



**Assessment of
Ecological Condition of
Silene spaldingii and
Polemonium pectinatum
Habitat**

Prepared for
U.S. Fish and Wildlife Service
Region 1

Prepared by

Rex C. Crawford
F. Joseph Rocchio

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U.S. Fish and Wildlife Service
Western Washington Fish and Wildlife Office
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Abstract

The objectives of this project were to evaluate the ecological condition of habitats associated with individual locations of *Silene spaldingii* and *Polemonium pectinatum* and to explore the use of Ecological Integrity Assessments (EIA) as a tool to inform conservation planning for these species. This report provides a description of sampling protocols, a summary of the habitats associated with each species location, an example of how the provided information may be used in addressing possible management needs, and a summary of possible future ecological site evaluations to address *Silene spaldingii* and *Polemonium pectinatum* conservation. A GIS file of sample locations and a Microsoft Excel workbook file with collected information accompany this report.

The Ecological Integrity Assessment method (EIA) is used to measure the ecological integrity of a site through a standardized and repeatable assessment of current ecological conditions associated with the structure, composition, and ecological processes relative to what is expected within the bounds of natural variation for any given ecological system. The result of the EIA methodology is the assignment of an index of ecological integrity to individual sites, which is meant to provide a general sense of conservation value. It can also be used to monitor condition over time, to identify management goals, and to measure the success of management efforts.

To characterize the ecological condition of sites associated with *Silene spaldingii* and *Polemonium pectinatum*, sampling was done at the scale of individual observations (“source features”) included (as of May 2011) in the Washington Natural Heritage Information System (WNHP). WNHP combines source features into element occurrences, roughly equivalent to functioning populations. Because the number of individual observations of *Silene spaldingii* and *Polemonium pectinatum* exceeded what was possible to sample with available funding, a list of potential locations were randomly selected to represent each species across its distribution in Washington. Eighty five (85) of a total of 485 source features for *Silene spaldingii* were sampled; twenty two (22) of a total of 156 *Polemonium pectinatum* source features were sampled. Twelve Key Conservation Areas (KCAs), as identified in the recovery plan for the species (USFWS 2007), were represented in the sampling for *Silene spaldingii* (from a total of eleven occurrences). Eight *Polemonium pectinatum* occurrences were represented by the sampling.

The results section summarizes how EIA ranks and metric information can be applied to a single site for fine-scale evaluations or to clusters of sites within a larger area for broad-scale interpretation. The section provides examples of how EIA information might be used to prioritize among *Silene spaldingii* KCAs in need of recovery attention at the broad-scale and to evaluate metric information at individual sites at the fine-scale.

Table of Contents

Abstract.....	i
1.0 Introduction.....	1
1.1 Project Objective	1
1.2 Ecological Integrity Assessments.....	1
1.3 Vegetation Classification	1
2.0 Methods	3
2.1 Overview	3
2.2 Ecological Integrity Assessment	3
2.3 NatureServe’s Stressors Checklist	6
2.4 Methodology Application	6
2.4.1 Sample Section	6
2.3.2 Field Methodology.....	9
2.3.3 Classification	9
2.3.4 Field Protocol.....	9
3.0 Results.....	11
3.1 <i>Silene spaldingii</i>	11
3.1.1 Ecological Integrity Assessments	11
3.1.2 Stressors.....	18
3.2 <i>Polemonium pectinatum</i>	21
3.2.1 Ecological Integrity Assessments.....	21
3.1.2 Stressors.....	24
4.0 Application Examples of the Ecological Integrity Assessment.....	25
4.1 Broad-scale application: Key Conservation Areas.....	25
4.2. Site-scale application	26
5.0 Recommendations	31
6.0 Citations.....	32
Appendix A. Plot locations for <i>Silene spaldingii</i> and <i>Polemonium pectinatum</i>	35
<i>Silene spaldingii</i>	35
<i>Polemonium pectinatum</i>	44
Appendix B. Stressor Forms	51
Appendix C. EIA Metadata.....	52

LIST OF FIGURES

Figure 1. Locations of <i>Silene spaldingii</i> element occurrences (EO) and Key Conservation Areas in Washington.	7
Figure 2. Location of <i>Polemonium pectinatum</i> sample sites and element occurrences (EO) in Washington.	8
Figure 3. Sample 10 by 10 meter plot (green square) location within the source feature (blue polygon) buffered by 100 meters (red circle) for Buffer or Edge EIA metrics and Landscape Stressors ratings.	10
Figure 4. Distribution of Overall Landscape Impact rating and EIA Condition ranks among Key Conservation Areas for <i>Silene spaldingii</i>	20
Figure 5. Screen shot of SISP_ summary sheet with general information on <i>Silene spaldingii</i> sites.	27
Figure 6. Screen shot of SISP_EIA worksheet with metric rating on <i>Silene spaldingii</i> site data.	28
Figure 7. Screen shot of SISP_stressor and impacts ratings on <i>Silene spaldingii</i> site data.	29
Figure 8. Screen shot of SISP_ plot data on <i>Silene spaldingii</i> sites.	30

LIST OF TABLES

Table 1. Basic Ecological Integrity Ranks.	3
Table 2. Ecological Integrity Rank Definitions.	4
Table 3. Ecological Integrity Assessment Scorecard Example for a Level 2 Assessment.	5
Table 4. <i>Silene spaldingii</i> plot or sample identifier and general location descriptors.	11
Table 5. EIA ranks and Impact ratings for each <i>Silene spaldingii</i> source feature location arranged by Key Conservation Area (KCA).	14
Table 6. Average EIA ranks and Impact ratings for <i>Silene spaldingii</i> KCAs (Key Conservation Areas) and associated Element Occurrence (EO).	17
Table 7. Average EIA Rank and Stressor impact ratings for Ecological Systems sampled with observations of <i>Silene spaldingii</i>	17
Table 8. Number of <i>Silene spaldingii</i> sites where a stressor was recorded (85 total sites).	18
Table 9. <i>Polemonium pectinatum</i> plot identifier and general location descriptors.	21
Table 10. EIA ranks and Impact ratings for each <i>Polemonium pectinatum</i> source feature location.	22
Table 11. EIA ranks and Impact ratings for <i>Polemonium pectinatum</i> Element Occurrence (EO).	23
Table 12. EIA Rank and Impact ratings for Ecological Systems sampled with observations of <i>Polemonium pectinatum</i> .”	23
Table 13. Number of <i>Polemonium pectinatum</i> sites where a stressor was recorded (22 total sites).	24
Table 14. Average metric ranks for the two sites in the Kamiak Butte KCA.	26

1.0 Introduction

1.1 Project Objective

The objectives of this project were to evaluate the ecological condition of habitats associated with individual locations of *Silene spaldingii* and *Polemonium pectinatum* and to explore the use of Ecological Integrity Assessments (EIA) as a tool to inform conservation planning for these species. This report provides a description of sampling protocols, a summary of the habitats associated with each species location, an example of how the provided information may be used in addressing possible management needs, and a summary of possible future ecological site evaluations to address *Silene spaldingii* recovery and *Polemonium pectinatum* conservation. In addition, a GIS file of sample locations a Microsoft Excel workbook file with collected information have been submitted with the report

1.2 Ecological Integrity Assessments

The Ecological Integrity Assessment method (EIA) is used to measure the ecological integrity of a site through a standardized and repeatable assessment of current ecological conditions associated with the structure, composition, and ecological processes relative to what is expected within the bounds of natural variation for any give ecological system (Rocchio and Crawford 2011). The purpose of assigning an index of ecological integrity is to give a general sense of conservation value, management effects, restoration success, etc. It can be used for monitoring (Rocchio and Crawford 2009) and for conservation planning (Rocchio and Crawford 2010).

An EIA is tailored to individual ecological systems by listing the major or key ecological attributes (KEA) that have an important function in the viability or integrity of each ecological system (see http://www1.dnr.wa.gov/nhp/refdesk/communities/eia_list.html for complete EIA lists and descriptions). Each KEA has associated indicators and/or metrics that provide the specificity needed to assess the major ecological attributes. Indicators or metrics are scored or rated to measure its expression on a particular site relative to the natural range of variation (NRV). Each indicator or metric, through its ratings relative to NRV, provides explicit endpoints and standards for management objectives. Further details are provided in the methods section of this report.

1.3 Vegetation Classification

Assessment and interpretation of ecological integrity depends on understanding the structure, composition, and processes that govern the wide variety of ecosystem types. The Washington Natural Heritage Information System (WNHP) uses two classifications to characterize ecosystem types: (1) the plant association within the National Vegetation Classification (NVC) and (2) Ecological Systems (FGDC 2008; Comer et al. 2003). The Ecological Systems and NVC classifications can be used in conjunction to sort out the ecological variability that may affect ecological integrity. EIAs are prepared for ecological systems and applied to their constituent plant associations. Washington ecological systems are described in Rocchio and Crawford

(2008) and are available on-line at
http://www1.dnr.wa.gov/nhp/refdesk/communities/ecol_systems.html

Ecological Systems

Ecological systems integrate vegetation with natural dynamics, soils, hydrology, landscape setting, and other ecological processes. Ecological systems types facilitate mapping at meso-scales (1:24,000 – 1:100,000; Comer and Schulz 2007). Using ecological systems as a classification meets two important needs for conservation, management and restoration, because they provide:

- An integrated approach that is effective at defining both biotic and abiotic variability within one classification unit.
- Comprehensive maps of all ecological system types exist for the State of Washington.

Plant Associations

The International Vegetation Classification (IVC) (Faber-Langendoen et al. 2012) covers all vegetation around the world. In the United States, its national application is the U.S. National Vegetation Classification (NVC), supported by the Federal Geographic Data Committee (FGDC 2008), NatureServe (Faber-Langendoen et al. 2009c), and the Ecological Society of America (Jennings et al. 2009), with other partners. The IVC and NVC were developed to classify and identify types based on vegetation composition and structure and associated ecological factors. The NVC is hierarchical. The finest-scale unit of the NVC is the plant association, which is defined by diagnostic species that reflect topo-edaphic, climate, substrate, hydrology, and/or natural disturbance regimes. The NVC levels allow for a linkage to NatureServe's Ecological Systems classification (described above). The NVC meets several important needs for conservation and resource management.

2.0 Methods

2.1 Overview

This project was designed to assess the ecological condition of *Silene spaldingii* and *Polemonium pectinatum* habitat using Ecological Integrity Assessments (Faber-Langendoen et al. 2009a, Rocchio and Crawford 2009) and NatureServe's Stressor checklist (Master et al. 2009). This section provides an overview of both of these assessment tools and a description of how they were applied for this project.

2.2 Ecological Integrity Assessment

The Ecological Integrity Assessment method (EIA) is used to measure the ecological integrity of a site through a standardized and repeatable assessment of current ecological conditions associated with the structure, composition, and ecological processes relative to what is expected within the bounds of natural variation for any given ecological system. The purpose of assigning an index of ecological integrity is to provide a succinct assessment of the current status of occurrences of a particular ecosystem type and to give a general sense of conservation value, management effects, restoration success, etc. An EIA is tailored to individual ecological systems by listing the major or key ecological attributes (KEA) that have an important function in the viability or integrity of that ecological system. KEAs fall into three categories: landscape context, condition, and size. Each KEA has associated indicators and/or metrics that provide the specificity needed to assess the major ecological attributes. Indicators or metrics are scored or rated to measure its expression on a particular site relative to the natural range of variation (NRV). Each indicator or metric provides explicit endpoints and standards for management objectives (see EIA example at <http://www1.dnr.wa.gov/nhp/refdesk/communities/eia.html>)

All metrics are scored on a standard ranking scale. Metrics, or indicators, are assigned one of four ranks, ranging from excellent (A) to poor (D), (see Tables 1 and 2).

Table 1. Basic Ecological Integrity Ranks

Ecological Integrity Rank	Description
A	Excellent estimated ecological integrity
B	Good estimated ecological integrity
C	Fair estimated ecological integrity
D	Poor estimated ecological integrity

Table 2. Ecological Integrity Rank Definitions (Faber-Langendoen et al. 2009a)

Rank Value	Description
A	Occurrence is believed to be, on a global or range-wide scale, among the highest quality examples with respect to major ecological attributes functioning within the bounds of natural disturbance regimes. Characteristics include: the landscape context contains natural habitats that are essentially unfragmented (reflective of intact ecological processes) and with little to no stressors; the size is very large or much larger than the minimum dynamic area ; vegetation structure and composition, soil status, and hydrological function are well within natural ranges of variation, exotics (non-natives) are essentially absent or have negligible negative impact; and, a comprehensive set of key plant and animal indicators are present.
B	Occurrence is not among the highest quality examples, but nevertheless exhibits favorable characteristics with respect to major ecological attributes functioning within the bounds of natural disturbance regimes. Characteristics include: the landscape context contains largely natural habitats that are minimally fragmented with few stressors; the size is large or above the minimum dynamic area, the vegetation structure and composition, soils, and hydrology are functioning within natural ranges of variation; invasives and exotics (non-natives) are present in only minor amounts, or have or minor negative impact; and many key plant and animal indicators are present.
C	Occurrence has a number of unfavorable characteristics with respect to the major ecological attributes, natural disturbance regimes. Characteristics include: the landscape context contains natural habitat that is moderately fragmented, with several stressors; the size is small or below, but near the minimum dynamic area; the vegetation structure and composition, soils, and hydrology are altered somewhat outside their natural range of variation; invasives and exotics (non-natives) may be a sizeable minority of the species abundance, or have moderately negative impacts; and many key plant and animal indicators are absent. Some management is needed to maintain or restore ¹ these major ecological attributes.
D	Occurrence has severely altered characteristics (but still meets minimum criteria for the type), with respect to the major ecological attributes. Characteristics include: the landscape context contains little natural habitat and is very fragmented; size is very small or well below the minimum dynamic area; the vegetation structure and composition, soils, and hydrology are severely altered well beyond their natural range of variation; invasives or exotics (non-natives) exert a strong negative impact, and most, if not all, key plant and animal indicators are absent. There may be little long-term conservation value without restoration, and such restoration may be difficult or uncertain. ²

Metrics within each rank factor category (i.e., landscape context, size and condition) are combined to provide a single score for each category. These category rankings can then be combined into an Overall Ecological Integrity Rank. The information can be displayed in tabular format (see Table 3). The EIA is a practical and transparent tool to document the ecological condition of a given site. For this project, metrics within each rank factor category were simply averaged to determine the score for that category, and scores for the three categories were averaged to calculate the overall ecological integrity score for individual sites. An alternative choice would have been to weight individual metrics, or rank factor categories, with different values.

¹ Ecological restoration is: “the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Restoration attempts to return an ecosystem to its historic trajectory” (SER 2004).

² D-ranked types present a number of challenges. First, with respect to classification, a degraded type may bear little resemblance to examples in better condition. Whether a degraded type has “crossed the line” (“transformed” in the words of SER 2004) into a semi-natural or cultural type is a matter of classification criteria. These criteria specify whether sufficient diagnostic criteria of a type remain, bases on composition, structure, and habitat.

EIA methodology can be applied at three scales, or levels:

- Level 1 Remote Assessments rely almost entirely on Geographic Information Systems (GIS) and remote sensing data shed (EPA 2006, Faber- Langendoen et al. 2009a).
- Level 2 Rapid Assessments use relatively rapid field-based metrics that are a combination of qualitative and narrative-based rating with quantitative or semi-quantitative ratings. Field observations are required for many metrics, and observations will typically require professional expertise and judgment (Fennessy et al. 2007).
- Level 3 Intensive Assessments require more rigorous, intensive field-based methods and metrics that provide higher-resolution information on the integrity of occurrences within a site.

The Washington Natural Heritage Program used the Level 2 EIA to assess ecological integrity of habitat associated with *Silene spaldingii* and *Polemonium pectinatum* observations. Level 2 EIAs are relatively rapid site assessments (~2 hours) that determine current ecological integrity at the classification scale of ecological system.

Table 3. Ecological Integrity Assessment Scorecard Example for a Level 2 Assessment. Metrics were not weighted and Ecological Categories rather than KEA are averaged to calculate EIA.

KEY ECOLOGICAL CATEGORIES	Assigned Metric Rating	Assigned Metric Points	Weight (W)	Metric Score (M)	Category Score (M/W)	Category Rank	Integrity Score	Ecological Integrity Rank (EO rank)
LANDSCAPE					4.0	B		
Buffer Length	A	5	1	5				
Buffer Width	A	5	1	5				
Buffer Condition	CD	2	1	2				
Connectivity (not used)								
			$\Sigma=3$	$\Sigma=12$				
SIZE					2.0	CD		
Relative Size	CD	2	1	2.0				
Absolute Size (not used)								
			$\Sigma=1$	$\Sigma=2$				
CONDITION					3.3	C		
VEGETATION attributes								
Cover of Native Plants	A	5	1	5				
Cover of Invasive Species	D	1	1	1				
Cover of Non-Native Species	D	1	1	1				
Species Composition	B	4	1	4				
Absolute Cover of Native Bunchgrass	B	4	1	4				
Relative Cover of Native Bunchgrass	C	3	1	3				
Relative Cover of Native Species	C	3	1	3				
Absolute Cover of Tall Shrubs	A	5	1	5				
HYDROLOGY attributes								
none								
SOILS (PHYSICOCHEMISTRY) attributes								
Soil Surface Condition	A	5	1	5				
			$\Sigma=9$	$\Sigma=30$				
RANK RATING SCORES A=4.5-5.0, B = 3.5-4.4, C=2.5-3.4, D=1.0-2.4					Categories $\Sigma=9.3$	3.1	C	

2.3 NatureServe's Stressors Checklist

Documenting stressors or direct threats can provide possible correlations between ecological integrity and specific stressors. Those correlations can be useful in the development of management recommendations, restoration actions, and conservation. Stressors were documented at each site using NatureServe's Stressor checklist methodology (Master et al. 2009; Appendix B). At each site a predefined list of stressors is used to document the presence, scope, and severity of stressors associated with four categories: (1) landscape stressors; (2) vegetation stressors; (3) soil stressors; and (4) hydrology stressors. For each category, scope and severity were combined to determine an overall impact of that category using Boolean logic matrices (Master et al. 2009). Similarly, an overall impact rating can be assessed by aggregating the impact ratings of the four categories and using the Boolean logic matrix to determine an overall impact rating for the site. Impact is expressed by combining Scope and Severity of identified stressor and then summing the rating scores for Landscape Context, Vegetation, Soils and Hydrological attributes as described by Masters and others (1999).

2.4 Methodology Application

2.4.1 Sample Section

To characterize the ecological condition of sites associated with *Silene spaldingii* and *Polemonium pectinatum*, sampling was done at the scale of individual observations ("source features") included (as of May 2011) in the Washington Natural Heritage Information System (WNHP). WNHP clusters source features into element occurrences, roughly equivalent to functioning populations. Because the number of individual observations of *Silene spaldingii* and *Polemonium pectinatum* exceeded what was possible to sample with available funding, a list of potential locations were randomly selected.

Randomly selected source features were stratified to ensure that samples were located across each species' range in Washington. In addition, for *Silene spaldingii*, selections were stratified to ensure representation across all Key Conservation Areas (KCAs) (USFWS 2007) and WNHP Element Occurrences (EO) (Figure 1). For *Polemonium pectinatum*, representation was sought across the species' element occurrences in Lincoln County (Figure 2). Additionally, potential sample sites were limited to public lands to minimize time constraints associated with contacting multiple private land owners. The randomly selected sites are shown in Appendix A by KCA and by EO. Actual field visits to sites were prioritized to ensure geographic coverage and to minimize field travel times. Eighty-five (85) of a total of 485 source features (referred to as sites in this report) for *Silene spaldingii* were sampled; twenty-two (22) of a total of 156 *Polemonium pectinatum* source features were sampled. Twelve Key Conservation Areas (KCAs) were represented in the sampling for *Silene spaldingii* (from a total of eleven occurrences). Eight *Polemonium pectinatum* occurrences were represented by the sampling.

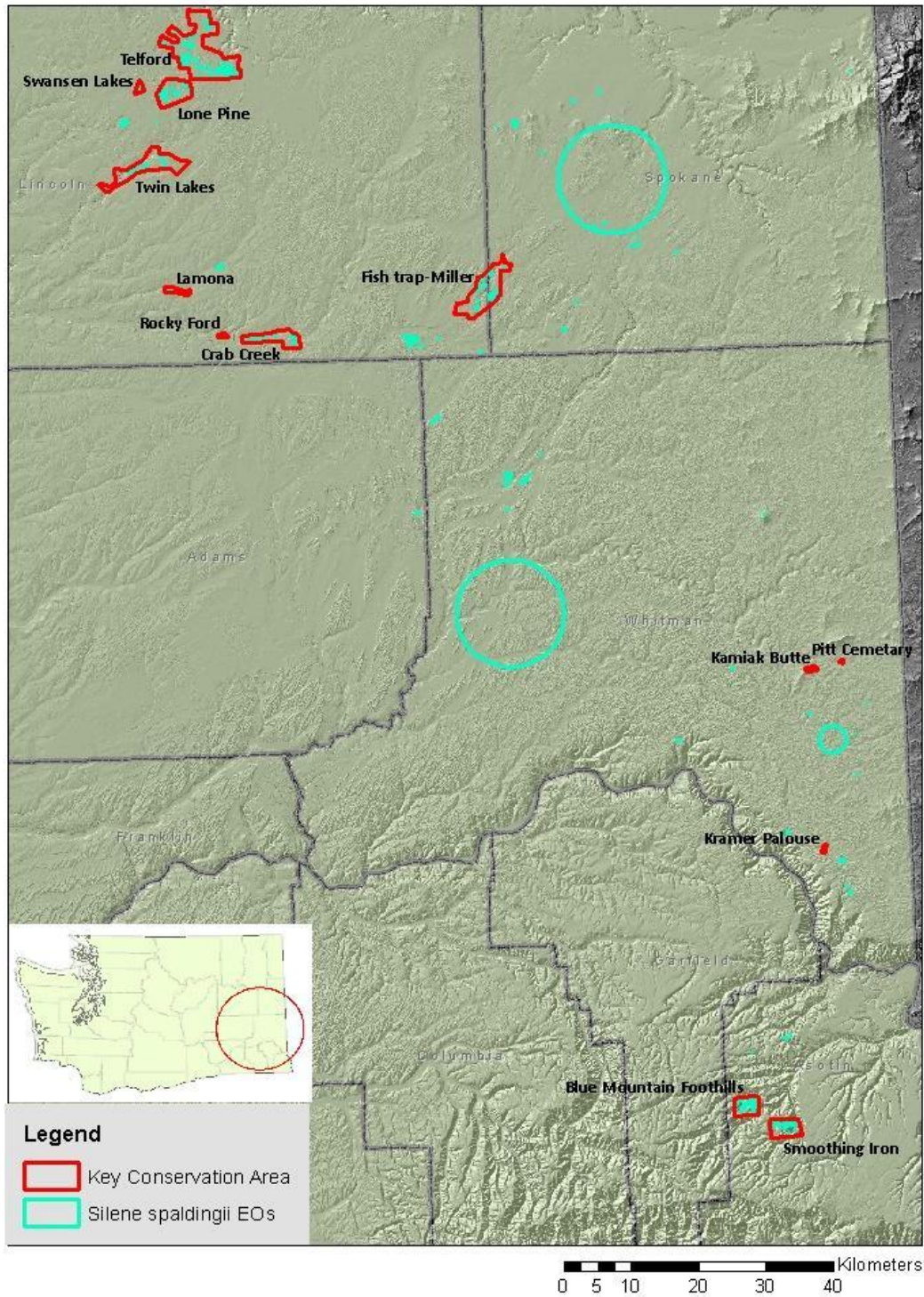


Figure 1. Locations of *Silene spaldingii* element occurrences (EO) and Key Conservation Areas in Washington.

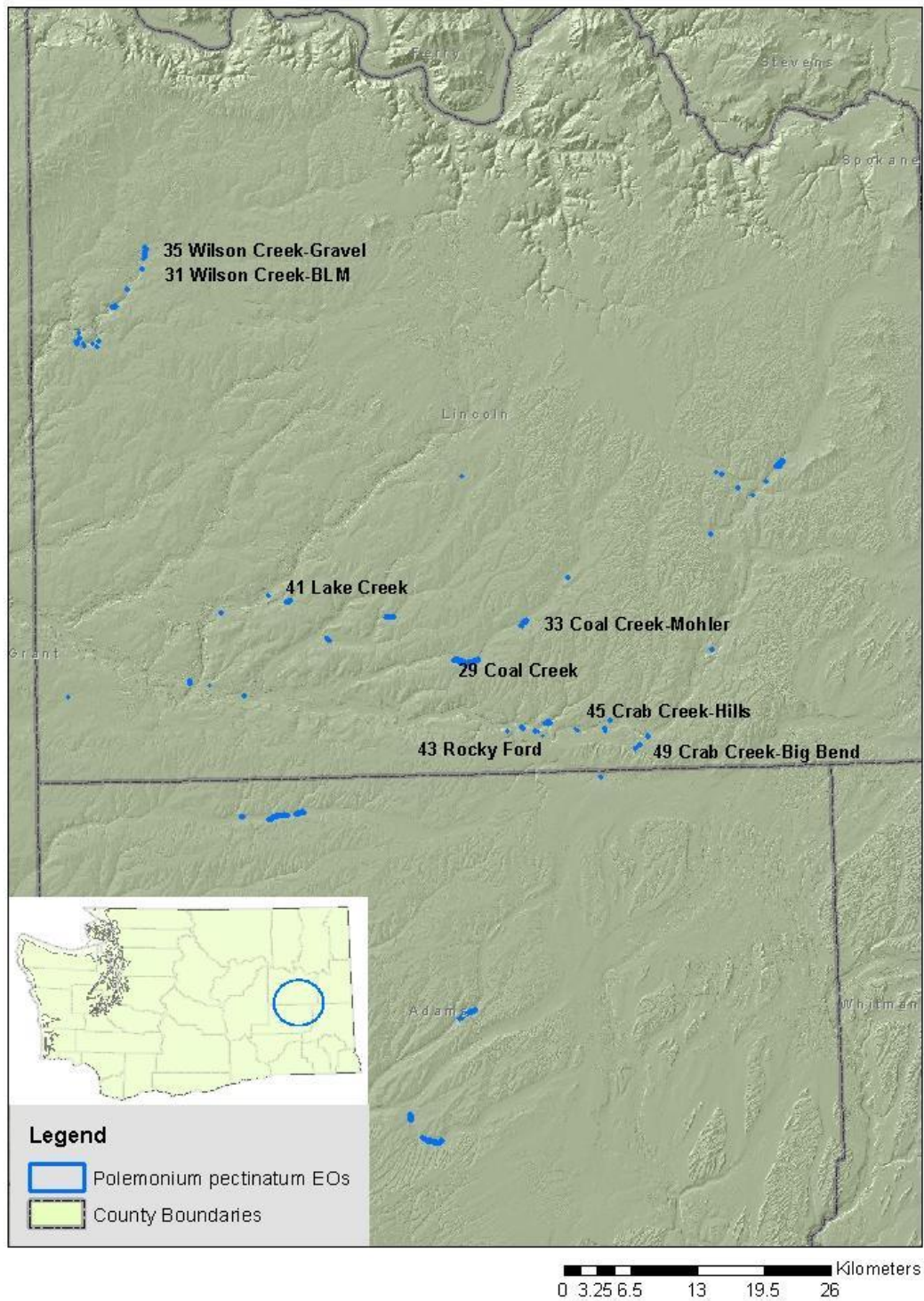


Figure 2. Location of *Polemonium pectinatum* sample sites and element occurrences (EO) in Washington.

2.3.2 Field Methodology

Data were collected electronically using an Ashtech MobileMapper 10; field forms used can be found in the provided Microsoft Excel workbook. Crawford and Rocchio each completed approximately half of the sampling.

At each surveyed location or site, the following ecological attributes were recorded:

- Vegetation Classification unit(s) present
- GPS location (Ashtech MobileMapper 10 units were used)
- Plant species and a cover-class estimate for each species
 - 100m² or 200 m² releve plots were established in each zone; species nomenclature follows USDA PLANTS Database: <http://plants.usda.gov/>
- Notes on soil depth, aspect, slope, site characteristics
- Ecological condition (using Ecological Integrity Assessment; see below)
- List of stressors, following NatureServe methodology (Master et al. 2009)

2.3.3 Classification

Each site was classified in the field according to Ecological Systems (Comer et al. 2003). The descriptions and keys in *Draft Field Guide to Washington's Ecological Systems* were used to identify the ecological system at each site (Rocchio and Crawford 2008). After collecting species data, a preliminary plant association name was assigned in the field. However, limited time and funding precluded conducting a vegetation classification analysis for this project. Thus, the plant associations names assigned in this report are place-holders and should be used accordingly.

2.3.4 Field Protocol

Each site was located by navigating *via* GPS on the Ashtech MobileMapper 10 to the center of the source feature polygon (Figure 3). Plot placement was sometimes adjusted to include the most homogenous vegetation that represented a single ecological system. The final plot center was recorded as a GPS point. Within the plot, a species and cover estimate was first recorded for every species observed in the plot (see SISP_plots or POPE_plots worksheet in the accompanying Microsoft Excel workbook), followed by a determination of the Ecological System classification, the completion of an EIA for that system, and finally the Stressor Form. The assessment area for the EIA was the individual plot and the EIA Landscape metrics apply to within 100 m of the plot edge. Condition metrics apply to the plot but not the expanse of the ecological system. In the EIA calculation, Buffer and Edge were the only Landscape Context metrics used; Relative Size was the only Size metric used. Individual condition metrics not addressed in the field were treated as missing values and thus did not contribute to the EIA rank.

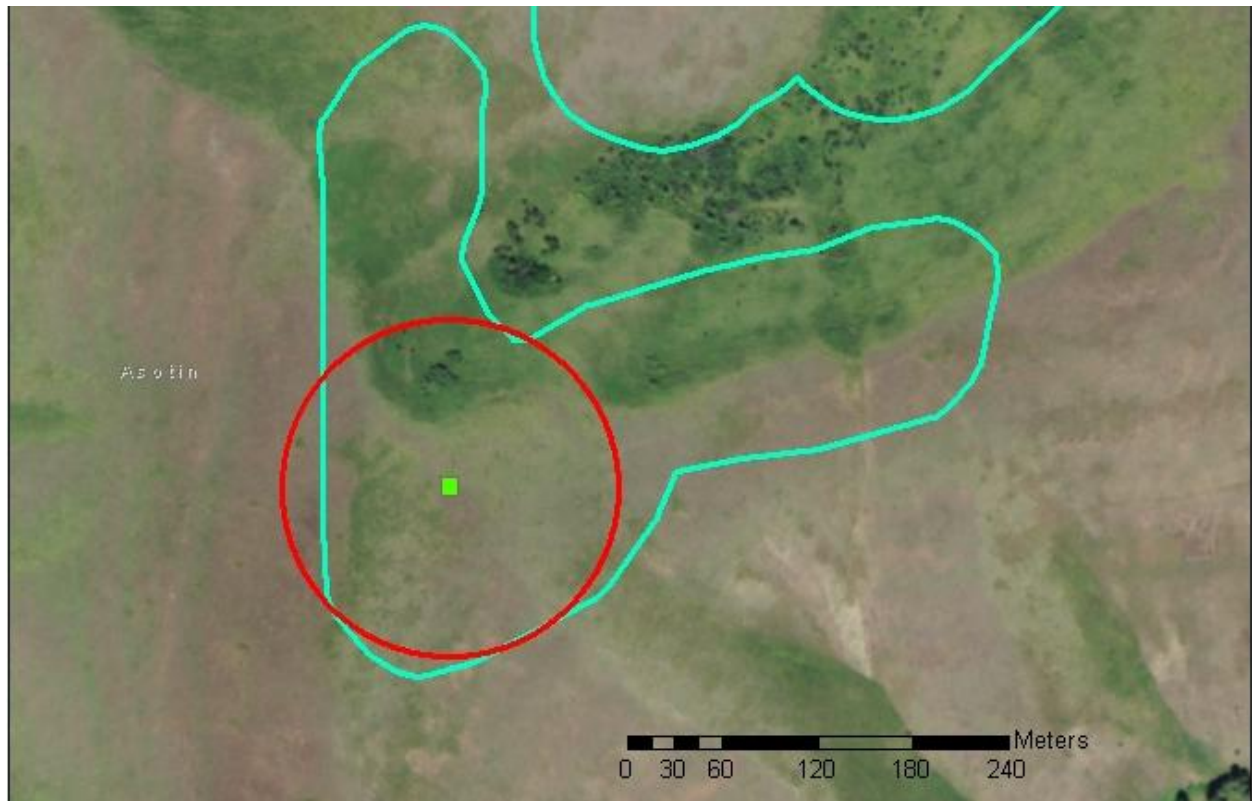


Figure 3. Sample 10 by 10 meter plot (green square) location within the source feature (blue polygon) buffered by 100 meters (red circle) for Buffer or Edge EIA metrics and Landscape Stressors ratings.

3.0 Results

3.1 *Silene spaldingii*

3.1.1 Ecological Integrity Assessments

Sampling included 85 sites representing eleven element occurrences and twelve KCAs. General site location (Appendix A), site identification and ecological system appear in Table 4.

Table 4. *Silene spaldingii* plot or sample identifier and general location descriptors. Element Occurrence is the identifier used with the element code (for example *032* = PDCAR0U1S0*032*WA) by NatureServe. KCA = Key Conservation Area are locations sited in the 2007 Recovery Plan (USFWS 2007) or more recent recovery team proposed areas (see Figure 1). Sample locations are illustrated Appendix A.

Site	Surveyor	Township Range Section	Element Occurrence	KCA	Ecological System
Src24481	Rocchio	T13N R44E S25	*006*	Kramer Palouse	CES304.792 Columbia Basin Palouse Prairie
Src24482	Rocchio	T13N R44E S25	*006*	Kramer Palouse	CES304.792 Columbia Basin Palouse Prairie
Src16796 -a	Rocchio	T16N R44E S36	*018*	Kamiak Butte	CES304.792 Columbia Basin Palouse Prairie
Src16796 -b	Rocchio	T16N R44E S35	*018*	Kamiak Butte	CES304.792 Columbia Basin Palouse Prairie
Obj1742	Rocchio	T21N R36E S25	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj1774; 209	Rocchio	T21N036E S24	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj1946	Rocchio	T21N R37E S30	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj4414	Rocchio	T21N R37E S30	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj1541	Rocchio	T21N R36E S21	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj1597; 995	Rocchio	T21N R36E S21	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj2902	Rocchio	T21N R36E S22	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj370	Rocchio	T21N R37E S19	*030*	Crab Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
28773	Rocchio/ Crawford	T22N R39E S36	*032*	Fishtrap-Miller	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj1917; 1911	Rocchio	T22N R39E S36	*032*	Fishtrap-Miller	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj2379	Rocchio	T21N R39E S09	*032*	Fishtrap-Miller	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
28758	Rocchio/ Crawford	021N040E S06	*032*	Fishtrap-Miller	CES306.040 Northern Rocky Mountain Lower Montane, Foothill, and Valley Grassland
28758p	Crawford	021N040E S06	*032*	Fishtrap-Miller	CES306.040 Northern Rocky Mountain Lower Montane, Foothill, and Valley Grassland
Obj2868	Rocchio	T21N R35E S24	*046*	Rocky Ford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe

Site	Surveyor	Township Range Section	Element Occurrence	KCA	Ecological System
Obj3175, 3188, 1401	Rocchio	T21N R35E S24	*046*	Rocky Ford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj3180	Rocchio	T21N R35E S24	*046*	Rocky Ford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj3328	Rocchio	T21N R35E S24	*046*	Rocky Ford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
2419	Crawford	022N035E S32	*048*	Lamona	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obs2070	Rocchio/ Crawford	022N035E S32	*048*	Lamona	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Src19505	Rocchio	T09N R43E S23	*049*	Blue Mts	CES304.792 Columbia Basin Palouse Prairie
Src28825	Rocchio	T09N R43E S23	*049*	Blue Mts	CES304.792 Columbia Basin Palouse Prairie
19501	Crawford	T09N R43E S23	*049*	Blue Mts	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
Src18673	Rocchio	T09N R43E S24	*049*	Blue Mts	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
Src19539	Rocchio	T09N R43E S13	*049*	Blue Mts	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
Src19540	Rocchio	T09N R43E S13	*049*	Blue Mts	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
Src19542	Rocchio	T09N R43E S13	*049*	Blue Mts	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
Src28828	Rocchio	T09N R43E S13	*049*	Blue Mts	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
Src18793	Rocchio	T09N R43E S15	*049*	Blue Mts	CES306.040 Northern Rocky Mountain Lower Montane, Foothill, and Valley Grassland
Src19535	Rocchio	T09N R43E S13	*049*	Blue Mts	CES306.040 Northern Rocky Mountain Lower Montane, Foothill, and Valley Grassland
Src19504	Rocchio	T09N R43E S23	*049*	Blue Mts	CES306.805 Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Src19506	Rocchio	T09N R43E S23	*049*	Blue Mts	CES306.805 Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest
Src18791	Rocchio	T09N R43E S14	*049*	Blue Mts	CES306.994 Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland
1332	Crawford	T24N R34E S34	*052*	Twin Lakes	CES304.083 Columbia Plateau Steppe and Grassland
1329	Crawford	T24N R34E S34	*052*	Twin Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
1369	Crawford	T23N R34E S3	*052*	Twin Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
1648	Crawford	T24N R34E S35	*052*	Twin Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
3447	Crawford	T23N R34E S3	*052*	Twin Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
3629	Crawford	T24N R34E S35	*052*	Twin Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
7248	Crawford	T24N R34E S35	*052*	Twin Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
33405	Rocchio/ Crawford	T25N R34E S26	*078*	Swanson Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Src21881	Rocchio	T25N R34E S26	*078*	Swanson Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe

Site	Surveyor	Township Range Section	Element Occurrence	KCA	Ecological System
Src21883	Rocchio	T25N R34E S26	*078*	Swanson Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Src21884	Rocchio	T25N R34E S26	*078*	Swanson Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Src33404	Rocchio	T25N R34E S26	*078*	Swanson Lakes	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
0	Crawford	T25N R35E S28	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
594	Crawford	T25N R35E S28	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
599	Crawford	T25N R35E S28	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
2114	Crawford	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
BLM1639	Crawford	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
BLM1642	Crawford	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
BLM2126	Crawford	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
BLM2128	Crawford	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
BLM2141	Crawford	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
BLM72	Rocchio	T25N R35E S31	*085*	Lone Pine	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
334	Crawford	T25N R35E S23	*085*	Telford	CES304.083 Columbia Plateau Steppe and Grassland
694	Crawford	T26N R35E S35	*085*	Telford	CES304.083 Columbia Plateau Steppe and Grassland
2086	Crawford	T26N R35E S35	*085*	Telford	CES304.083 Columbia Plateau Steppe and Grassland
3257	Crawford	T25N R35E S3	*085*	Telford	CES304.083 Columbia Plateau Steppe and Grassland
3971	Crawford	T25N R35E S12	*085*	Telford	CES304.083 Columbia Plateau Steppe and Grassland
4638	Crawford	T25N R35E S2	*085*	Telford	CES304.083 Columbia Plateau Steppe and Grassland
790	Crawford	T25N R35E S12	*085*	Telford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
916	Crawford	T25N R35E S12	*085*	Telford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
1510	Crawford	T25N R36E S19	*085*	Telford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
2131	Crawford	T25N R35E S24	*085*	Telford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
2455	Crawford	T25N R36E S25	*085*	Telford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
3970	Crawford	T25N R35E S12	*085*	Telford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
1306	Crawford	T25N R35E S12	*085*	Telford	CES306.958 Northern Rocky Mountain Foothill Conifer Wooded Steppe
30877	Crawford	T09N R44E S28	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland

Site	Surveyor	Township Range Section	Element Occurrence	KCA	Ecological System
31252	Crawford	T09N R44E S34	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
31254	Crawford	T09N R44E S34	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
31259	Crawford	T09N R44E S33	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
31260	Crawford	T09N R44E S33	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
31262	Crawford	T09N R44E S32	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
31266	Crawford	T09N R44E S33	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
31272	Crawford	T09N R44E S34	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
32976	Crawford	T09N R44E S29	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
32978	Crawford	T09N R44E S33	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
32981	Crawford	T09N R44E S33	*088*	Smoothing Iron	CES304.993 Columbia Basin Foothill and Canyon Dry Grassland
32975	Crawford	T09N R44E S32	*088*	Smoothing Iron	CES306.030 Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
31263	Crawford	T09N R44E S33	*088*	Smoothing Iron	CES306.994 Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland
31271	Crawford	T09N R44E S28	*088*	Smoothing Iron	CES306.994 Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland

Table 5 displays the roll-up (average) Landscape, Condition, Relative Size and EIA ranks and Stressor Impact ratings for each source feature location. As an initial guideline, any “C” or “D” rank for either a Rank Category or the overall EIA rank, **bolded** in table, suggests that management needs are present at that site. Ranks of “A” or “B” suggest that the site is in good ecological condition and that current management of the site appears to be maintaining ecological integrity.

Table 5. EIA ranks and Impact ratings for each *Silene spaldingii* source feature location arranged by Key Conservation Area (KCA). “n” is the number of metrics used in EIA score and ranking (see Table 1) . Land = Landscape Context (100 m buffer), Cond = Condition, and Veg = Vegetation categories. Impact ratings are a combination of scope and severity L= low impact, M= moderate impact, H= high impact, VH=very high impact, and blank =no stressors observed thus no or minimal impact.

Site	KCA	n	EIA Rank				Impact		
			Land	Cond	Size	EIA	Soil	Veg	Land
Src24481	Kramer Palouse	14	A	B	A	A		L	L
Src24482	Kramer Palouse	14	A	A	A	A			M
Src16796-a	Kamiak Butte	13	B	C	D	C		H	H
Src16796-b	Kamiak Butte	13	B	C	B	B		H	H
Ob1742	Crab Creek	14	B	B	A	B	L	VH	VH
Ob1774; 209	Crab Creek	14	B	A	A	A	L	L	VH

Site	KCA	n	EIA Rank				Impact		
			Land	Cond	Size	EIA	Soil	Veg	Land
Ob1946	Crab Creek	14	B	C	A	B	H	VH	VH
Ob4414	Crab Creek	15	B	C	A	B	H	VH	VH
Obj1541	Crab Creek	14	A	C	A	B	H	VH	VH
Obj1597; 995	Crab Creek	14	A	B	A	B	H	VH	VH
Obj2902	Crab Creek	14	B	C	A	B	VH	VH	VH
Obj370	Crab Creek	15	A	B	A	B	H	M	VH
28758	Fishtrap-Miller	13	A	B	A	B		VH	VH
28773	Fishtrap-Miller	14	A	B	A	B			H
28758p	Fishtrap-Miller	13	A	B	A	B		M	H
Obj1917; 1911	Fishtrap-Miller	14	B	B	A	B		H	VH
Obj2379	Fishtrap-Miller	14	B	C	A	B		VH	VH
Obj2868	Rocky Ford	14	A	B	A	A	M	H	H
Obj3175, 3188, 1401	Rocky Ford	14	A	B	A	A	H	VH	VH
Obj3180	Rocky Ford	14	A	C	A	B	VH	VH	VH
Obj3328	Rocky Ford	15	A	B	A	A	H	H	VH
2419	Lamona	14	A	B	A	B		VH	VH
Obs2070	Lamona	14	A	B	A	A		L	L
19501	Blue Mts	13	A	B	A	A		VH	VH
Src18673	Blue Mts	13	A	B	A	B	L	M	H
Src18791	Blue Mts	11	A	C	A	B	L	L	L
Src18793	Blue Mts	13	A	A	A	A			
Src19504	Blue Mts	10	A	B	A	A	L	L	L
Src19505	Blue Mts	13	A	B	A	A	L	L	L
Src19506	Blue Mts	11	A	B	A	A	L		L
Src19535	Blue Mts	13	B	B	A	B	L	L	H
Src19539	Blue Mts	12	B	D	A	B	M	VH	VH
Src19540	Blue Mts	13	B	C	A	B	L	M	H
Src19542	Blue Mts	13	A	B	A	A	L	L	M
Src28825	Blue Mts	13	A	A	A	A	L	L	L
Src28828	Blue Mts	13	A	B	A	B	M	M	VH
1329	Twin Lakes	14	A	B	A	B		M	VH
1332	Twin Lakes	12	A	B	A	B		M	VH
1369	Twin Lakes	13	A	B	A	A		L	VH
1648	Twin Lakes	14	A	B	A	B		L	H
3447	Twin Lakes	14	A	C	B	B		VH	VH
3629	Twin Lakes	13	A	C	A	B		M	H
7248	Twin Lakes	14	A	B	A	B		M	H
33405	Swanson Lakes	14	B	C	A	B		L	VH
Src21881	Swanson Lakes	14	A	D	A	B		VH	VH
Src21883	Swanson Lakes	14	B	C	A	B		VH	VH
Src21884	Swanson Lakes	14	B	B	A	B		M	VH
Src33404	Swanson Lakes	15	B	C	A	B		VH	VH
0	Lone Pine	13	A	C	A	B		VH	H
594	Lone Pine	14	B	C	A	B		H	VH
599	Lone Pine	13	A	B	A	A		M	VH

Site	KCA	n	EIA Rank				Impact		
			Land	Cond	Size	EIA	Soil	Veg	Land
2114	Lone Pine	13	A	B	A	A		H	H
BLM1639	Lone Pine	14	A	B	A	A		L	VH
BLM1642	Lone Pine	14	A	B	A	A		H	VH
BLM2126	Lone Pine	14	A	B	A	A		M	H
BLM2128	Lone Pine	14	A	B	A	A		H	H
BLM2141	Lone Pine	14	A	B	A	A		L	VH
BLM72	Lone Pine	14	A	B	A	A		L	VH
334	Telford	13	A	B	A	A		M	VH
694	Telford	14	A	B	A	A		L	VH
790	Telford	13	A	C	B	B		VH	VH
916	Telford	12	A	B	B	B		H	VH
1306	Telford	11	A	A	A	A		L	VH
1510	Telford	14	A	C	A	B		VH	VH
2086	Telford	13	A	B	A	B		VH	VH
2131	Telford	13	A	B	A	B		L	L
2455	Telford	13	B	B	A	B		M	H
3257	Telford	12	A	B	A	A		VH	VH
3970	Telford	12	B	B	B	B		L	H
3971	Telford	13	A	C	A	B		VH	VH
4638	Telford	12	A	B	A	B		VH	VH
30877	Smoothing Iron	12	A	B	A	A		M	H
31252	Smoothing Iron	12	A	C	A	B		L	M
31254	Smoothing Iron	12	A	B	A	B		L	M
31259	Smoothing Iron	14	A	B	A	A		L	H
31260	Smoothing Iron	14	A	A	A	A		H	VH
31262	Smoothing Iron	13	A	C	B	B		M	VH
31263	Smoothing Iron	11	A	B	A	A		M	VH
31266	Smoothing Iron	14	A	B	B	B		L	VH
31271	Smoothing Iron	11	B	B	B	B		M	H
31272	Smoothing Iron	14	B	C	A	B		VH	M
32975	Smoothing Iron	12	A	C	A	B		M	VH
32976	Smoothing Iron	13	A	C	A	B		L	H
32978	Smoothing Iron	14	A	C	A	B		L	M
32981	Smoothing Iron	13	A	A	A	A		H	H

Table 6 displays the EIA ranks and stressor impacts by KCA (synonymous with WNHP element occurrences except Lone Pine and Telford, which are part of the same occurrence). Comparison of average EIA scores for each KCA indicates some difference in overall integrity and provides information that may be useful in determining whether the goal of the recover strategy for “*S. spaldingii* is being met (... first manage its habitat on an ecosystem basis – maintaining the habitat so that *S. spaldingii* and its natural interactions within the ecosystem (*e.g.* pollinators, fire) may be maintained. This will be accomplished by developing and implementing habitat management plans at all key conservation areas that provide guidance in managing *S. spaldingii*, and that also address the threats to the species” (USFWS 2007).

Table 6. Average EIA ranks and Impact ratings for *Silene spaldingii* KCAs (Key Conservation Areas) and associated Element Occurrence (EO). Bold “C” or “D” EIA ranks indicate where threats are most likely. Sites = the number of sample sites in each area. Land = Landscape Context (100 m buffer), Cond = Condition, and Veg = Vegetation categories. Impact ratings are a combination of scope and severity L= low impact, M= moderate impact, H= high impact, VH=very high impact, and blank =no stressors observed thus no or minimal impact.

KCA (EO)	sites	EIA Rank				Impact		
		Land	Cond	Size	EIA	Soil	Veg	Land
Blue Mts (049)	13	A	B	A	B	L	M	M
Crab Creek (030)	8	B	C	A	B	M	VH	VH
Fishtrap-Miller (032)	5	B	B	A	B		H	VH
Kamiak Butte (018)	2	B	C	C	C		H	H
Kramer Palouse (006)	2	A	B	A	A		L	M
Lamona (048)	2	A	B	A	A		L	L
Rocky Ford (046)	4	A	B	A	A	H	VH	VH
Smoothing Iron (085)	14	A	B	A	B		M	VH
Swanson Lakes (078)	5	B	C	A	B		VH	VH
Lone Pine (088)	10	A	B	A	B		M	VH
Telford (088)	13	A	B	A	B		H	VH
Twin Lakes (052)	7	A	B	A	B		H	VH

The ecological systems supporting *Silene spaldingii* vary somewhat in terms of their overall EIA rank, but are evenly split between A and B ranks (Table 7). As sampled, the ecological systems supporting *Silene spaldingii* are overall in good condition (Condition rank B) although the only sample of the Northern Rocky Mountain Ponderosa Pine Woodland and Savanna ecological system ranked C and the only Northern Rocky Mountain Foothill Conifer Wooded Steppe system ranked A. A single sample for each of those ecological systems limits generalizing any relationships between those ecological systems and *Silene*.

Table 7. Average EIA Rank and Stressor impact ratings for Ecological Systems sampled with observations of *Silene spaldingii*. Bold “C” or “D” EIA ranks indicate where management concerns are likely. Land = Landscape Context (100 m buffer), Cond = Condition, and Veg = Vegetation. Impact ratings are a combination of scope and severity L= low impact, M= moderate impact, H= high impact, VH=very high impact, and blank =no stressors observed thus no or minimal impact.

Ecological System	sites	EIA Rank				Impact		
		Land	Cond	Size	EIA	Soil	Veg	Land
CES304.083 Columbia Plateau Steppe and Grassland	7	A	B	A	A		M	VH
CES304.778 Inter-Mountain Basins Big Sagebrush Steppe	44	A	B	A	B	M	H	VH
CES304.792 Columbia Basin Palouse Prairie	6	A	B	B	B	L	M	M
CES304.993 Columbia Basin Foothill and Canyon Dry Grassland	17	A	B	A	B	L	M	H

Ecological System	sites	EIA Rank				Impact		
		Land	Cond	Size	EIA	Soil	Veg	Land
CES306.030 Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	1	A	C	A	B		VH	M
CES306.040 Northern Rocky Mountain Lower Montane, Foothill, and Valley Grassland	4	A	B	A	A	L	M	H
CES306.805 Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	2	A	B	A	A	L	L	L
CES306.958 Northern Rocky Mountain Foothill Conifer Wooded Steppe	1	A	A	A	A		L	VH
CES306.994 Northern Rocky Mountain Lower Montane Mesic Deciduous Shrubland	3	A	B	A	B	L	L	VH

3.1.2 Stressors

One of the primary objectives for each KCA is to meet the recovery goal to reduce or eliminate threats; particularly those discussed in the recovery plan, section G. “REASON FOR LISTING / THREATS ASSESSMENT” (USFWS 2007 p.26). Several threats on the Stressor Checklist (Appendix B) are identified in the recovery plan. The two most common stressors recorded on *Silene spaldingii* sites are:

- 1) Invasive exotic plant species as a Landscape Stressor at 79 of 85 sites and as a Vegetation Stressor in 76 sites and
- 2) Ranching or livestock grazing in the surrounding landscape of 63 of 85 sites and as a Vegetation Stressor in 50 sites and as a Soil Stressor in 12 sites (Table 8; see USFWS 2007 p.26 and p.39 threats).

Invasive exotic plant species were recorded as being pervasive or large in scope in 72 landscapes surrounding sites and serious to extreme in severity in 56 landscapes (see worksheet: *SISP_stressors&impacts* in *SIDP_POPE_Tables.xlsx* Excel workbook). Livestock grazing as a landscape stressor was pervasive or large in scope at 57 of 85 sites but only slight to moderate severity at 28 sites and not present at 22. Other recovery plan threats addressed through the standard stressor checklist as listed Table 8 are “Altered Natural Disturbance Regime”, (USFWS 2007 p.34), “Pesticide or vector control, chemicals” (USFWS 2007 p.42), and “Soil disturbance (trampling, vehicle, livestock)” (USFWS 2007 p.43-44).

Table 8. Number of *Silene spaldingii* sites where a stressor was recorded (85 total sites). Buffer is 100 meter beyond the plot edge, Site Vegetation is stress to vegetation in the plot, and Site Soil is stress to soil in the plot.

Stressor	Number of sites		
	Buffer (100 m)	Site Vegetation	Site Soil
16. Invasive exotic plant species	79	76	
7. Livestock, grazing, excessive herbivory	63	50	12
24. Soil disturbance (trampling, vehicle, livestock,)	17	14	23
10. Passive recreation (bird-watching, hiking, trampling)	13	6	
8. Roads (gravel, paved, highway), railroad	12	3	
15. Excessive animal herbivory, insect pest damage	8	8	

Stressor	Number of sites		
	Buffer (100 m)	Site Vegetation	Site Soil
19. Altered natural disturbance regime	7	2	
11. Active recreation (ATV, biking, hunting, fishing)	4	2	
13a. Tree resource extraction (clearcut, selective cut)	4	1	
17. Pesticide or vector control, chemicals	3	2	
1. Residential, recreational buildings and pavement	1		
3. Utility / powerline corridor	1		
6. Hay field	1		
14. Vegetation management (cutting, mowing)	1		

The summary of overall impacts (the combination of Scope and Severity) to sites arranged by KCA appears in Table 5. Impact summarized by KCA and by Ecological System appears in Tables 6 and 7, respectively. Conclusions from these results about KCAs are tentative since the survey effort was not designed to assess individual KCAs, but rather individual *Silene spaldingii* sites across Washington. Results do indicate that the Asotin County KCAs proportionally have more medium to no landscape impacts (Blue Mountains and Smoothing Iron 41% medium, low and no impacts) and more A condition ranks (Blue Mountains and Smoothing Iron 4 A ranks) than those in Lincoln County (Crab Creek, Lamona, Lone Pine, Rocky Ford, Swanson Lakes, Telford, Twin Lakes with 4% low impacts and 1 A condition rank) (Figure 4).

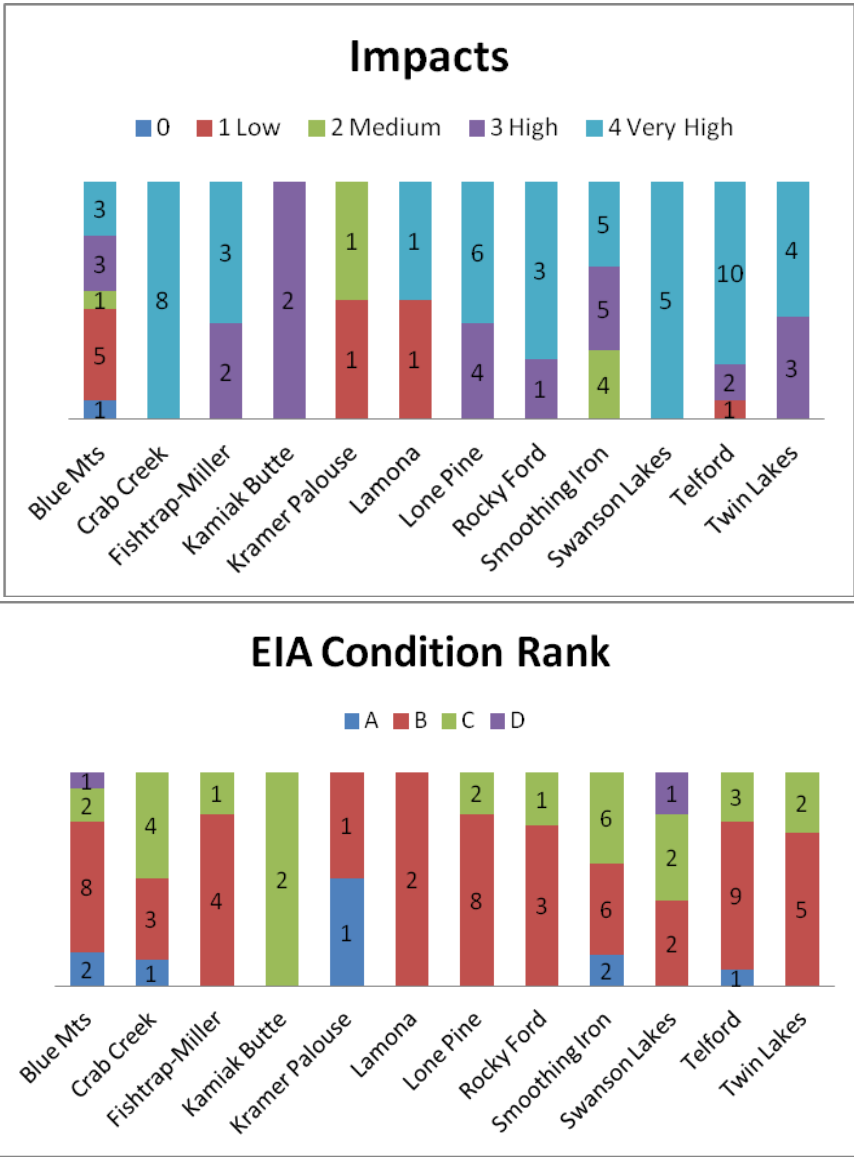


Figure 4. Distribution of Overall Landscape Impact rating and EIA Condition ranks among Key Conservation Areas for *Silene spaldingii*. The value in the bars is the number of sites in that category.

3.2 *Polemonium pectinatum*

3.2.1.1 Ecological Integrity Assessments

Sampling for *Polemonium pectinatum* included twenty-two source features (sites) from eight different element occurrences. General site location, identification and ecological system for each sample appear in Table 9.

Table 9. *Polemonium pectinatum* plot identifier and general location descriptors. Element Occurrence (EO) is the identifier used by NatureServe and the Natural Heritage Program. General Area is the location name of the Element Occurrence (see Figure 2). Site locations are illustrated in Appendix A.

Site	Surveyor	Township Range Section	Element Occurrence	General Area	Ecological System
3058p	Crawford	T22N R35E sec32	29	Coal Creek	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
3064p	Crawford	T22N R35E sec32	29	Coal Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
3658p	Crawford	T22N R35E sec32	29	Coal Creek	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obs3698	Rocchio/ Crawford	T22N R35E sec32	29	Coal Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
Obs3699	Rocchio/ Crawford	T22N R35E sec32	29	Coal Creek	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
3742	Crawford	T26N R32E sec 31	31	Wilson Creek BLM	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
3608p	Crawford	T22N R35E sec13	33	Coal Creek-Mohler	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
3709p	Crawford	T22N R35E sec13	33	Coal Creek-Mohler	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
3712p	Crawford	T22N R35E sec13	33	Coal Creek-Mohler	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
3717p	Crawford	T22N R35E sec13	33	Coal Creek-Mohler	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
3632	Crawford	T26N R32E sec29	35	Wilson Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
3634	Crawford	T26N R32E sec29	35	Wilson Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
3753	Crawford	T26N R32E sec29	35	Wilson Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
3755	Crawford	T26N R32E sec29	35	Wilson Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
3756	Crawford	T26N R32E sec29	35	Wilson Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
25203	Crawford	T26N R32E sec20	35	Wilson Creek	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
Obj3735	Rocchio	T22N R33E sec5	41	Lake Creek	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
Obj3671	Rocchio	T21N R35E sec24	43	Rocky Ford	CES300.xxx Columbia Plateau Wet Meadow (Provisional)
Obj4481; 1236	Rocchio	T21N R35E sec24	43	Rocky Ford	CES304.778 Inter-Mountain Basins Big Sagebrush Steppe
Obj4557	Rocchio	T21N R35E sec24	43	Rocky Ford	CES300.xxx Columbia Plateau Wet Meadow (Provisional)

Site	Surveyor	Township Range Section	Element Occurrence	General Area	Ecological System
Src8424	Rocchio	T21N R37E sec19	45	Crab Creek Hills road	CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland
Obj103	Rocchio	T21N R37E sec23	49	Crab Creek Big Bend	CES300.xxx Columbia Plateau Wet Meadow (Provisional)

Table 10 displays the roll-up (average) Landscape Context, Condition, Relative Size and EIA ranks and Stressor Impact ratings for each site. As an initial guideline, any “C” or “D” rank for either a Rank Category or the overall EIA rank, **bolded** in table, suggests that management needs are present at that site. Ranks of “A” or “B” suggest that the site is in good ecological condition and that current management of the site appears to be maintaining ecological integrity.

Table 10. EIA ranks and Impact ratings for each *Polemonium pectinatum* source feature location. “n” is the number of metrics used in EIA score and ranking (see Table 1) . Land = Landscape Context (100 m buffer), Cond = Condition, Hydro = Hydrological, and Veg = Vegetation. Impact ratings are a combination of scope and severity L= low impact, M= moderate impact, H= high impact, VH=very high impact, and blank =no stressors observed.

Site	General Area	n	EIA Rank				Impact			
			Land	Cond	Size	EIA	Hydro	Soil	Veg	Land
3058p	Coal Creek (29)	14	A	B	B	B			L	L
Obs3699	Coal Creek (29)	14	A	B	B	B		VH	VH	VH
Obs3698	Coal Creek (29)	16	A	B	A	B			M	L
3658p	Coal Creek (29)	15	A	B	A	B			VH	VH
3064p	Coal Creek (29)	15	A	A	A	A			L	H
Obj103	Crab Creek Big Bend (49)	15	A	B	C	B	M	VH	VH	VH
Src8424	Crab Creek Hills road (45)	15	A	C	B	B		VH	VH	VH
Obj3735	Lake Creek (41)	15	B	B	B	B		L	L	M
3608p	Coal Creek-Mohler (33)	14	A	B	B	B			L	L
3709p	Coal Creek-Mohler (33)	14	B	C	B	B			VH	VH
3712p	Coal Creek-Mohler (33)	14	B	C	B	B			VH	VH
3717p	Coal Creek-Mohler (33)	21	A	C	A	B		M	VH	VH
Obj3671	Rocky Ford (43)	15	A	C	C	C			L	VH
Obj4557	Rocky Ford (43)	15	A	C	B	B			H	L
Obj4481; 1236	Rocky Ford (43)	15	A	A	A	A		VH	VH	VH
3632	Wilson Creek (35)	16	B	D	D	D			VH	VH
3634	Wilson Creek (35)	16	B	D	D	D			VH	VH
3753	Wilson Creek (35)	13	B	D	B	C	H		VH	VH
3755	Wilson Creek (35)	13	B	D	B	C	H		VH	VH
3756	Wilson Creek (35)	13	B	C	B	B		L	VH	VH
25203	Wilson Creek (35)	13	B	C	B	B			L	M
3742	Wilson Creek BLM (31)	13	C	D	C	D			VH	VH

Condition and overall EIA ranks and stressor impacts for WNHP *Polemonium pectinatum* element occurrences are presented in Table 11. Comparison of Element Occurrence EIA average ranks indicates differences in overall integrity and possible future management needs for ecological integrity. For example, both occurrences at Wilson Creek (31 and 35) have EIA ranks of C and D, as well as, C or D ranks in all but one category rank. Wilson Creek appears to have

greater need of possible management evaluation than the other EOs that rank B overall. The Coal Creek-Mohler (33) occurrence has a B overall rank although a Condition rank C indicates some degradation that may influence *Polemonium pectinatum*. The Crab Creek Big Bend (49), Crab Creek Hills Road (45) and Lake Creek (41) occurrences ranked B overall, although each had only one sample site. *Polemonium pectinatum* occurs in sites with lower condition ranks, 59% C and D ranks than *Silene spaldingii*, 32% C and D ranks. *Polemonium pectinatum* had higher cover in high Condition rank (average of 15% cover in A; 40% in B rank) than lower condition rank (3% in C and 2% in D) suggesting a positive relationship between Condition rank and cover.

Table 11. EIA ranks and Impact ratings for *Polemonium pectinatum* Element Occurrence (EO). Sites = the number of sample locations in each area. Land = Landscape Context (100 m buffer), Cond = Condition, Hydro = Hydrological, and Veg = Vegetation. Impact ratings are a combination of scope and severity L= low impact, M= moderate impact, H= high impact, VH=very high impact, and blank =no stressors observed impact.

General Area	sites	EIA Rank				Impact			
		Land	Cond	Size	EIA	Hydro	Soil	Veg	Land
Coal Creek (29)	5	A	B	A	B			L	L
Crab Creek Big Bend (49)	1	A	B	C	B		M	VH	VH
Crab Creek Hills road (45)	1	A	C	B	B		VH	VH	VH
Lake Creek (41)	1	B	B	B	B			L	VH
Coal Creek-Mohler (33)	4	A	C	B	B			VH	VH
Rocky Ford (43)	3	A	B	B	B	M	H	VH	H
Wilson Creek (35)	6	B	D	C	C	H	L	VH	VH
Wilson Creek BLM (31)	13	C	D	C	D			VH	VH

As sampled, EIA Rank varies little by ecological system (Table 12). Overall, the ecological systems supporting *Polemonium pectinatum* are in good condition. Sites within the Columbia Basin Foothill Riparian Woodland and Shrubland ecological system ranked C in condition; the significance of this is unclear.

Table 12. EIA Rank and Impact ratings for Ecological Systems sampled with observations of *Polemonium pectinatum*. Bold “C” or “D” EIA ranks indicate where management concerns are likely. Number of sites = “n”.

Ecological System	n	EIA				Impact			
		Land Rank	Cond Rank	Size Rank	EIA Rank	Hydro	Soil	Veg	Land
CES300.xxx Columbia Plateau Wet Meadow (Provisional)	9	B	B	B	B	M	H	H	H
CES304.768 Columbia Basin Foothill Riparian Woodland and Shrubland	9	B	C	B	B	H	M	VH	VH
CES304.778 Inter-Mountain Basins Big Sagebrush Steppe	4	A	B	A	B		L	M	H

3.1.2 Stressors

The most common landscape stressors at *Polemonium pectinatum* sites were ranching or livestock grazing, noted at all 22 sites and invasive exotic plant species at 21 sites (Table 13). These two stressors were also the most common vegetation stressors in the sites. Livestock grazing was also the major soil stressor. Livestock grazing was pervasive in scope at 15 of the 22 sites, only one site was rated extreme in grazing, and 10 sites were rated as slightly grazed (see worksheet: POPE stressors&impacts in SISP_POPE_Tables.xlsx Excel spreadsheet) . Invasive exotic species was rated pervasive in scope at 14 sites; it was rated as extreme or serious severity at 15 of the 21 sites. Nine other stressors were observed at *Polemonium pectinatum* sites.

Table 13. Number of *Polemonium pectinatum* sites where a stressor was recorded (22 total sites). Buffer is 100 meter beyond the plot edge, Site Vegetation is stress to vegetation in the plot, and Site Soil is stress to soil in the plot.

Stressor	Number of sites			
	Buffer (100 m)	Site Vegetation	Site Soil	Site Hydrology
7. Livestock, grazing, excessive herbivory	22	12	5	1
16. Invasive exotic plant species	21	21		
17. Pesticide or vector control, chemicals	6	5		
21. Excessive sediment or organic debris, gullyng, erosion	6	5		
8. Roads (gravel, paved, highway), railroad	6	4		
30. Dam, ditch, diversion, dike, levee, unnatural inflow, reservoir	4	1		2
29. Non-point source discharge (urban runoff, farm drainage)	4			
24. Soil disturbance (trampling, vehicle, livestock, skidding)	1		5	
25. Grading, compaction, plowing, discing, fire lines	1		1	
22. Trash or refuse dumping	1			
31. Groundwater extraction (water table lowered)	1			

4.0 Application Examples of the Ecological Integrity Assessment

As presented in the results, EIA ranks and metric information can be applied and interpreted at a fine-scale (to individual sites) or at a broad-scale (to a cluster or group of sites). This section provides examples of how EIA information might be used to prioritize among *Silene spaldingii* KCAs in need for recovery attention (the broad-scale) and to evaluate metric information at individual sites of species (fine-scale).

4.1 Broad-scale application: Key Conservation Areas

Overall EIA ranks for each KCA are summarized in Table 6. These EIA ranks can be used to indicate recovery actions as described in the recovery plan for *Silene spaldingii* (USFWS 2007 p. 67). For example, the Recovery Action Narrative “2.2. Develop *Silene spaldingii* habitat management plans at all key conservation areas” might be evaluated as illustrated in the following discussion.

- EIA ranks provide a means of prioritizing sites for conservation actions. For example, an EIA rank of “A” means that a site’s composition, structure, and ecological processes are relatively intact (e.g., Kramer Palouse, Lamona and Rocky Ford KCAs). Management actions should be focused on maintaining the intact conditions, perhaps including pursuing land management designations (e.g., natural area designation) that optimize or maximize conservation opportunities. An EIA rank of “C,” on the other hand, means that a site’s ecological characteristics have been degraded (e.g., Kamiak Butte). A recovery plan for Kamiak Butte will likely need to address more threats to *Silene spaldingii* than more intact sites. High ranks, of course, do not mean an absence of management needs but do suggest that they may lack threats currently found at other KCAs.
- EIA category ranks (Landscape Context, Condition and Size) provide more detail about each area. Landscape Context (100 meter buffer) rank was either A or B for all KCAs indicating that the areas surrounding plot locations on average support high quality habitat. Relative Size of all but one assessment site ranks as A. The exception is Kamiak Butte, which ranked C, indicating some loss of habitat at that site. Condition Ranks of most KCAs are B, except Crab Creek, Kamiak Butte and Swanson Lakes that ranked C. These three KCAs would likely require more direct management actions to address threats. Kamiak Butte has an expected added challenge of its reduced size.
- Reviewing metric ratings within a KCA will indicate more specifically where and what management or recovery actions should be considered to improve overall EIA rank for the KCA. For example, in the case of the Kamiak Butte KCA within the Palouse Grasslands, the Edge Condition metric had a C Rank (Table 14), defined as “Moderate (25–50%) cover of non-native plants, moderate or extensive soil disruption” which indicates that habitat quality adjacent to the sample locations has been degraded. Similarly, the two metrics “Absolute Cover of Non-native Species” and “Absolute Cover of Invasive Species” both ranked D indicating that weed control actions are needed in the area to improve EIA rating and to address specific recovery actions (see Section 1.5.5. “Control and manage invasive nonnative plant species specific to the Palouse

Grasslands” in the *Silene spaldingii* Recovery Plan). Additionally, a CD rating for the “Species Composition” metric and a C rating for “Relative Cover of Native Bunchgrass” and “Relative Cover of Native Plant Species” metrics indicate that the degree of deviation from reference condition for these ecological characteristics may require more intensive restoration activities to improve overall ecological integrity in the KCA. The EIA information should not be used alone, without information on *Silene spaldingii* abundance and vigor, to determine appropriate management at a site.

Table 14. Average metric ranks for the two sites in the Kamiak Butte KCA.

Category	Metric	Rank
Landscape	Edge Condition	C
	Edge Length	A
	Edge Width	A
Condition	Soil Surface Condition	A
	Absolute Cover of Non-native Species	D
	Absolute Cover of Invasive Species	D
	Absolute Cover of Native Bunchgrass	B
	Relative Cover of Native Bunchgrass	C
	Absolute Cover of Native Plant Species	A
	Relative Cover of Native Plant Species	C
	Species Composition	CD
	Absolute Tall Shrub Cover	A
Size	Relative Size	C

4.2. Site-scale application

This section gives examples of how overall site integrity and specific metrics ranks might be used to evaluate individual sites for management planning. The section is also a “how-to” guide to the use of the accompanying “SISP_POPE_tables.xls” Microsoft Excel workbook, which contains the results of the field data for each site including: general information and summarized ranks, the EIA with all metrics, Stressor and Impact evaluation, and species abundance plot data (Figure 5). In the examples below, “sheet:SISP summary” refers to worksheet tabs in the SISP_POPE_tables.xls workbook (Appendix C is metadata for workbook). It is recommended that the spreadsheet be open when reading the material discussed below.

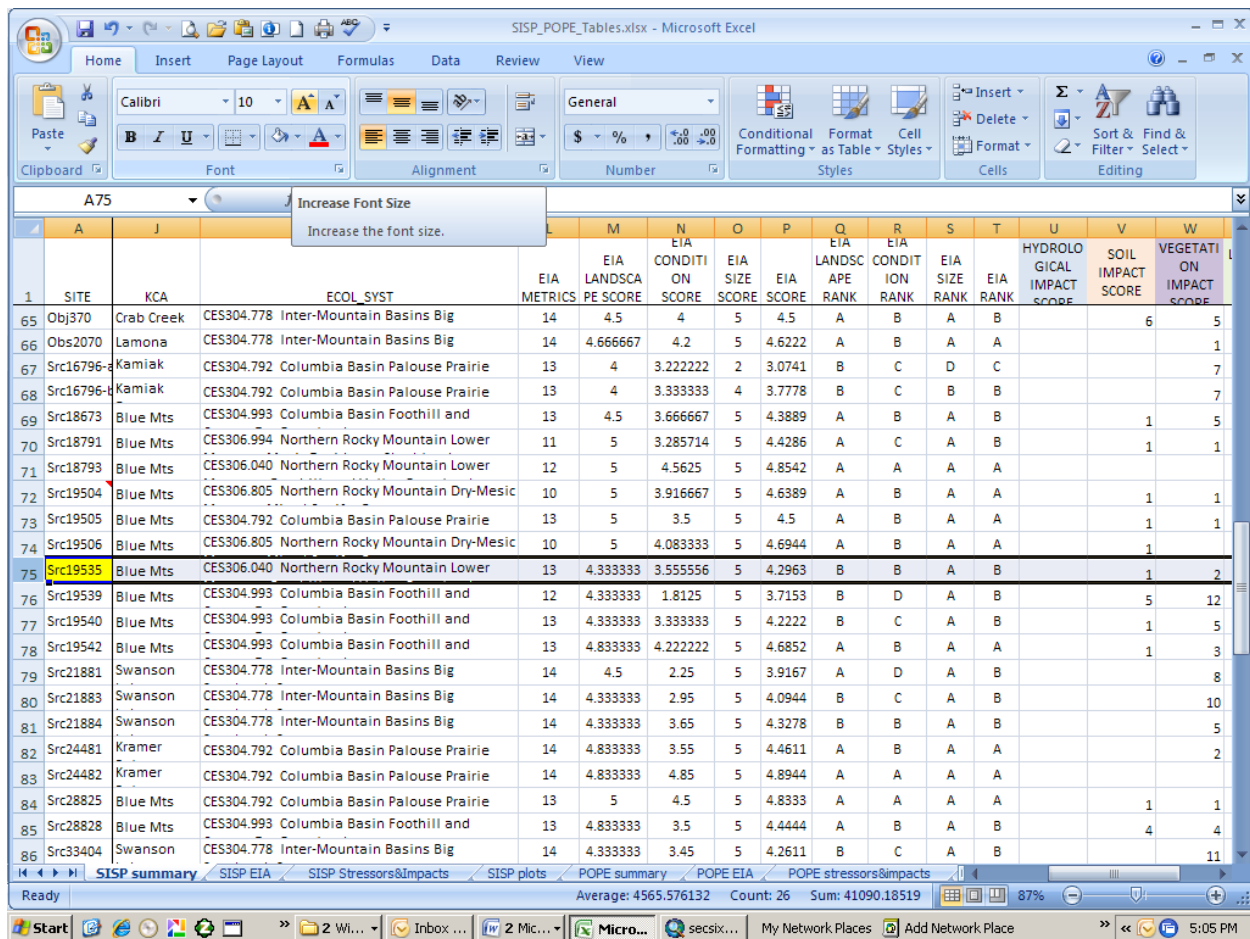


Figure 5. Screen shot of SISP_summary sheet with general information on *Silene spaldingii* sites. This is intended to assist the user in navigating the SISP_POPE_tables.xls workbook. The highlighted row is an individual site and columns are site variables. Appendix C describes values of each variable in the table.

The site summary information provides a basis for site-level management planning, among site comparisons, and evaluations for future information needs. To illustrate how this information may be used, scenarios are presented for two *Silene spaldingii* sites. Both sites are in the Canyon Grasslands physiographic region and in the Blue Mountains Key Conservation Area, which is composed of 23 source features, of which thirteen sites were randomly selected and sampled. These assessments can be used to evaluate recovery actions listed in the Recovery Plan (USFWS 2007 p. 67). The Recovery Action Narrative for “2.3 Habitat management plans and recovery actions should manage for impacts and threats to *Silene spaldingii* populations and habitat both at key conservation areas as well as at smaller populations” (USFWS 2007 p. 69) could be evaluated as follows.

Site Src18793 (Appendix A), classified as the Northern Rocky Mountain Lower Montane, Foothill, and Valley Grassland ecological system, received an overall EIA rank of A. All Category ranks were A (Table 5, sheet:SISP summary) and of twelve individual metrics, ten ranked A and the other three ranked B.

Because all metrics had an “excellent” (A rank) or “good” (B rank) rating, no recommendations are currently indicated at Site Src18793 to address item 2.3.1. “Implement invasive nonnative plant control and integrated pest management programs at all *Silene spaldingii* sites, taking care not to impact *S. spaldingii*” or other items under section 2.3. Other recovery actions at this site might be appropriate including 2.4 “Monitor population trends and habitat conditions” or 2.5 “Conduct research essential to the conservation of *Silene spaldingii*”.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	which metric applies to	all	all	except Palouse,	all	all	Shrubstepp	Shrubste	all	all	all	only Palou	only Shrubstepp	only DecidSh	Wsteppe	Wsteppe	Wsteppe & DM Conifer	Pine	Wsteppe & DM Conifer
2	Category	CONDI	CONDI	COND	CON	CON	CONDI	CON	CON	CON	CONDI	CO	CONDI	CON	CONDIT	CONDITION	CONDIT	CONDIT	CONDIT
3	Key	Physic	Vegeta	Vegeta	Veget	Veget	Vegetat	Veget	Vege	Veget	Vegeta	Veg	Vegetat	Veget	Vegetati	Vegetation	Vegetati	Vegetatio	Natural
4	"A"	Bare soil	Where	None	None	Perennia	Perennial	TBD	Cover	Cover	Species	None	Fire-	Trees	Vast majority	Over 75% of area	Within old	Vast majority	Pathogens
5	"B"	Some bare	Where	Invasive	Invasive	Perennia	Perennial	TBD	Cover	Cover	Species	5-10%	Fire-	Trees	Some (10-	50-75% of area with	Snags and	Some (10-	Native
6	"C"	Bare soil	Where	Invasive	Invasive	Perennia	Perennial	TBD	Cover	Cover	Species	10-	Shrub 20-	Trees	Many (over	25-50% of area with	Snags and	Many (over	Exotic and
7	"D"	Bare soil	Where	Invasive	Invasive	Perennia	Perennial	TBD	Cover	Cover	Vegetatio	>25%	Shrubs well	Trees	Most (over	<25% of area with	Snags and	Most (over	Exotic and
8	Indicator metric	Soil Surface Condition	Biological Soil Crust	Absolute Cover of Non-native	Absolute Cover of Invasive	Absolute Cover of Native	Relative Cover of Native Bunchgrass	Percent Tolerant (C value <= 3)	Absolute Cover of Native	Relative Cover of Native	Species Composition	Absolute Tall Shrub	Fire-sensitive Shrubs	Tree Abundance	Old, Large-tree Stand Structure	Patch Diversity	Coarse Woody Debris (upland)	Late Seral Patches	Forest Pathogens
9	site																		
76	Src16796-h	5		1	1	4	3		5	3	3	5							
77	Src18673	4.5	4.5	1	1	5	5		5	4	3								
78	Src18791	5		1	1				5	3	4			4					
79	Src18793	5		4	4	5	4		5	5	4.5								
80	Src19504	4		3	3				5	5	3.5						missing		missing
81	Src19505	4		3	4	1	1		5	5	3.5	5							
82	Src19506	5	not	3	3				5	5	3.5						missing		missing
83	Src19535	4.5	4	1	1	5	4		5	4	3.5								
84	Src19539	3.5		1	1	1	1		5	1	1								
85	Src19540	4	4	1	1	5	4		5	4	2								
	Src19542	4.5	4	4	4	4	5		4	5	3.5								

Figure 6. Screen shot of SISPEIA worksheet with metric rating on *Silene spaldingii* site data. This is intended to assist the user in navigating the SISPEIA_tables.xls workbook. The highlighted row is individual site and columns are EIA indicator metrics. Appendix C describes values in table.

Site Src19535 is also part of the Blue Mountain Foothills KCA (Appendix A). It is representative of the Columbia Basin Foothill and Canyon Dry Grassland ecological system and received an overall EIA rank of B, with an “A” rank for Landscape Context, “D” for Condition and “B” for Size (Table 5, Figure 6, sheet:SISP summary). The “D” Condition rank raises a red flag as it suggests the site is degraded and that potential recovery actions may be a priority. Of thirteen total metric ranks (sheet:SISP eia) at Src19535 seven metrics were rated a “C” or “D” (Absolute Cover of Non-native Species, Absolute Cover of Invasive Species, Absolute Cover of Native Bunchgrass, Relative Cover of Native Bunchgrass, and Relative Cover of Native Plant Species,

and Edge Condition) suggesting management actions that focus on improvement of these ecological characteristics are needed at this particular site.

The stressor checklist data for Site Src19535 (Figure 7, sheet:SISP_stressors&impacts) indicates that high impacts of excessive animal herbivory, insect pest damage, invasive exotic plant species, and soil disturbance (trampling, vehicle, livestock, skidding, etc.) are present in the surrounding landscape. Similarly, impacts associated with invasive exotic plant species and high impact of excessive animal herbivory, insect pest damage, and soil disturbance (trampling, vehicle, livestock, skidding, etc) are also present within the site. Plot data indicate *Bromus tectorum* (75-95% cover), *Sisymbrium altissimum* (25-50%) and *Lactuca serriola* (10-25%) are the most abundant of the eight exotic plants recorded (Figure 8 sheet:SISP plots).

Based on the EIA and stressor information, actions at the Src19535 site could focus on weed control, particularly identifying the source of soil disturbance that may be promoting *Bromus tectorum*. The status of the *Silene spaldingii* population at the site would guide the type and intensity of actions implemented. These actions would address recovery plan section 2.3.1. “Implement invasive nonnative plant control and integrated pest management programs at all *Silene spaldingii* sites”.

	A	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
1		15. Excessive animal herbivory, insect pest damage			16. Invasive exotic plant species			17. Pesticide or vector control, chemicals (give onsite evidence)			19. Altered natural disturbance regime (specify expected regime)		24. Soil disturbance (trampling, livestock, skidding, etc)		
2	SITE	Buffer (100 m) Severity	Buffer (100 m) Scope	15 Landscape Impact	Buffer (100 m) Severity	Buffer (100 m) Scope	16 Landscape Impact	Buffer (100 m) Severity	Buffer (100 m) Scope	17 Landscape Impact	Buffer (100 m) Severity	Buffer (100 m) Scope	19 Landscape Impact	Buffer (100 m) Severity	Buffer (100 m) Scope
66	Obj370				4	7	4								
67	Obs2070				3	3	1								
68	Src16796-a				7	7	7								
69	Src16796-b				7	7	7								
70	Src18673				5	7	5							1	1
71	Src18791	1	7	1											
72	Src18793														
73	Src19504	1	7	1											
74	Src19505	1	7	1											
75	Src19506	1	7	1											
76	Src19535	1	7	1	5	5	5								
77	Src19539	5	7	5	5	7	5							5	7
78	Src19540				5	7	5							1	7
79	Src19542				3	7	3							1	7
80	Src21881				6	7	6								
81	Src21883				6	7	6								
82	Src21884				6	7	6								
83	Src24481				4	3	2								
84	Src24482				5	5	5								
85	Src28825	1	7	1											

Figure 7. Screen shot of SISP_stressor and impacts ratings on *Silene spaldingii* site data. This is intended to assist the user in navigating the SISP_POPE_tables.xls workbook. The highlighted row is individual site and columns are site variables. Appendix C describes values in table.

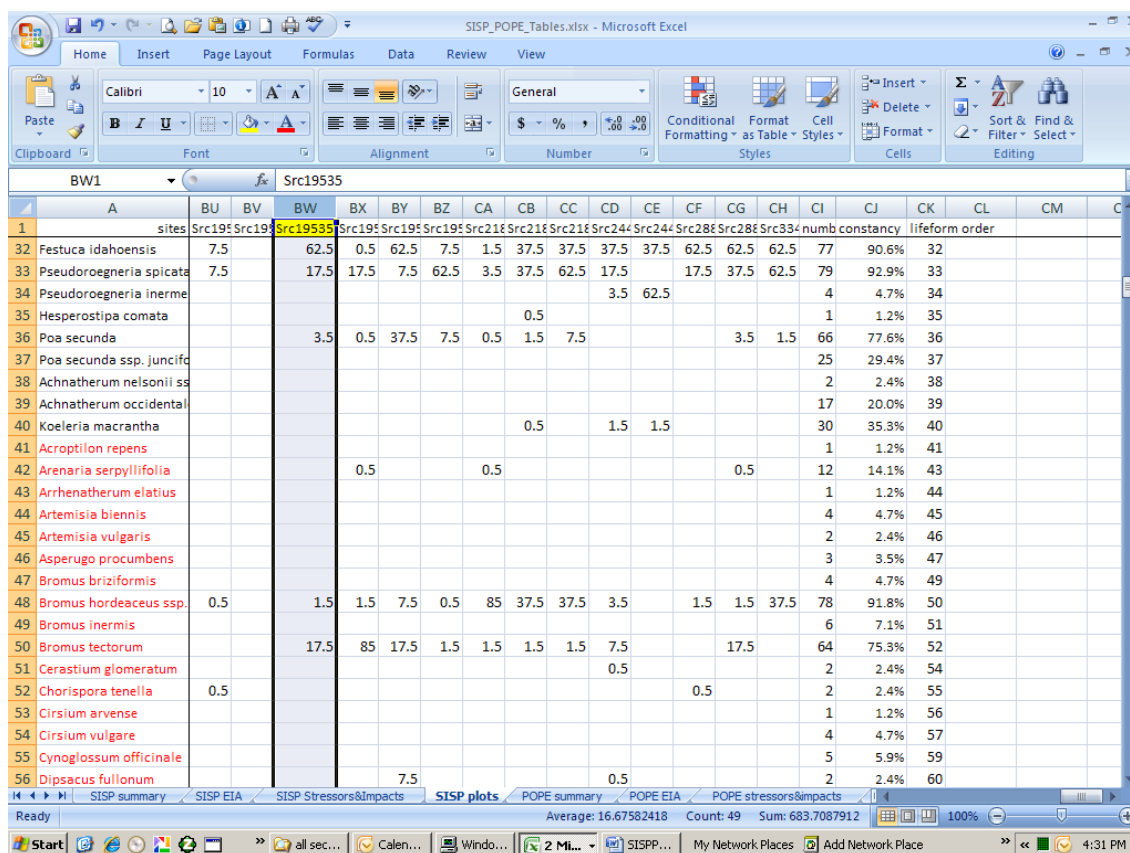


Figure 8. Screen shot of SISP_plot data on *Silene spaldingii* sites. This is intended to assist the user in navigating the SISP_POPE_tables.xls workbook. The highlighted row is species, columns are individual sites and cells values are mid-point of cover classes assign in field. Appendix C describes cover classes.

These two site-level examples demonstrate the utility the EIA protocol may have as a rapid monitoring tool that can address several recognized threats or concerns in species conservation planning.

5.0 Recommendations

The data gathered as part of this project should be used to help identify overall conservation priorities and specific management needs. However, the EIA information should not be used by itself. Rather, it would be best to use it in conjunction with information about the abundance and vigor of the target rare plant populations. This project did not explicitly explore the relationship between overall ecological condition (as measured by the EIA ranks) and the health and vigor of the target rare plant populations. Future research should explore this relationship, which in turn might identify key ecological condition factors on which to focus.

6.0 Citations

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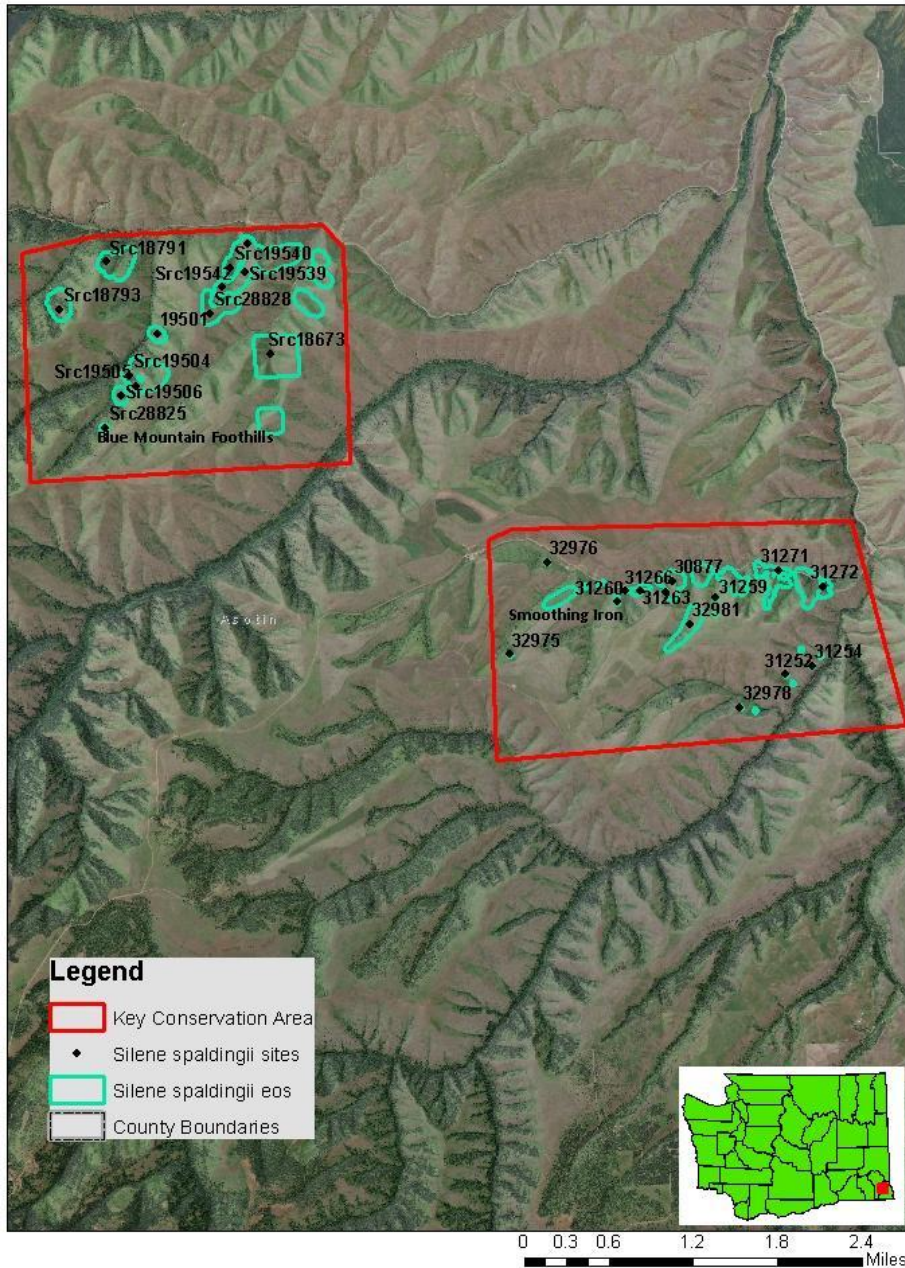
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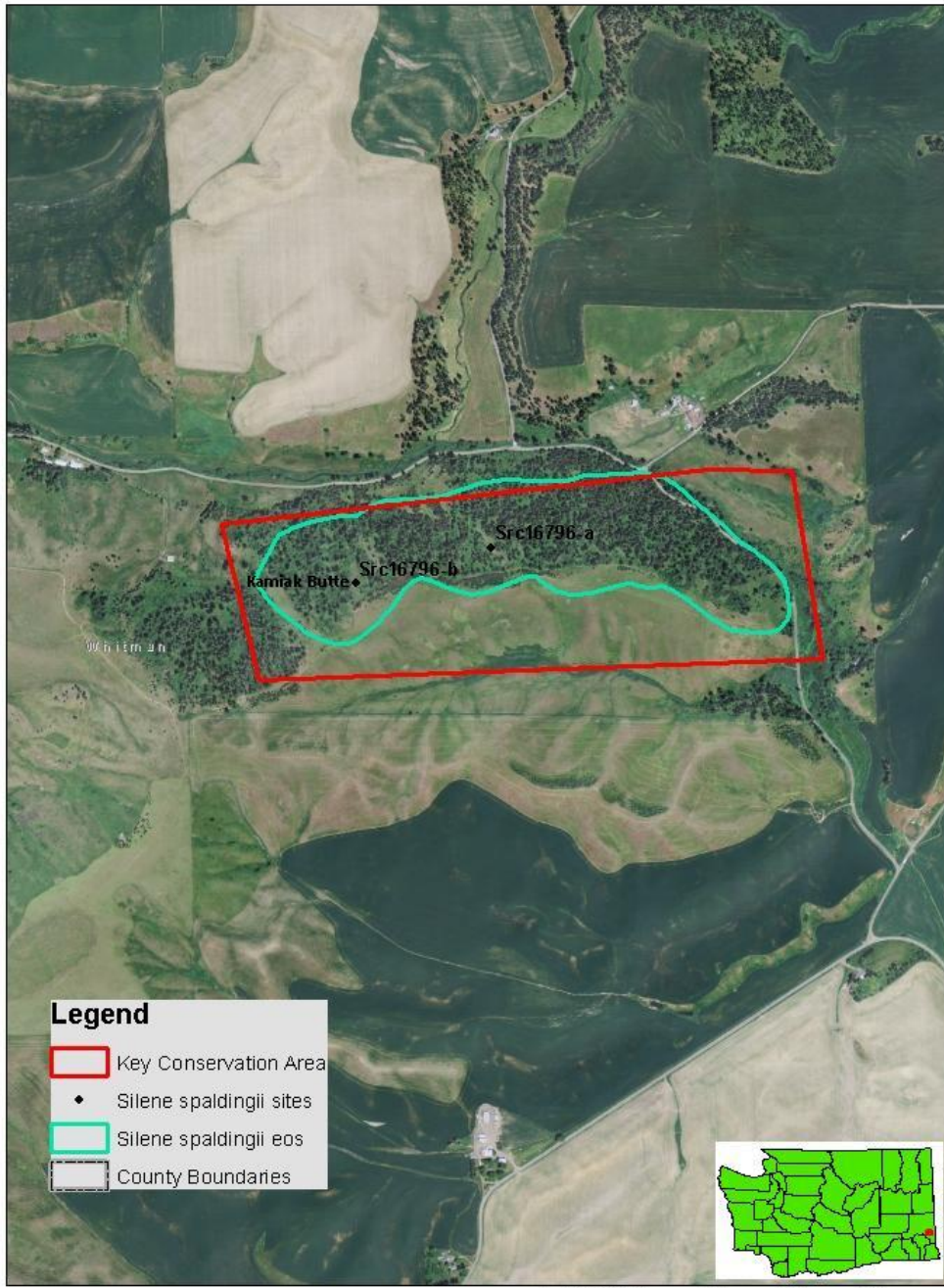
U.S. Fish and Wildlife Service (USFWS). 2007. Recovery Plan for *Silene spaldingii* (Spalding's Catchfly). U.S. Fish and Wildlife Service, Portland, Oregon. xiii + 187 pages.

United States Environmental Protection Agency (EPA). 2006. Application of Elements of a State Water Monitoring and Assessment Program for Wetlands. Wetlands Division, Office of Wetlands, Oceans and Watersheds, U.S. Environmental Protection Agency, Washington, DC.

Appendix A. Plot locations for *Silene spaldingii* and *Polemonium pectinatum*.

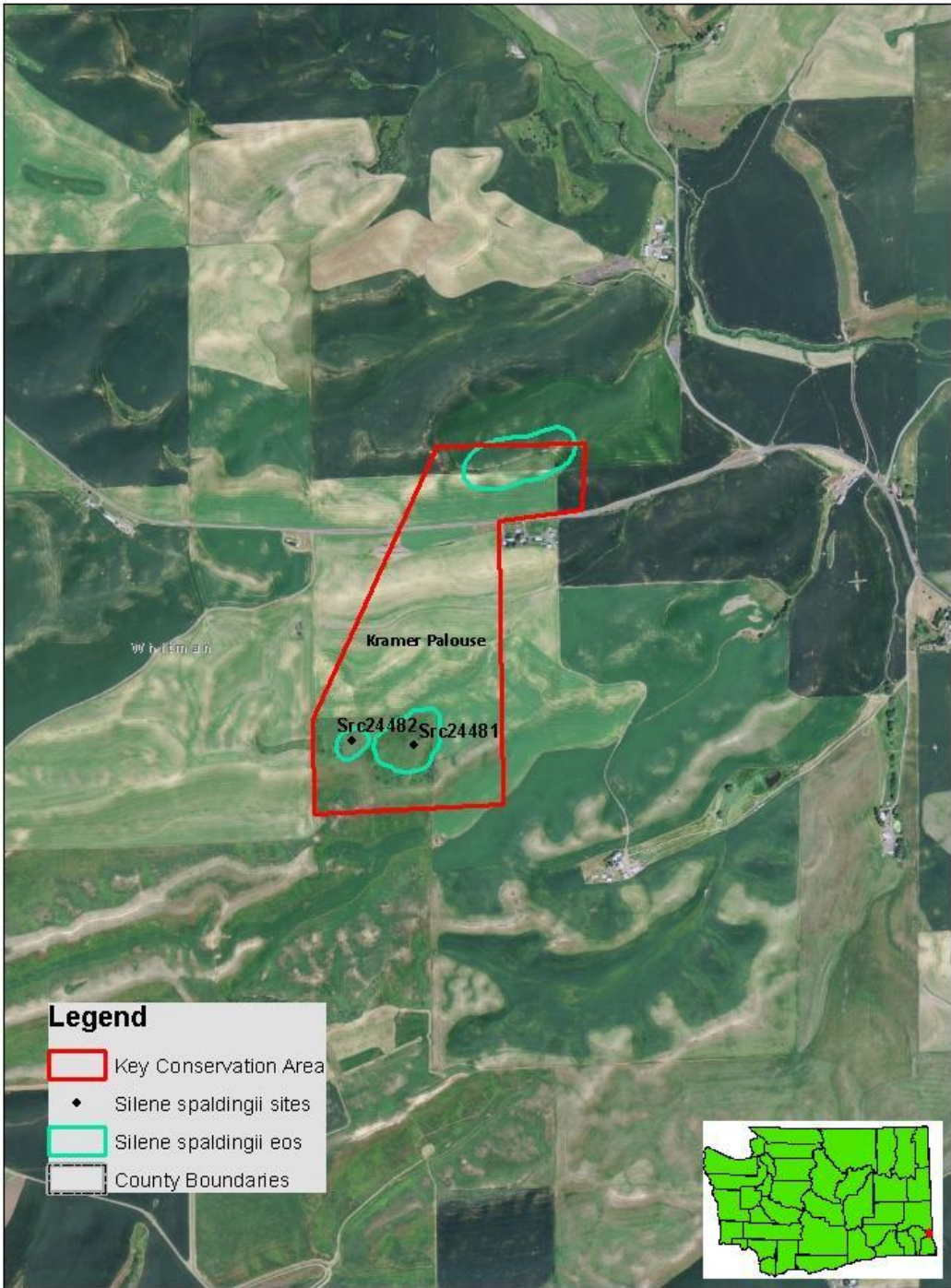
Silene spaldingii





- Legend**
-  Key Conservation Area
 -  Silene spaldingii sites
 -  Silene spaldingii eos
 -  County Boundaries

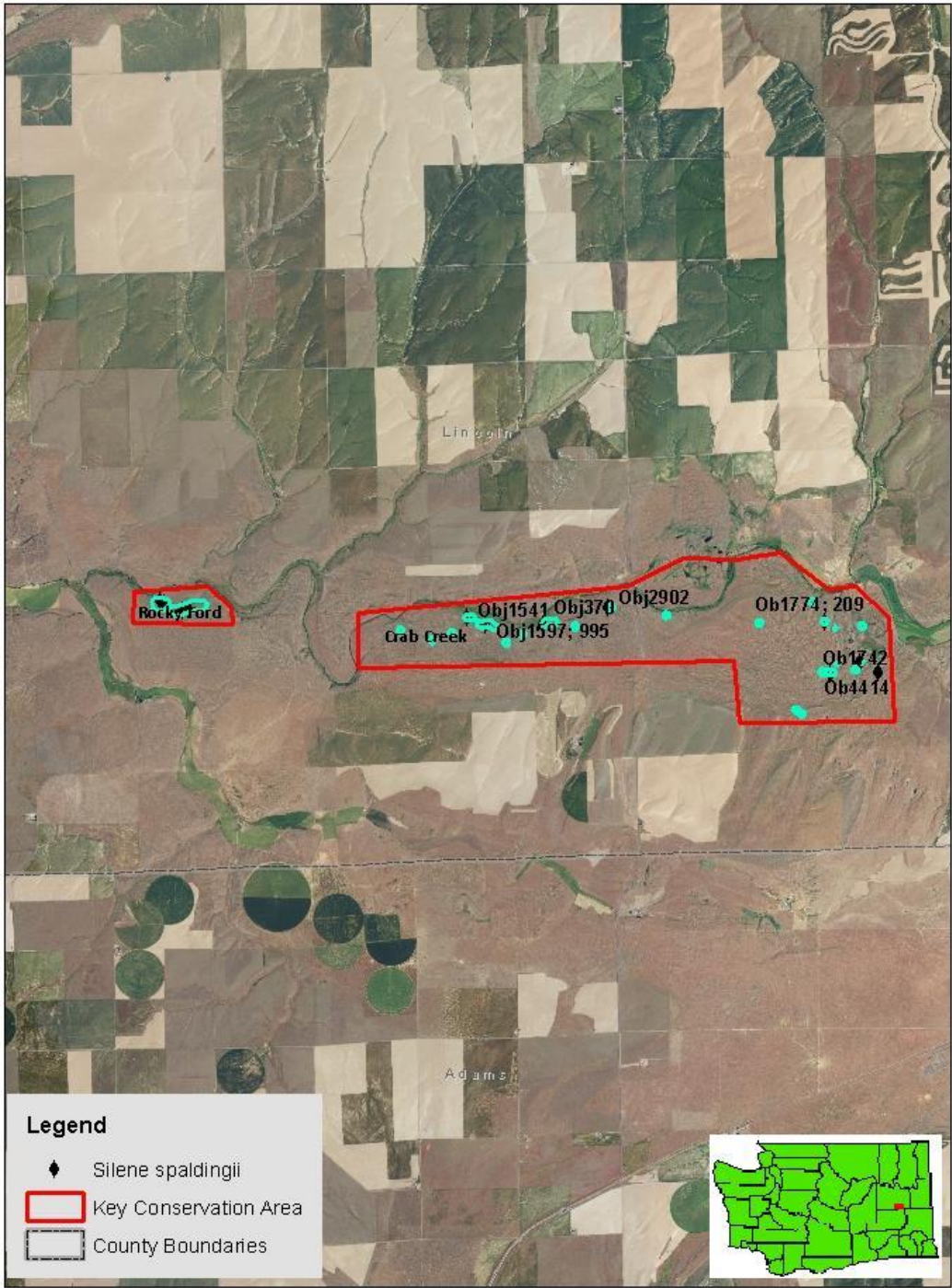
0 0.0750.15 0.3 0.45 0.6 Miles



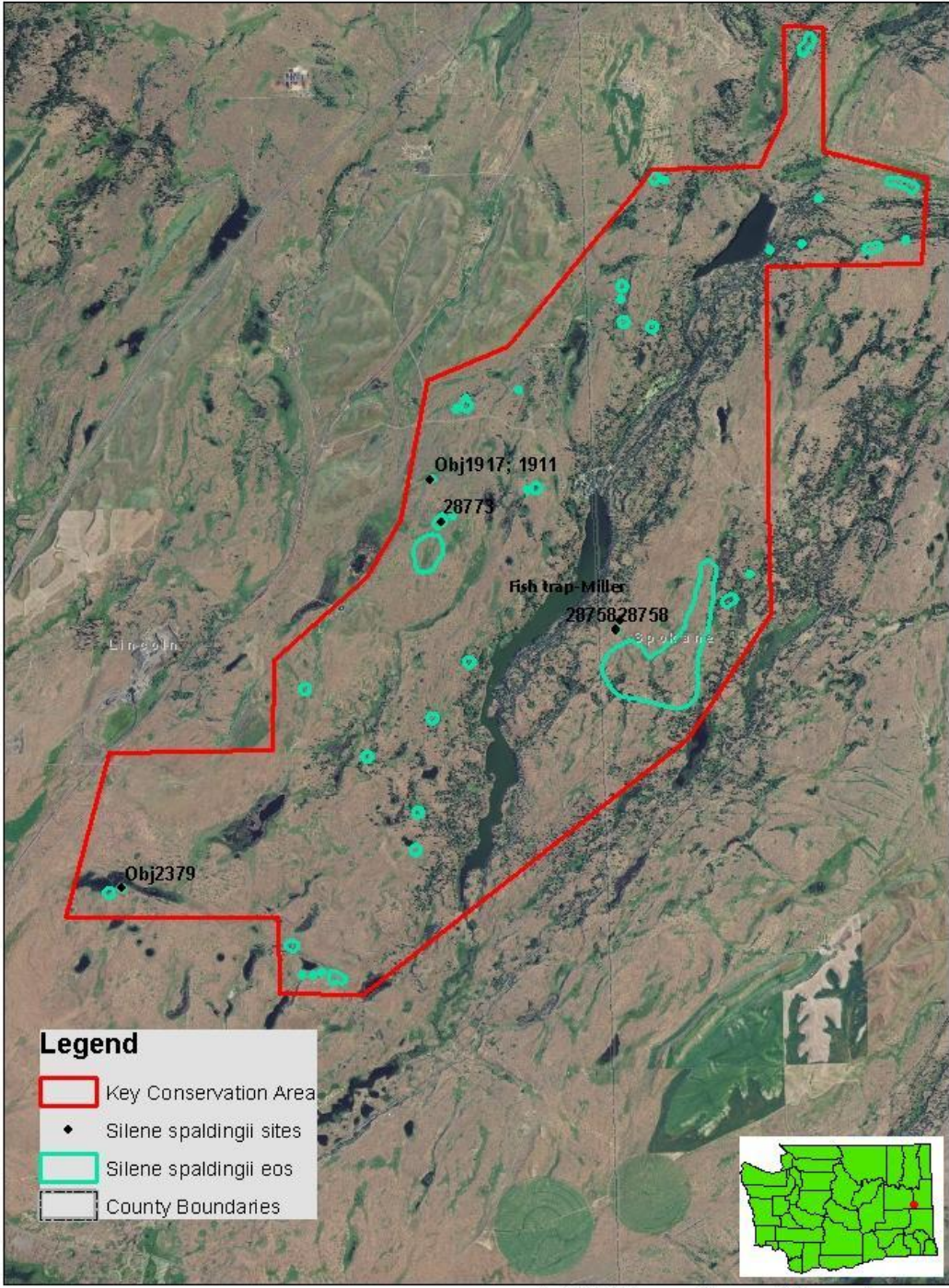
Legend

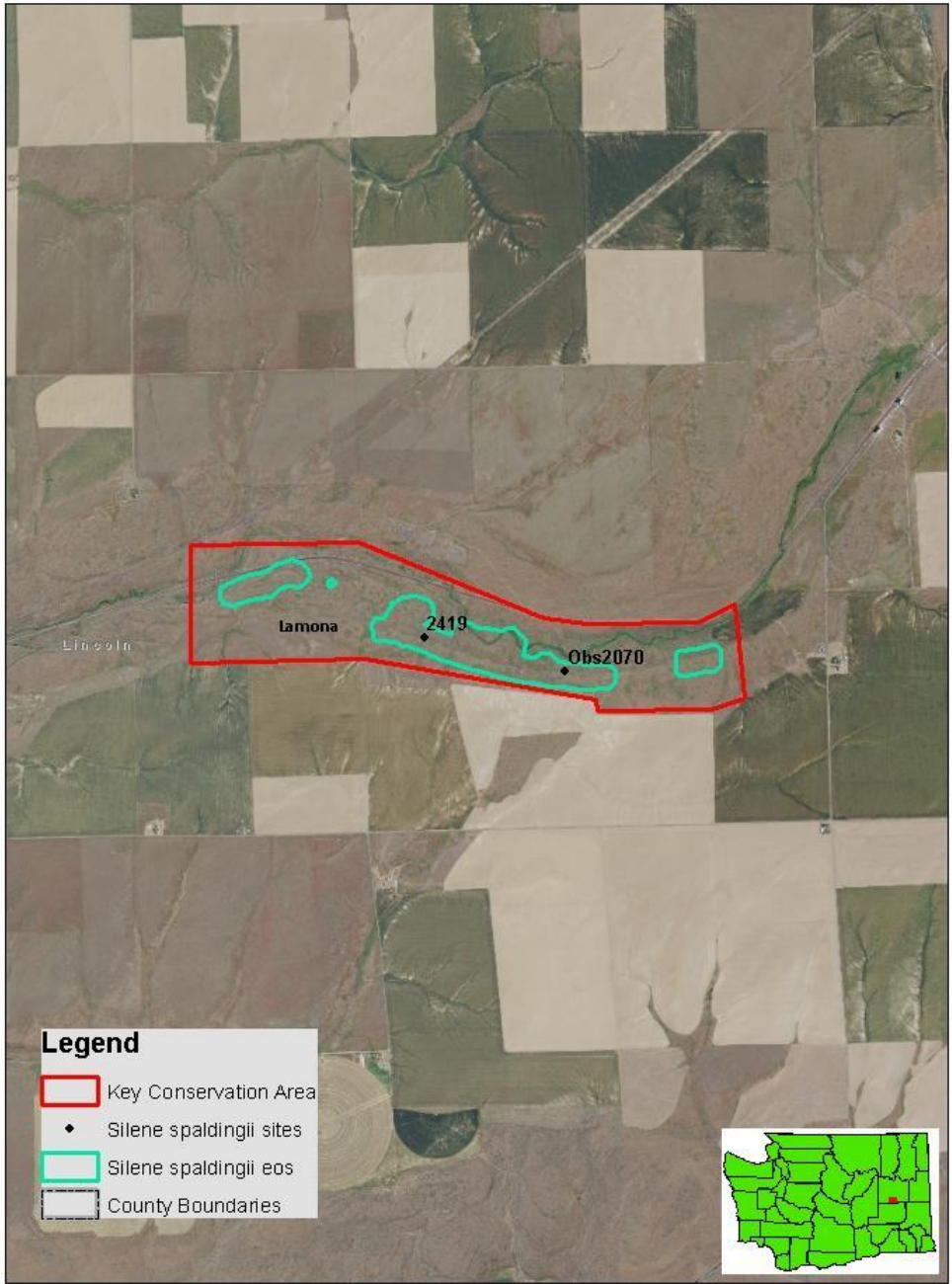
- Key Conservation Area
- Silene spaldingii sites
- Silene spaldingii eos
- County Boundaries

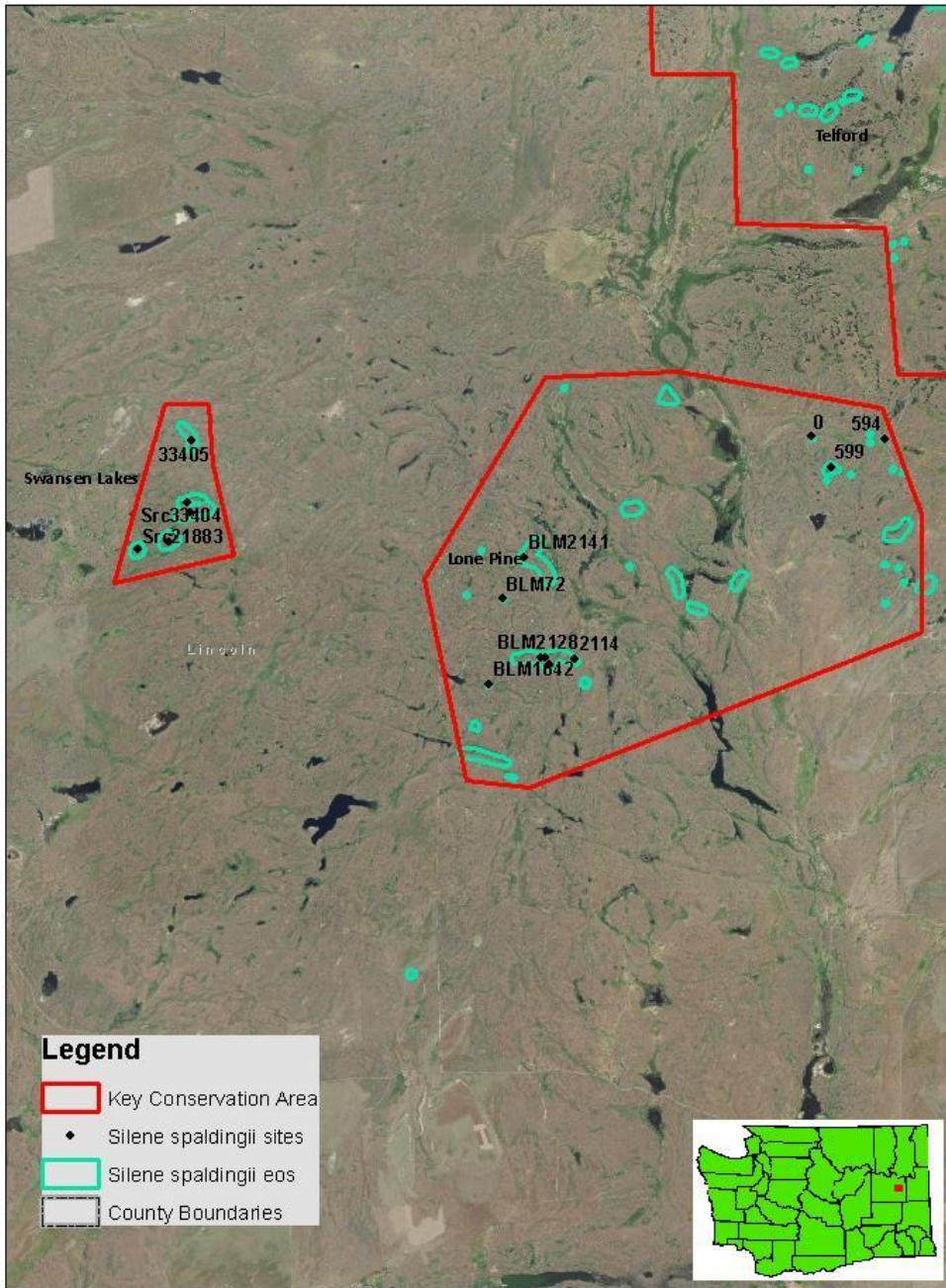




0 0.5 1 2 3 4 Kilometers







Swansen Lakes

33405

Src33404

Src21883

Lone Pine

Lone Pine

BLM2141

BLM72

BLM21282114

BLM1842

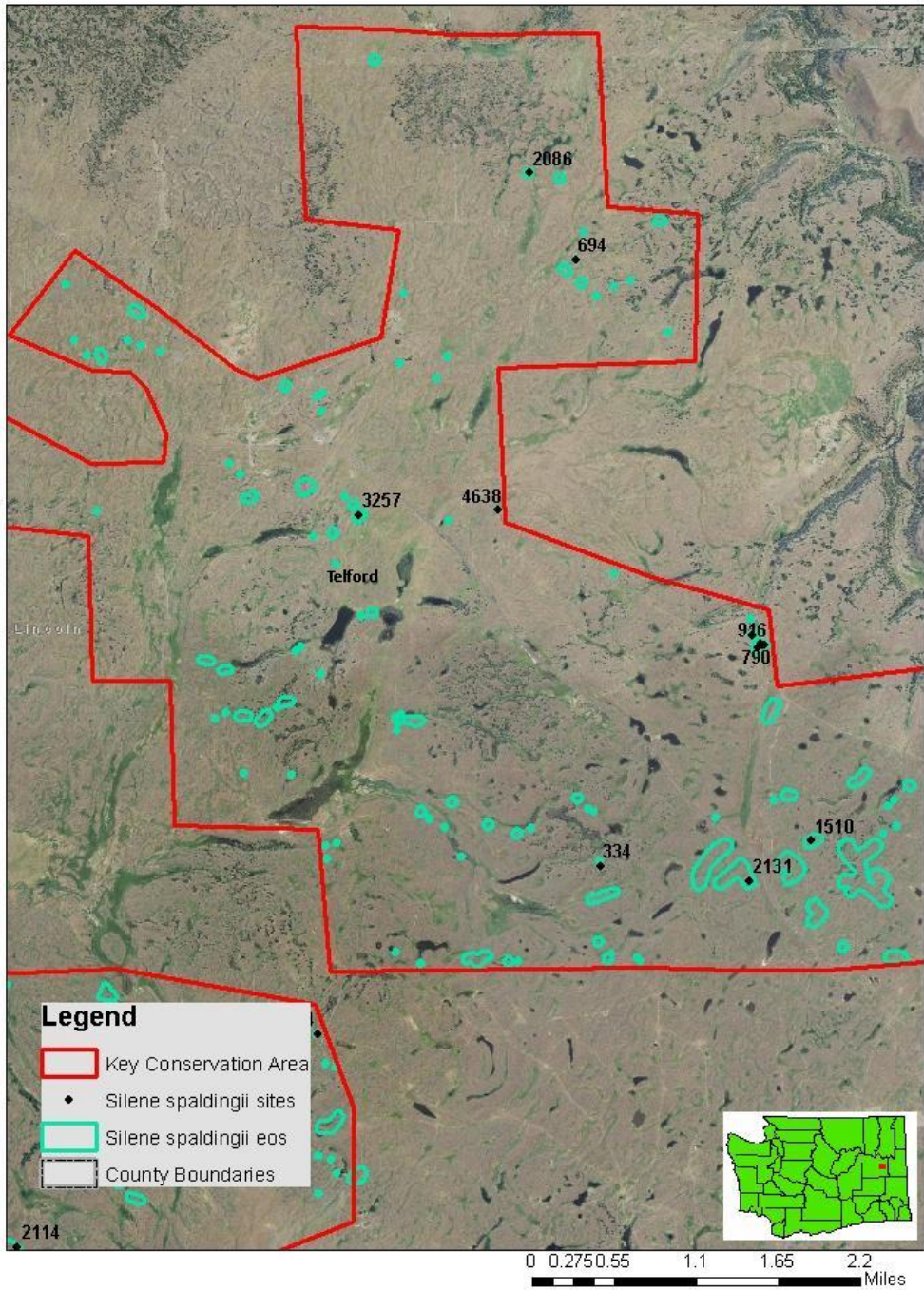
Telford

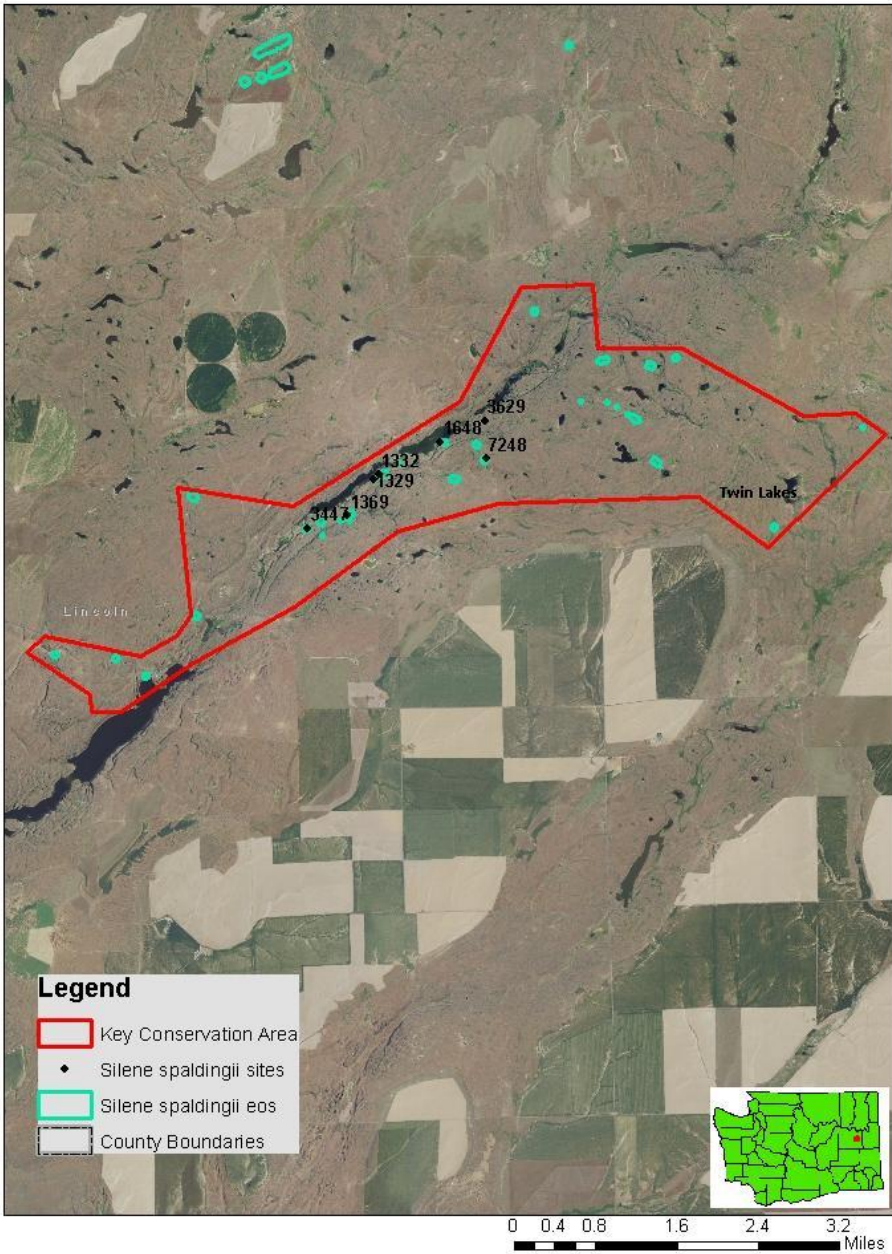
0

594

599

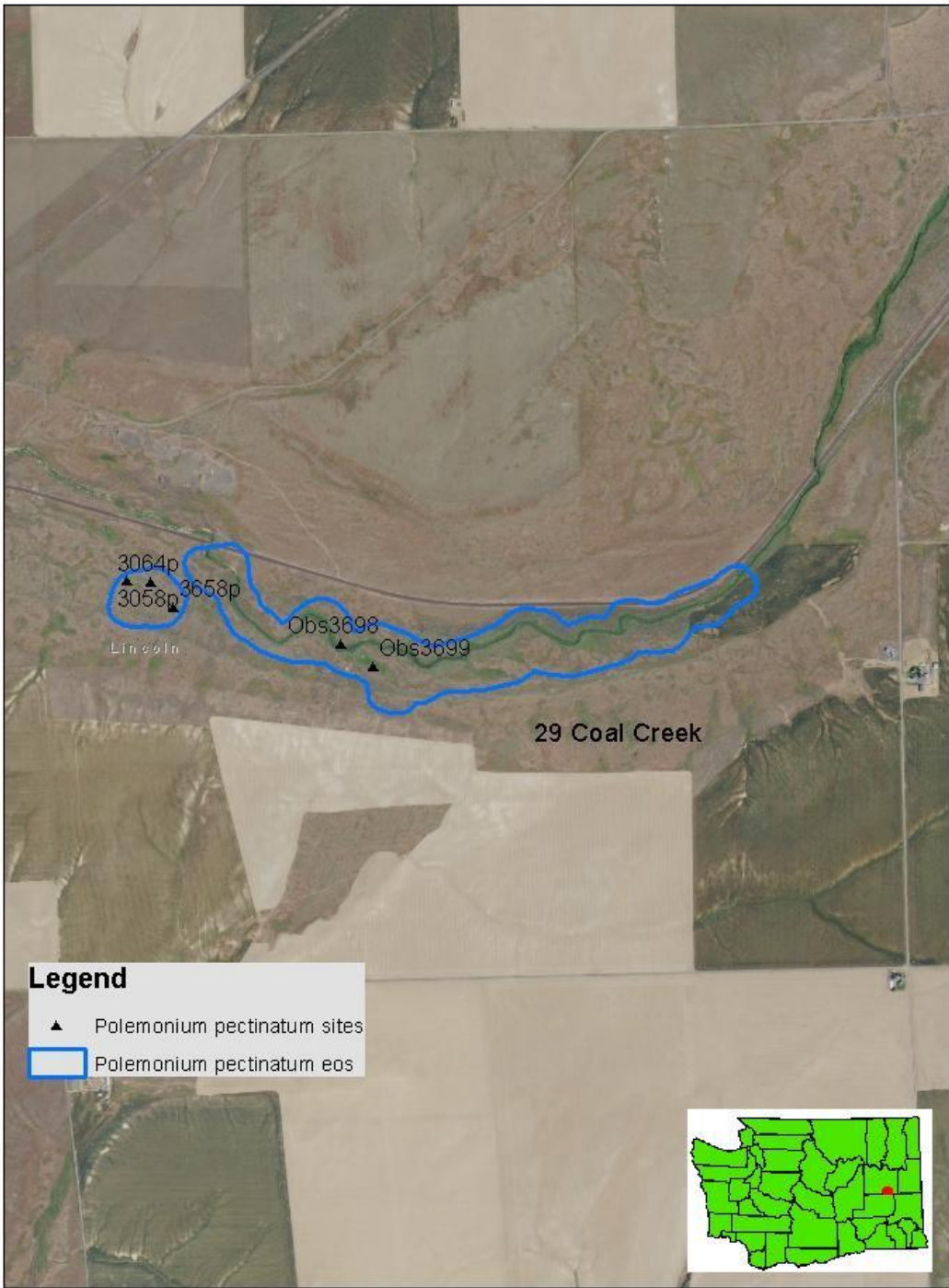




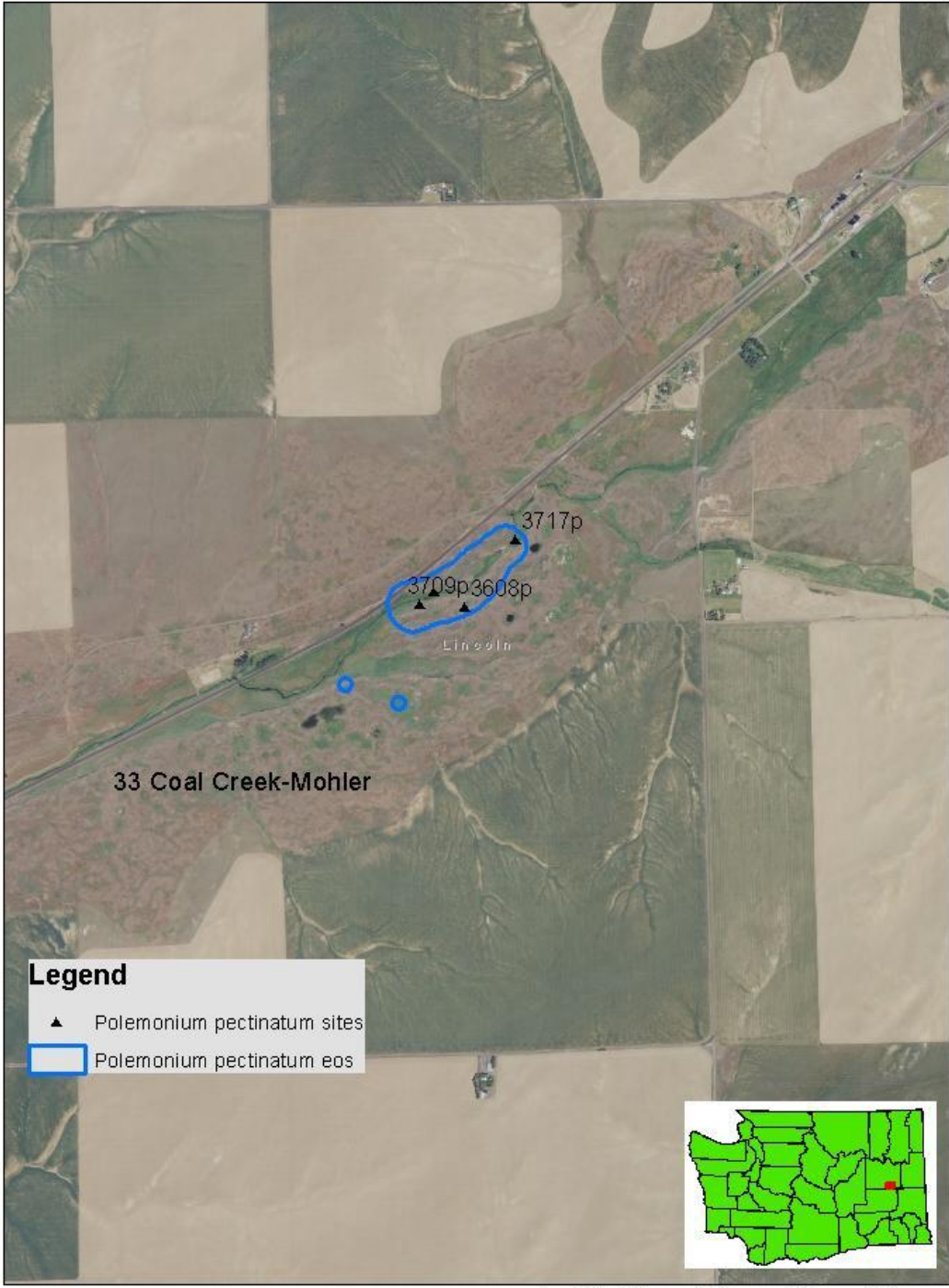


Polemonium pectinatum













Legend

- ▲ *Polemonium pectinatum* sites
- *Polemonium pectinatum* eos

0 0.1 0.2 0.4 0.6 0.8 Miles



Legend
▲ Polemonium pectinatum sites
○ Polemonium pectinatum eos



0 0.075 0.15 0.3 0.45 0.6 Miles

Appendix B. Stressor Forms

Appendix C. EIA Metadata.

This appendix lists the attributes found in the SISP_POPE_Tables Microsoft excel workbook spreadsheet and the fields used in the Ecological Integrity Assessment SISP_EIA and POPE_EIA worksheets, Stressor and Impacts ratings (SISP_stressors&impacts and POPE_stressors&impacts worksheet) and vegetation plot data (SISP_plots and POPE_plots).

Worksheet- all

SITE

Text field

Unique identifier for sample location. Value derived from original source feature, identifier or Bureau of land Management observation points.

Worksheet-SISP_summary & POPE_summary

DATE

Text field

Date field data was collected.

ASPECT/SLOPE

Text field

Aspect of plot center expressed either in degrees or cardinal direction, i.e. N, N20E, etc. Slope is descriptive (steep, flat) or in degrees.

PLOT SIZE

Text field

Plot dimensions in meters.

SOIL DEPTH (in)

Text field

Approximate depth of soil in inches and/or other soil descriptor

SURVEYOR

Text field

Name of person who collected information.

TRS

Text field

Township Range Section of site.

EO

Text field

Washington Natural Heritage Program Element Occurrence number assigned the observation location in May 2012.

KCA

Text field

SISP_summary only; Key Conservation Area name cited in USFWS (2007).

EO NAME

Text field

POPE_summary only; the location name referring to element occurrence location used by Washington Natural Heritage Program.

ECOL_SYST

Text field

The ecological system name including NatureServe code used for EIA.

EIA METRICS

Numeric field

The number of metrics used in EIA calculations.

EIA LANDSCAPE SCORE

Numeric field

This is the average of BUFFER or EDGE attributes of each ecological system.

EIA CONDITION SCORE

Numeric field

This is the average of all attributes in condition category of each ecological system.

EIA SIZE SCORE

Numeric field

This is the relative size of each ecological system.

EIA SCORE

Numeric field

This is the average LANDSCAPE, CONDITION and SIZE scores of each ecological system.

LANDSCAPE_RANK, CONDITION RANK, SIZE RANK, EIA RANK

Text field

EIA numeric scores are converted: A=4.5-5.0, B = 3.5-4.4, C=2.5-3.4, D=1.0-2.4

HYDROLOGICAL IMPACT SCORE, SOIL IMPACT SCORE, VEGETATION IMPACT SCORE

Numeric field

This is the sum of site impact rating values in Hydrological, Soil, and Vegetation stressor groups.

LANDSCAPE IMPACT SCORE

Numeric field

This is the sum of Landscape Context (100 m of site) impact rating values.

LANDSCAPE IMPACT, HYDROLOGICAL IMPACT, SOIL IMPACT, VEGETATION IMPACT

Text field

Impact scores converted to ratings: Very High >8, High 6-7, Medium 4-5, Low <4

Workheet- SISP_EIA and POPE_EIA

EIAs are represented in a matrix format with Site unique values in the first column beginning in row 10 and EIA indicator metrics in the second columns. In the spreadsheet the indicator metric in row 8 is below

which EIA uses the metric (row 1), Category (row 2), Key Attribute (row 3), description of “A” rank (row 4), “B” rank (row 5) “C” rank (row 6) “AD” rank (row 7). See Table 3.

Values in cells are site ratings for that metric were:

5=A, 4.5=AB, 4=B, 3.5=BC, 3=C, 2=CD, 1=D

Not = metric not applicable to ecological system at site

Missing = failed to record

Final columns:

EIA METRICS

Numeric field

The number of metrics used in EIA calculations.

EIA LANDSCAPE SCORE

Numeric field

This is the average of BUFFER or EDGE attributes of each ecological system.

EIA CONDITION SCORE

Numeric field

This is the average of all attributes in condition category of each ecological system.

EIA SIZE SCORE

Numeric field

This is the relative size of each ecological system.

EIA SCORE

Numeric field

This is the average LANDSCAPE, CONDITION and SIZE scores of each ecological system.

LANDSCAPE_ RANK, CONDITION RANK, SIZE RANK, EIA RANK

Text field

EIA numeric scores are converted: A=4.5-5.0, B = 3.5-4.4, C=2.5-3.4, D=1.0-2.4

Worksheet- SISP Stressors&Impacts and POPE Stressors&Impacts

Stressors and Impacts are represented in matrix format and modified from the field form in Appendix B. Site unique values are the first column beginning in row 4 and Stressors in the second columns. Stressors are listed in three columns: severity, scope, and landscape or site impact rating. Stressor and impact ratings are in Appendix B.

Numeric scores are listed in table below.

Threat Impact Calculator		Scope			
		Pervasive=7	Large=5	Restricted=3	Small=1
Serverity	Extreme=7	very High=7	High=5	Medium=3	Low=1
	Serious=5	High=5	High=5	Medium=3	Low=1
	Moderate=3	Medium=3	Medium=3	Low=1	Low=1
	Slight=1	Low=1	Low=1	Low=1	Low=1

Tie ratings were assign mid-point values.

HYDROLOGICAL IMPACT SCORE, SOIL IMPACT SCORE, VEGETATION IMPACT SCORE
 Numeric field

This is the sum of site impact rating values in Hydrological, Soil, and Vegetation stressor groups.

LANDSCAPE IMPACT SCORE

Numeric field

This is the sum of Landscape Context (100 m of site) impact rating values.

LANDSCAPE IMPACT, HYDROLOGICAL IMPACT, SOIL IMPACT, VEGETATION IMPACT
 Text field

Impact scores converted to ratings: Very High >8, High 6-7, Medium 4-5, Low <4

Worksheet- SISP plots and POPE plots

Matrix format with species in column 1 and sites in row 1.

Values in cells are mid-point of cover classes:

mid-point	class	definition
0.1	1	trace
0.5	2	0-<1%
1.5	3	1-<2%
3.5	4	2-<5%
7.5	5	5-<10%
17.5	6	10-<25%
37.5	7	25-<50%
62.5	8	50-<75%
85	9	75-<95%
97	10	>95%