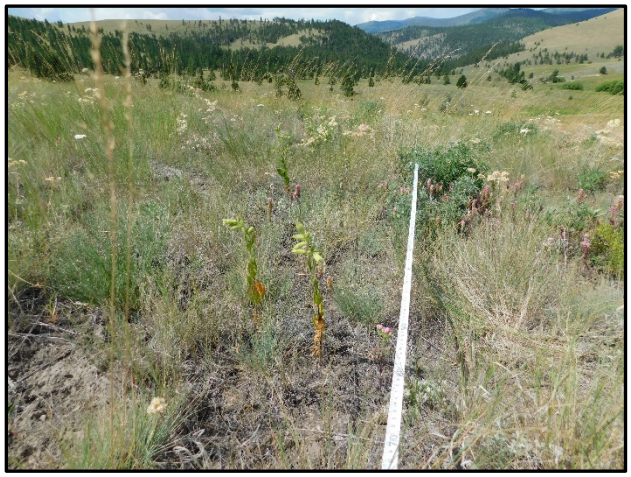

Photo credit: Andrea Pipp, Spalding's catchfly trend monitoring at Sullivan Gulch KCA.

The range-wide monitoring guidelines (which are recommended, not required) were designed for conducting trend monitoring and not demographic studies. They are meant to be used as recommendations for designing long-term monitoring for Spalding's catchfly at the KCAs to help ensure that monitoring data are both meaningful and statistically relevant. However, because demography varies across populations in different parts of the plant's range, it is recommended that experts and local studies be utilized when designing a site-specific monitoring plan. Each KCA is unique and monitoring methods are based on many factors including, but not limited to, site-specific population factors, time and resources available, and availability of existing long-term datasets.

The IFWO recognized that designing and implementing monitoring (Action Number 2.4.1) could be a significant task. Therefore, for those KCA partners that did not already have existing monitoring in place and who determined that the range-wide monitoring guidelines were appropriate for their site, the IFWO provided funding and expertise for field training in designing and implementing monitoring based on the guidelines. Other KCA partners either already had long term monitoring in place or will be using other methods appropriate for their particular site. The majority (83 percent) of KCAs now have trend monitoring initiated. See Delisting Criterion 3 for a discussion of where monitoring is currently occurring.

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.)**:

Another major Recovery Plan accomplishment was the completion of a range-wide genetic analysis of Spalding's catchfly (Action Number 2.5.9). The distribution of KCAs within physiographic regions was designed to preserve genetic diversity, maintain connectivity and, to the extent possible, preserve historical distribution across the remaining potential habitat within the range of the species. Since genetic data were not available at the time the Recovery Plan was developed, physiographic regions were used as a proxy for genetic differentiation in the absence

of actual knowledge of the distribution of genetic diversity (Figure 2). To better understand how genetic variation was distributed across the range of the species, a range-wide genetic analysis for Spalding's catchfly was conducted (Lesica et al. 2016). This information was designed to help inform managers which populations should be protected in order to conserve genetic variation, help determine whether the physiographic regions put forward in the Recovery Plan are optimal for attaining this goal, and potentially identify populations that exhibited low levels of genetic diversity and heterozygosity, resulting from limited gene flow and high levels of inbreeding.


Figure 2: The five physiographic regions as identified in The Recovery Plan for *Silene spaldingii* (Spalding's Catchfly) (USFWS 2007): Channeled Scablands, Palouse Grasslands, Canyon Grasslands, Blue Mountain Basins, and Intermontane Valleys.

Leaf samples were collected in 19 of the largest populations across all five physiographic regions, with an average of 26 well-dispersed plants sampled per population. Using these samples, USFWS geneticists at the Abernathy Fish Technology Center employed microsatellite and chloroplast DNA markers to determine how genetic variation was distributed across the range of the species and how well physiographic regions reflected population structure within this species.

The results suggested that there was little evidence for genetic differentiation among populations in the main range of the species (which encompasses nearly all of four contiguous physiographic regions including the Channeled Scablands, Palouse Grasslands, Blue Mountain Basins and the Canyon Grasslands physiographic regions). This indicates that gene flow has been relatively unrestricted despite widespread agricultural development over the past century (Meinig 1991) and the isolation of many populations. The plant's long lifespan and presumably long generation time may partially explain this lack of genetic differentiation in the face of recent anthropogenic landscape fragmentation.

However, 3 other distinct genetic groups (outlying populations or population groups) were identified: 1) Lower Salmon (the Center Ridge and Mud Springs populations which combined make up the Center Ridge KCA in the Canyon Grasslands physiographic region and another adjacent population referred to as Schoolmarm, all located at the southeast edge of the main range), 2) Northern Intermontane (the Lost Trail and Dancing Prairie KCAs), and 3) Sullivan Gulch (also located in the Intermontane physiographic region). The results suggest that a model of four population groups would better reflect intraspecific neutral genetic variation than the physiographic regions identified in the Recovery Plan (See Figure 3). These would include the Main Range, plus the three mentioned above (Lower Salmon, Northern Intermontane, and Sullivan Gulch).

While population genetic structure in this species did not match the five physiographic regions identified in the Recovery Plan, those 5 regions are distinctive from one another in climate, vegetation, historical fire frequencies, and soil characteristics, which could be associated with current genetic differences in particular life histories, habitat trends, consequences of fire suppression, and types of weed control as they apply to conservation of Spalding's catchfly. So while the physiographic regions are still useful, the results of the genetic study provides some flexibility when considering the distribution of KCAs.

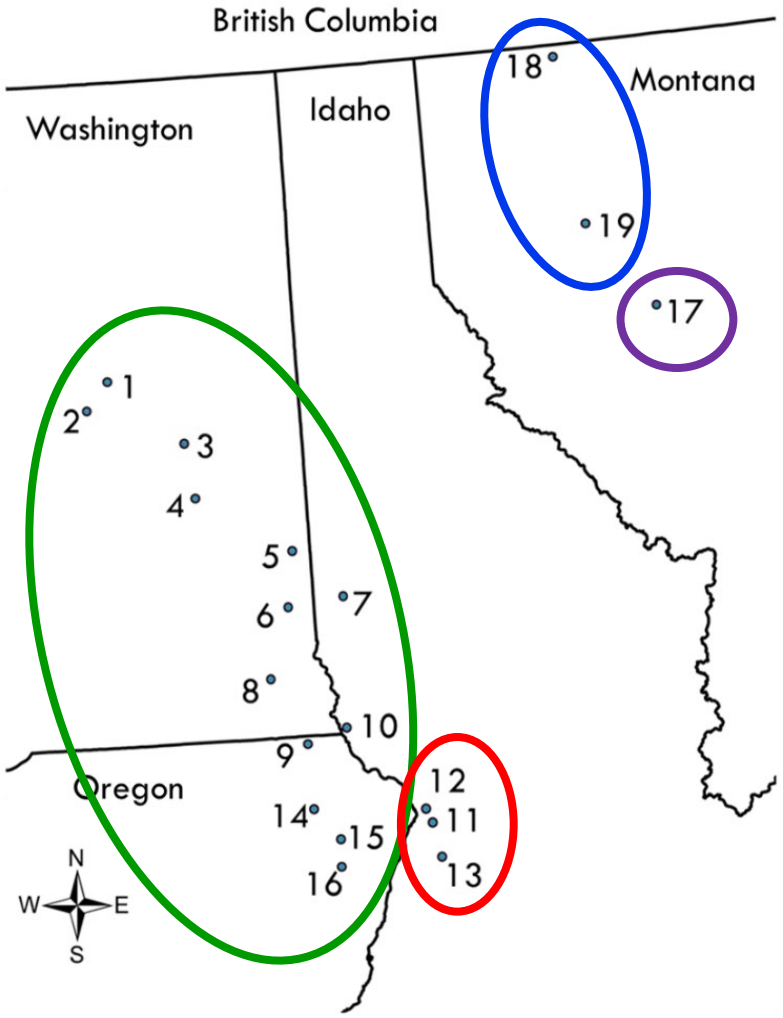


Figure 3. The four genetic groups revealed by the results of the genetic analysis: (1) a single cluster reflecting the proposed Lower Salmon genetic group; *red*, (2) one cluster reflecting the proposed Main Range genetic group (Scablands, Palouse, Blue Mountain, northern Canyon Grasslands; *green*), and (3) two clusters representing the splitting of the Intermontane genetic group (Dancing Prairie; *blue* and Lost Trail; *purple*).

Results of this study also suggested that the Lost Trail KCA population in Montana had significantly lower genetic diversity and experienced a higher degree of inbreeding compared to all other sampled populations, suggesting that this population has experienced a genetic bottleneck. The Lost Trail population occurs in a small isolated valley. The other two populations sampled in the Intermontane Valleys physiographic region (Dancing Prairie and Sullivan Gulch) occur in the relatively wide valley of the Rocky Mountain Trench where the possibility of gene flow is potentially more likely. These other two sites did show relatively low heterozygosity and allelic richness, but not as extreme as Lost Trail.

**2.3.1.4 Taxonomic classification or changes in nomenclature**:

There have been no changes in the taxonomy of Spalding's catchfly.

**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.)**:

As discussed in Section 2.3.1.1, the number of known populations of Spalding's catchfly has increased since 2009. New occurrences are likely a result of increased survey effort, not an increase in actual plant distribution or vigor. Most of these new EOs were located near or in the general vicinity of existing EOs and therefore did not significantly expand the known range of the species.

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem)**:

Palouse Prairie Conservation

One of the primary conservation actions identified in the Recovery Plan was to work to find, document, and conserve Palouse Grasslands remnants, with an emphasis on conservation of Spalding's catchfly (recovery task 1.5.2 and 2.7.3). It has been estimated that more than 99 percent of the original Palouse Prairie habitat has been lost (Noss et al. 1995). Therefore, studies to identify intact Spalding's catchfly habitat in the Palouse Prairie were recommended in the Recovery Plan. One of these Palouse Grasslands inventory projects has been completed and 2 additional projects are currently underway. The inventory in Latah County, Idaho has been completed (Hill et al. 2012). This multi-year project was located in the portion of Latah County that lies within the Palouse Grassland physiographic region, primarily in the northwestern, southwestern, and south-central areas of the county. The inventory consisted of 4 phases: 1) delineation of areas with high potential to support Palouse Grassland remnants (using a combination of National Agricultural Imagery Program (NAIP) from 1989 and 2004), 2) landowner contact and education, 3) field surveys and assessment of potential remnant areas, and 4) development of a comprehensive conservation strategy (still in progress).

Assessment of potential remnant areas consisted primarily of landowner sites for which permission to access was granted. In summary, the total area assessed encompassed 1,267 acres, involving 185 individual landowners. Of the areas assessed, 103 met the criteria for designation as Palouse Grassland Remnants and represent good-condition intact habitat for Spalding's catchfly. The assessed area (1,267 acres) is 36 percent of the total area delineated in potential remnant polygons in Latah County (3,500 acres); 64 percent remains to be assessed and would require additional landowner permission and additional funding. In addition to identifying remnant habitat, two previously unknown occurrences of Spalding's catchfly were also located, with 29 total individuals documented. These EOs were found at two different landowner sites approximately 5 miles apart. See Hill et al. 2012 for a full description of the project.

The Latah County inventory effort has both helped provide the information needed to initiate conservation of the Paradise Ridge KCA and garner partner and private landowner support for these efforts. The entirety of the Paradise Ridge KCA is located on privately owned land. In the

Recovery Plan, the Paradise Ridge KCA comprised 150 acres. Based on the additional inventory and landowner support, this KCA now covers 4,754 acres. At present, 11 percent of this KCA is in a permanent conservation easement or owned by a conservation organization for the purpose of Spalding's catchfly conservation (B. Morlin, pers. comm. 2019). No Spalding's catchfly plants were located during surveys at this site. All currently occurring Spalding's catchfly plants in the Paradise Ridge KCA were planted there beginning in 2013. See Section 2.3.1.2 on Outplantings for more information on these reintroduction efforts.

The Latah County inventory effort serves as a model for additional inventory and conservation of remnants in the Palouse Grassland physiographic region in eastern Washington, northeastern Oregon and other counties in Idaho. As a result, two similar projects were undertaken: a prairie mapping project in Nez Perce County (Pekas et al. 2020) and another prairie remnants project in the Southern Palouse that focused on the Nez Perce tribal land (Sondenaa and McClarin, 2019).

The Nez Perce County project, initiated in 2011, focused on both Palouse Grasslands as well as Canyon Grasslands that have high potential to support Spalding's catchfly and contain suitable habitat for Spalding's catchfly (Pekas et al. 2020). Phase 1 of the project, which included mapping potential remnant polygons in Palouse and Canyon Grasslands using GIS and compiling landowner information, identified 229 potential remnant polygons (74 representing Palouse Grasslands and 155 representing Canyon Grasslands). Phase 2, which included landowner contact and education, resulted in 142 landowners within the delineated polygons being contacted; 29 percent of landowners responded with 16 percent granting permission to access their property. This enabled Phase 3 to be initiated, which included site assessments of the potential remnant polygons for which landowner access permission was granted. Thirteen site assessments (7 Palouse Grassland sites and 6 Canyon Grassland sites) were conducted in 2015, with a total of 232 acres assessed, 29.8 acres of which met the designated criteria for either a Palouse Grassland Remnant or a Canyon Grassland Remnant. Phase 4, identifying cooperative landowners that are willing to implement conservation projects on their land, has not yet been conducted. Therefore, it is unknown at this time if this project will result in the identification of any additional Palouse Grasslands KCAs (in order to meet the number of Palouse Grassland KCAs identified in the Recovery Plan; See Delisting Criteria Analysis, Criterion 1 for further discussion). See Pekas et al. 2020 for a full description of the project.

The prairie remnants project on the Nez Perce tribal land (which focused on the southern Palouse Prairie within the southwestern section of the Nez Perce Reservation) included conducting ecological assessments, rare plant surveys, Spalding's catchfly seed collection, limited conservation actions on high priority prairie remnants within Lewis and Nez Perce Counties, and the identification of high priority remnants for potential future reintroduction sites for Spalding's catchfly (Sondenaa and McClarin, 2019, McClarin and Sondenaa 2007, Robins and Sondenaa 2014, Robins and Sondenaa 2015, Sondenaa and McClarin 2018). This latter objective was accomplished through surveying of 94 remnants from 2017 through 2019, 12 of which met the remnant criteria. Three of the 12 already support Spalding's catchfly populations. The total area of all the remnants surveyed for both was 1,435 acres (Sondenaa and McClarin, 2019). One of these remnants has been identified as having potential to meet the KCA criteria for becoming a Palouse Grasslands KCA. Because this site currently has less than the 500 plants required to be a KCA, the Nez Perce Tribe is currently pursuing efforts to initiate outplanting at this site (K.

Colson, pers. comm. 2020). See Sondenaa and McClarin, 2019 for a full description of the remnant project.

Pollinator Conservation

Another conservation action identified in the Recovery Plan that was associated with habitat quality and quantity was research regarding essential pollinators for Spalding's catchfly (Action Number 2.5.6). Previous studies have suggested that: Spalding's catchfly reproduces best when outcrossing occurs; pollinators are essential in maintaining the fitness of Spalding's catchfly; *Bombus fervidus* (Golden Northern Bumble Bee) is the primary pollinator of Spalding's catchfly; and adjacent invasive nonnative plants may negatively affect reproduction (see the Recovery Plan for a full summary of these studies). Limited research on Spalding's catchfly pollinators has occurred since these studies were conducted; however, some new information is available and summarized below.

While *Bombus fervidus* is the only confirmed pollinator of Spalding's catchfly, *Bombus appositus* (white-shouldered bumblebee) and Halictid bees have been observed on Spalding's catchfly during separate occasions (Lesica and Heidel 1996, Taylor and DeBano 2012). Taylor and DeBano (2012) found that *Bombus appositus* accounted for 10 percent of the bees visiting Spalding's catchfly plants on the Zumwalt Prairie Preserve. Results of their study also indicated that bees were more likely to visit dense patches of Spalding's catchfly and areas having high numbers of blooming forbs. The authors noted that although Spalding's catchfly on the Zumwalt Prairie appears to have adequate insect pollinators available, they observed low seed production and viability.

At a separate study conducted by the Nez Perce Tribe at Spalding's catchfly populations in Idaho and Washington, *Bombus fervidus* was the only pollinator observed during pollinator observations (Smothers and Sondenaa 2010). In this study, 2 sites (Joseph Creek in Oregon and Asotin Creek in Washington) were also evaluated for seed production. Results suggested that availability of *B. fervidus* might be limiting seed production at these 2 sites. Approximately 5-12 flowers per plant failed to produce mature seeds.

Likewise, research conducted on the Zumwalt Prairie preserve suggested that even when Spalding's catchfly does succeed in producing seed, the quality of seed might be low. A study of germination rates of seeds collected from the Zumwalt population found that only 9 percent of seeds germinated (Taylor and DeBano 2012). Using their data on fruit production along with estimates of seed production and seed viability, they estimated that each Spalding's catchfly plant produces on average approximately one viable seed per plant per year. The cause of low germination rates is not known, but they suggested pollination limitation as one possibility. For example, Lesica (1993) found that excluding pollinators reduced seed production by 82 percent and seedlings arising from self-pollination were less vigorous.

Photo credit: Tim Hatten, *Bombus fervidus* on *Silene spaldingii* plant.

Field work conducted by Hatten (2016) in Channeled Scabland habitats of Lincoln and Spokane Counties of eastern Washington, documented the overall bumblebee community to be comprised of 13 species, including the putative pollinators of Spalding's catchfly *Bombus fervidus* and *B. appositus*. Comparison with bumblebee communities of the Palouse Grasslands and the Zumwalt Grasslands reveals a similar list of species. However, Hatten found that the composition of the community differed among ecoregions, potentially having implications for pollination systems and for ongoing pollination studies. Unfortunately, the number of native bees visiting Spalding's catchfly during the study was very low, and as such, no conclusions could be made about the identity of Spalding's catchfly pollinators in particular. Like the Zumwalt study (Taylor and DeBano 2012), data available in Hatten's study hint at *B. appositus and* Halictine bees as potential pollinators of Spalding's catchfly.

In Hatten's (2016) study the pool of pollinator traps that bracketed the Spalding's catchfly pollinator plots captured very few bumblebees and confirmed low flight activity during the plot-level observational period. However, it is likely that drought conditions in 2015 resulted in low numbers of activity of bumblebees. Initial data on the plant community in the study plots reveals potential differences in the density of Spalding's catchfly patches within local populations among KCAs, and also hints at differences in the plant community among areas. These differences could have implications for pollination systems and visitation patterns.

Overall results from these recent pollinator studies suggest that pollinator conservation, particularly for *Bombus fervidus* and potentially *B*. *appositus*, is an important consideration in management of Spalding's catchfly populations and may be one way to reduce the likelihood that low seed viability leads to declines in Spalding's catchfly populations. They also suggest more information is needed to fully understand how the local pollinator community may be affecting long-term viability at Spalding's catchfly populations.

Predation

Predation has also been documented at Spalding's catchfly occurrences. For example, rodent activity is considered a significant factor affecting the persistence of Spalding's catchfly at several sites as documented in the Recovery Plan (B. Benner, *in litt.* 1999; Caplow 200; Hill and Gray 2004b; P. Lesica, *in litt.* 2006). Rodent activity was again identified as a disturbance in certain demographic studies. For example, rodent activity in both Idaho studies was associated with mortality, dormancy, and declining population trends (Hill 2012, Hill et al. 2014). Rodents, likely primarily voles, appeared to target Spalding's catchfly, especially the larger, stemmed plants with the most aboveground vegetation. Similarly, in the Lesica (2012)

Photo credit: Peter Lesica. Dried stems of Spalding's catchfly in or near holes presumably made by voles.

study, herbivory associated with rodents, also mainly voles, appeared to be one of the main drivers of mortality and population decline of the Lamona site located in Washington. High mortality recorded at Lamona in 2006 can be attributed mainly to rodent activity, although this was not true for the high mortality recorded in 2009 and 2010. Vole activity was also documented at Lick Creek, the other Washington site, from 2010 through 2012 but this activity did not appear to influence mortality (which was measured only between 2006 and 2010). Observations suggested that the voles were targeting the caudex. Sometimes they would just eat the top of the caudex, which the plant could recover from, but more often, they would eat enough of the caudex, causing the plant to die. Similar observations of damage (vole trails leading to Spalding's catchfly plants and herbivory of below- and aboveground portions of the plants) were noted by Luke (2013) in the BLM study in Washington. Evidence of vole activity (holes, runways) was not observed at either of the Montana demographic study sites even though voles occur throughout the range of Spalding's catchfly. However, during trend monitoring conducted on the Flathead Indian Reservation in Montana in 2017, vole tunnels, pocket gopher diggings, and activity from other small mammals activity were observed along most transects, although only 4 uprooted Spalding's catchfly plants were found along a total of 22 transects (Pipp 2019).

Meadow vole population sizes are notoriously cyclical, with population peaks occurring every 2 to 5 years (Foresman 2001). Lesica (2012) noted that the higher recruitment rates of the Washington Spalding's catchfly populations may allow them to recover during vole declines, although this did not appear to happen at the Lamona population during the duration of this study.

Photo credit: Janice Hill, Spalding's catchfly severed stem.

Rodent activity was not documented in the Zumwalt Prairie study site, although results of Taylor et al. (2012) suggested that reproductive potential of Spalding's catchfly is limited by high rates of insect (primarily moth) and ungulate (primarily elk) predation, resulting in low rates of fecundity. Over 5 years, 76 percent of plants were predated upon and less than one percent of plants produced mature fruits (Taylor et al. 2012).

Other granivores, especially insects like grasshoppers, beetles and moth larvae have been observed to prey on Spalding's catchfly flowers and seeds. Seed predation by caterpillars of the dark-spotted straw moth (*Heliothis phloxiphaga*), which is a nocturnal moth, was witnessed at three of six Spalding's catchfly sites in the Southern Palouse remnant project (Sondenaa and McClarin, 2019). At one EO, 60 percent of plants were entirely decimated by the moth's larvae. The moth did not appear as destructive at other EOs, although the larvae appear to be widespread (Sondenaa and McClarin, 2019). Another moth, *Heliothis oregona*, has been documented on Spalding's catchfly in Oregon (Taylor & Debano. 2012).

Browsing of Spalding's catchfly by cattle has been identified as a possible threat for populations occurring where livestock are pastured (USFWS 2007). However, information specific to livestock grazing and Spalding's catchfly is limited, with most of our information being from informal anecdotal observations. A separate study of browse rates in areas having different cattle stocking rates conducted on the Zumwalt Prairie Preserve suggested that cattle do not consume significant numbers of catchfly plants during the peak of their growing season at the Zumwalt population, although the authors noted that the browse rates reported may be underestimates due to the timing of their study (Cullen and Taylor 2010). They also cautioned that they could not conclude that cattle grazing does not harm Spalding's catchfly populations, since browsing of plants is only one effect that cattle could have on Spalding's catchfly populations. Other factors such as trampling of plants and soils (soil compaction), changes in total plant cover, soil nutrient cycling, and gradual changes in species composition may all be long-term effects of cattle grazing and need to be addressed through continued research (Cullen and Taylor 2010).

A study was also conducted by Heinse (2014) to understand relationships between ecological integrity, cattle grazing, and Spalding's catchfly in the plant community of the canyon grasslands in southeast Washington. Heinse (2014) identified that exotic and annual functional groups were the most important indicators of both plant community ecological integrity and changes in Spalding's catchfly demographics at her study sites, but because these indicators showed consistent trends on both grazed and nongrazed pastures, she was not able to associate changes in ecological integrity to cattle grazing during her study. It is also likely that the duration of the study was too short to tease out long-term effects.

While other anecdotal observations are available at some KCAs, no other significant new research regarding livestock grazing specific to Spalding's catchfly and its habitat has become available since the last 5-year review conducted in January 2009 (USFWS 2009).

**2.3.1.7 Other**: N/A

## 2.4 Synthesis

**Analysis Summary:**

No new threats and no significant new information regarding the species' biological status have become available since the last 5-year review conducted in January 2009 (USFWS 2009). In addition, the status of the species has not changed significantly and recovery criteria for delisting have not been met.

Conservation efforts include survey and inventory efforts, monitoring and demographic studies, research, outplanting efforts, invasive nonnative plant control, prescribed fire, and land acquisition, among others. Many of these efforts are detailed in the Recovery Plan for Spalding's catchfly (USFWS 2007). Several of the major accomplishments since 2009 as described in this 5-year review include: 1) a range-wide genetic analysis of Spalding's catchfly, 2) identification of, and conservation efforts at 23 Key Conservation Areas, 3) finalizing

rangewide demographic studies, 4) development of range-wide monitoring guidelines and initiation of monitoring at the majority of KCAs, 5) general outplanting recommendations, and initiation of several outplanting efforts throughout the range of the species, 6) seed collection, 7) initiation of the Palouse Grassland Remnant projects, and 7) the identification of new populations though survey efforts.

While these numerous conservation actions are moving this species towards recovery, overall, Spalding's catchfly is not secure from threats range-wide; as in the 2009 5-year review, none of the delisting criteria identified have fully been met.

Overall, more quantitative information is needed to determine how close we are to meeting the delisting criteria. Although the Recovery Plan identifies 27 KCAs as being necessary for recovery across the species range, as described above, many KCAs have been merged and/or expanded. This suggests that the current 23 identified KCAs would suffice for recovery purposes as the KCAs are now larger, more robust, and therefore potentially more secure and less prone to extirpation than those that are smaller (Shaffer 1981). However, it is recommended that we continue to pursue opportunities to engage additional KCAs in an effort to provide a buffer in case not all 23 are able to meet the recovery criteria. In addition, each of these 23 KCAs has a lead person or person(s) working toward implementing conservation actions that will lead to recovery. However, currently only 78 percent of the KCAs have the required 500 or more plants and while monitoring has been initiated at the majority of KCAs (83 percent) none of the KCAs have the required 20 years of monitoring data so long-term trends cannot yet be determined.

In addition, as per the Recovery Plan, each KCA shall have a Habitat Management Plan. Only 13 percent of the KCAs currently have HMPs or plans that would meet the requirements of an HMP. It is strongly recommended that these HMPs be developed for each KCA as they will assist with: identifying site-specific threats at each KCA, creating a strategic plan for not only addressing those threats but also quantifying them, and providing a means for reporting progress towards meeting the recovery criteria. Quantitative data is needed in particular to identify if KCAs have met the goal of having 80 percent native vegetation and ensure that invasive species are being managed.

Spalding's catchfly is not in immediate threat of extinction. However, because populations are still not secure from threats, Spalding's catchfly continues to meet the definition of threatened.

## 3.0 RESULTS

### 3.1 Recommended Classification:

**____ Downlist to Threatened**

**____ Uplist to Endangered**

____ **Delist**

____ *Extinction*

____ *Recovery*

____ *Original data for classification in error*

_X_ **No change is needed**

**3.2 New Recovery Priority Number**:

No change is needed.

## 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

**Recommendations for Future Actions:**

The many conservation activities on-going for Spalding's catchfly should continue:

- Continue working as a Technical Team to collaborate on recovery actions for this species, particularly at the KCAs.
- Continue to pursue additional partnerships at areas identified as having potential to be KCAs.
- Continue outplanting efforts in order to increase population numbers at KCAs with less than 500 plants (which includes investing in seed increase and grow-out of Spalding's catchfly plants and studying techniques such as direct seeding and site preparation techniques).
- Continue the range-wide monitoring program at each of the KCAs and periodically analyze data sets.
- Continue survey efforts to locate potential new populations or document population expansions at known locations.

In addition to continuing those efforts, the following recovery actions should be made a priority (for funding and implementation) over the next 5 years:

- Initiate development of Spalding's catchfly Habitat Management Plans at KCAs that currently are not covered.
- Monitor, manage, and evaluate the response of Spalding's catchfly to site-specific stressors at KCAs, such as livestock, rodent activity, and insect herbivory; fire; potential loss of pollinators, and invasive nonnative plant species.
- Prioritize the collection of quantitative invasive nonnative plant cover within KCAs.
- Complete long-term seed banking at KCAs as well as smaller populations in order to preserve the breadth of genetic material across the species' range.

## A Note of Appreciation

The Spalding's Technical Team is extremely passionate and committed to working toward recovery of Spalding's catchfly. Recovery would not be possible without their on-going and continued efforts. Thank you to all of the members of this Team for being tireless champions for conservation of this species, as well as everyone working towards Spalding's catchfly recovery, for all your hard work, positive energy, persistence and commitment.

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**U.S. FISH AND WILDLIFE SERVICE**
SIGNATURE PAGE for 5-YEAR REVIEW of
**Spalding's catchfly *(Silene spaldingii)***

**Recommendation resulting from this 5-year review:**

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X_ No change is needed

**New Recovery Priority Number:** No change, remain as RPN of 8C (moderate degree of threat/high potential for recovery).

**Field Supervisor, Idaho Fish and Wildlife Office**

CHRISTOPHER SWANSON

Digitally signed by CHRISTOPHER SWANSON
Date: 2020.09.28 13:58:28 -06'00'

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