WASHINGTON NATURAL HERITAGE PROGRAM

Conservation Status Ranks of Washington's Ecological Systems

Prepared for

Washington Dept. of Fish and Wildlife

Prepared by

F. Joseph Rocchio and Rex. C. Crawford

August 04, 2015

Natural Heritage Report 2015-03

WASHINGTON STATE DEPARTMENT OF Natural Resources

Conservation Status Ranks for Washington's Ecological Systems

Washington Natural Heritage Program Report Number: 2015-03

August 04, 2015

Prepared by:
F. Joseph Rocchio and Rex C. Crawford
Washington Natural Heritage Program
Washington Department of Natural Resources
Olympia, Washington 98504-7014

ON THE COVER: (clockwise from top left) Crab Creek (Inter-Mountain Basins Big Sagebrush Steppe and Columbia Basin Foothill Riparian Woodland and Shrubland Ecological Systems); Ebey's Landing Bluff Trail (North Pacific Herbaceous Bald and Bluff Ecological System and Temperate Pacific Tidal Salt and Brackish Marsh Ecological Systems); and Judy's Tamarack Park (Northern Rocky Mountain Western Larch Savanna).

Photographs by: Joe Rocchio

Table of Contents

Tables

Introduction

Information about the rarity or potential risk of elimination or extirpation of ecosystems can help prioritize and guide conservation and/or management actions toward those ecosystems of most concern. The Washington Department of Fish and Wildlife (WDFW) desires a list of the highest priority Ecological Systems for statewide habitat-planning purposes and contracted with Washington Department of Natural Resources, Natural Heritage Program (WANHP) to systematically rank rarity/risk of Washington's most imperiled ecosystems using NatureServe's/Natural Heritage network methodology for assigning conservation status ranks.

Since the early 1980s, the NatureServe/Natural Heritage Network has conducted conservation assessments of species and ecosystems to help prioritize conservation actions (Master et al. 2012). The outcome of those assessments is a conservation status rank which indicates the rarity and risk of extinction (species) or elimination (ecosystems) of each target. These ranks provide a succinct indication of the potential elimination or extirpation risk of elements of biodiversity (Master et al. 2012, Faber-Langendoen et al. 2012). In the past, conservation status ranks were assigned by a qualitative process whereby species/ecosystems experts trained in making decisions about the relative imperilment of species and ecosystems assigned ranks based on information associated with certain factors relevant to rarity and/or risk (Regan et al. 2004; Faber-Langendoen et al. 2012p; for a brief history of NatureServe's ranking process see Master et al. 2012). Despite extensive training and review, this qualitative approach has sometimes resulted in issues with consistency, repeatability, and transparency associated with the rank assessments (Faber-Langendoen et al. 2012). To address these concerns, starting in 2004 NatureServe developed a transparent ranking protocol. This method is summarized in Master et al. (2012) and Faber-Langendoen et al. (2012). Additionally, NatureServe developed a Rank Calculator that automates much of the ranking process: http://www.natureserve.org/conservation-tools/conservation-rank-calculator

The objective of this project was to assign State Conservation Status Ranks to Ecological System types in Washington using the methods described in Faber-Langendoen et al. (2012) and Master et al .(2012) and to implement those methods using the Rank Calculator.

Methods

Ecological Systems Classification

NatureServe has developed a mid-scale ecological classification, useful for conservation and environmental planning (http://www.natureserve.org/getData/USecologyData.jsp). The classification, Ecological Systems, represent recurring groups of terrestrial (both upland and wetland) plant communities that are found in similar climatic and physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding (Comer et al. 2003). The classification describes over 800 upland and wetland ecological system types found in the United States, and in adjacent portions of Mexico and Canada. Ecological systems types facilitate mapping at meso-scales (1:24,000 – 1:100,000; Comer and Schulz 2007). Terrestrial ecological systems have formed the basis for map legends on national mapping efforts, including the inter-agency Landfire (http://www.landfire.gov/) and Gap Analysis Program efforts (http://gapanalysis.usgs.gov/gap-analysis/). The results of these large-scale mapping projects have been combined into a national map of ecological systems which can be downloaded from NatureServe's website: (http://www.natureserve.org/getData/USecologyData.jsp). A comprehensive ecological systems map exists for Washington State (www.landscope.org).

Ecological Systems incorporate temporal variability in biotic composition by including early-, mid-, and later-seral vegetation (i.e. plant associations) into one classification unit, assuming succession progresses within a 50 year time frame. Thus, Ecological Systems provide a spatial-ecological perspective on the relation of U.S. National Vegetation Classification (USNVC) associations and alliances (fine-scale USNVC types), integrating vegetation with natural dynamics, soils, hydrology, landscape setting, and other ecological processes.

For this project, Conservation Status Ranks were assigned to the Ecological Systems which occur or are thought to occur (either historically or currently) in Washington. The Ecological Systems that occur in Washington are partially described in Rocchio and Crawford (2008), which is a draft guide. Since 2008, there have been some changes of opinion regarding the distribution of specific Ecological Systems. The list of Ecological System shown in Table 2 reflects the most recent conclusions about which Ecological Systems occur in Washington. This list trumps any list generated from NatureServe's Ecological Systems map (Sayre et al. 2009). For example, Sayre et al. (2009) maps the Middle Rocky Mountain Montane Douglas-fir Forest and Woodland Ecological System as occurring in the Blue Mountains of southeast Washington even though the System does not occur in the State.

Conservation Status Ranks

The Conservation Status Rank, which is an integral part of Natural Heritage Methodology, indicates the conservation significance of an element and is used to assist in determining conservation priorities (NatureServe 2002; Master et al. 2009; http://www.natureserve.org/explorer/ranking.htm). The method used to assign a Conservation Status Rank facilitates a quick assessment of an element's rarity or risk of extinction. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by a letter reflecting the appropriate geographic scale of the assessment (G = Global and S = State or Subnational). The Global rank characterizes the relative rarity or endangerment of the element across its entire global range whereas the Subnational rank characterizes the relative rarity or endangerment within a subnational unit (in our case, the State of Washington.).

Global ranks are assigned through a collaborative process involving both NatureServe and individual Natural Heritage Program scientists. Subnational ranks are assigned by state or provincial scientists with the proviso that subnational rank cannot be rarer than indicated by the global rank. WNHP scientists have responsibility for assigning Washington's State ranks. A number of factors, such as the total range, the number of occurrences, severity of threats, and resilience contribute to the assignment of global and state ranks.

Natural Heritage scientists apply their field experience along with herbarium records, plot data, and published research to assign a G/S rank. Recently, NatureServe developed a Microsoft Excel-based calculator for systematically assigning Conservation Status Ranks (Faber-Langendoen et al. 2009b) which has improved repeatability and standardization of factors used to assign conservation status ranks. **For this project, only Subnational, or S Ranks, were assigned to each Ecological System.**

The ranks assigned in this project have the following meaning:

- **S1 = Critically Imperiled.** At very high risk of extirpation in Washington due to very restricted range, very few occurrences, very steep declines, severe threats, or other factors.
- **S2 = Imperiled**. At high risk of extirpation in Washington due to restricted range, few occurrences, steep declines, severe threats, or other factors.
- **S3 = Vulnerable.** At moderate risk of extirpation in Washington due to a fairly restricted range, relatively few occurrences, recent and widespread declines, threats, or other factors.
- **S4 = Apparently Secure.** At a fairly low risk of extirpation in Washington due to an extensive range and/or many occurrences but with possible cause for some concern as a result of local recent declines, threats, or other factors.
- **S5 = Secure.** At very low or no risk of extirpation in Washington due to a very extensive range, abundant occurrences, with little to no concern from declines or threats.
- **SU = Unrankable.** Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
- **SH = Possibly Extirpated.** Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching and/or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction.
- **SNR = Unranked.** Sufficient time and effort have not yet been devoted to ranking this taxon.
- **SNA = Not Applicable**. A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.
- **SX = Presumed Extinct.** Species or ecosystem is believed to be extirpated from Washington. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
- **S? = Inexact Numeric Rank.** Denotes inexact numeric rank; this should not be used with any of the Variant National or Subnational Conservation Status Ranks, or NX, SX, NH, or SH.

- **S#S# = Range Rank.** Numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).

S1 indicates critical imperilment within a particular state or province, regardless of its status elsewhere. Conversely, a S5 indicates that an element is demonstrably secure, widespread, and abundant throughout its state range.

Uncertainty in the Conservation Status Rank is expressed as a Range Rank. For example, S2S3 indicates a range of uncertainty such that there is a roughly equal chance of it being a S2 or S3 and that other ranks are less likely. Range ranks can span three ranks, e.g., S2S4, meaning that the appropriate rank is somewhere between S2 and S4. A rank of SU indicates that a rank is unable to be assigned due to a lack of information or due to conflicting information about status or trends. When the taxonomic distinctiveness of an element is questionable, it is given a modifier of "Q" in combination with a standard numerical S rank. For example S3Q, indicates that the element is considered vulnerable within Washington but that there is uncertainty about the taxonomic status of the element.

Assigning Conservation Status Ranks

Because of limited resources for this project, a stepwise approach was used to assess and assign conservation status ranks to Washington's Ecological Systems. The approach used is outlined below:

1. Using the guidelines and information provided in Faber-Langendoen et al. (2012) and Master et al .(2012), WANHP ecologists attempted to assign preliminary conservation status ranks (Table 2) to most of the 93 Ecological Systems that are known to occur in the State. The Rank Calculator was used but data inputs were primarily based on best professional judgment of WANHP ecologists and/or readily accessible data. In other words, extended research was not conducted to populate Rank Calculator metrics. Assumptions and possible additional data sources were noted in comment fields.
2. Preliminary conservation status ranks were then used to prioritize which Ecological Systems would be assessed and assigned a conservation status rank using a more thorough process of research and analysis. Those Ecological Systems with a preliminary rank of S1 to S2 were priorities. If time allotted, Ecological Systems with S3 to S3S4 were assessed.

Results

A summary of the Preliminary and Final Conservation Status Ranks are show in Table 1. Table 2 shows the Preliminary and Final Ranks for each Ecological Assessment assessed. These ranks reflect the knowledge and understanding of current status and ongoing and past threats of each Ecological System at the date of publication of this report. New information or changes in trends and/or threat could suggest that Conservation Status Ranks need to be reassessed.

Twenty three Ecological Systems are considered to be critically imperiled (S1 or S1S2 rank), 18 to be imperiled (S2 or S2S3 rank), and 11 to be vulnerable (S3 or S3S4 rank), while the remaining Systems are of less risk (S4 or S5 rank) or have Q or U status (Tables 1, 2).

All four of the Ecological Systems that were not given a Preliminary Rank (i.e., = NR) are types that do not occur in Washington, although they have been identified as such in the past.

Appendices A and B provide more detail about the specific information used to assign the Conservation Status Rank of each Ecological System.

Table 1. Summary of Conservation Status Ranks

Conservation Status Rank	Preliminary Rank (# of Ecological Systems Assigned)	Final Rank (# of Ecological Systems Assigned)
NR	4	
S1	13	16
S1S2	8	7
S1S2Q	1	
S2	13	14
S2S3	9	4
S3	4	9
S3?	2	
S3S4	13	2
S3S5	3	
S4	14	3
S4?	3	
S4S5	4	
S5	6	
Q	4	1
U	1	
Totals	**102**	**56**

Table 2. Washington's Ecological Systems and Their Conservation Status Ranks. Ecological Systems in *italics* are those that do not occur, or there is significant uncertainty of their occurrence, in Washington. There are **no** ranking reports for those Systems in Appendix B as they were not ranked.

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
Boreal Depressional Shrub Bog	*not included*	*CES103.871*		*NR*	*G360 Western North American Boreal Acidic Bog & Fen (in Washington = G515 Rocky Mountain Acidic Fen)*	Does not occur in Washington, although it has been listed for WA in the past. Any areas mapped as this system are most likely the Rocky Mountain Subalpine-Montane Fen.
Columbia Basin Foothill and Canyon Dry Grassland	same	CES304.993	S1S2	S1S2	G311 Intermountain Semi-Desert Grassland	
Columbia Basin Foothill Riparian Woodland and Shrubland	same	CES304.768	S1	S1	G506 Rocky Mountain & Great Basin Montane Riparian Forest; G526 Rocky Mountain & Great Basin Lowland & Foothill Riparian Shrubland; G796 Northern Rocky Mountain Lowland & Foothill Riparian Forest	
Columbia Basin Palouse Prairie	same	CES304.792	S1	S1	G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland	
Columbia Plateau Ash and Tuff Badland	*not included*	*CES304.081*		*NR*	*G570 Intermountain Basins Cliff, Scree & Badland Sparse Vegetation*	Does not occur in Washington, although it had been previously listed for WA.
Columbia Plateau Low Sagebrush Steppe	same	CES304.080	S1S2	S2S3	G308 Intermountain Low & Black Sagebrush Shrubland & Steppe	
Columbia Plateau Scabland Shrubland	same	CES304.770		S5	G307 Columbia Plateau Scabland Shrubland	
Columbia Plateau Silver Sagebrush Seasonally Flooded Shrub-Steppe	*not included*	*CES304.084*		*NR*	*G526 Rocky Mountain & Great Basin Lowland & Foothill Riparian Shrubland*	Does not currently occur in Washington. There is uncertainty as to whether the type historically occurred in the State but has since

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
						been extirpated or if it never occurred in Washington. Ares mapped as this System are likely either the Columbia Basin Foothill Riparian Woodland and Shrubland or Inter-Mountain Basins Big Sagebrush Steppe or Inter-Mountain Basins Semi-desert Shrub-Steppe systems.
Columbia Plateau Steppe and Grassland	same	CES304.083	S2	S2	G302 Intermountain Mesic Tall Sagebrush Shrubland & Steppe	
Columbia Plateau Vernal Pool	same	CES304.057	S2S3	S2	G529 Oregon-Washington-British Columbia Vernal Pool	
Columbia Plateau Western Juniper Woodland and Savanna	same	CES304.082		S3S4	G248 Columbia Plateau Western Juniper Woodland & Savanna	
East Cascades Mesic Montane Mixed-Conifer Forest and Woodland	same	CES204.086		S3S4	G212 East Cascades Mesic Grand Fir - Douglas-fir Forest	
East Cascades Oak-Ponderosa Pine Forest and Woodland	same	CES204.085	S1S2	S1S2	G206 Cascadian Oregon White Oak - Conifer Forest & Woodland	
Inter-Mountain Basins Active and Stabilized Dune	same	CES304.775	S1	S1	G775 Intermountain Sparsely Vegetated Dune Scrub & Grassland	
Inter-Mountain Basins Alkaline Closed Depression	Inter-Mountain Alkaline Marsh and Flats	CES304.998	S2	S2	G538 North American Desert Alkaline-Saline Herbaceous Wetland & Playa	
Inter-Mountain Basins Big Sagebrush Shrubland	*not included*	*CES304.777*	*Q*	*S1S2Q*	*G302 Intermountain Mesic Tall Sagebrush Shrubland & Steppe; G303 Intermountain Dry Tall Sagebrush Shrubland;*	Previously thought to occur in Washington but WANHP believes

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
						areas matching the description of this system in Washington are actually degraded areas or simply areas of dense cover of sagebrush within the Inter-Mountain Basins Big Sagebrush Steppe and Inter-Mountain Basins Semi-Desert Shrub-Steppe.
Inter-Mountain Basins Big Sagebrush Steppe	same	CES304.778	S2	S2	G302 Intermountain Mesic Tall Sagebrush Shrubland & Steppe; G303 Intermountain Dry Tall Sagebrush Shrubland;	
Inter-Mountain Basins Cliff and Canyon	same	CES304.779		S5	G570 Intermountain Basins Cliff, Scree & Badland Sparse Vegetation	
Inter-Mountain Basins Curl-leaf Mountain-mahogany Woodland and Shrubland	Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland	CES304.772	S1	S1	G249 Intermountain Basins Curl-leaf Mountain-mahogany Scrub & Woodland	
Inter-Mountain Basins Greasewood Flat	same	CES304.780	S1	S1S2	G537 North American Desert Alkaline-Saline Shrub Wetland	
Inter-Mountain Basins Interdunal Swale Wetland	*not included*	*CES304.059*		*Q*	*G531 Arid West Interior Freshwater Emergent Marsh*	Currently does not occur in Washington but historically may have been found in the sand dune areas near Moses Lake prior to irrigation development. Not mapped (Sayre et al. 2009).
Inter-Mountain Basins Mixed Salt Desert Scrub	*not included*	*CES304.784*		*Q*	*G300 Intermountain Shadscale - Saltbush Scrub*	Not certain it occurs in Washington. What is currently mapped

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
						(Sayre et al. 2009) as this system better fits the Inter-Mountain Basins Semi-Desert Shrub-Steppe. Areas with *Grayia spinosa*, *Krascheninnikovia lanata*, on Ringold formation in Hanford area and on glacial lake flood deposits and old sand dune deposits might better fit into Inter-Mountain Basins Active and Stabilized Dune Ecological System.
Inter-Mountain Basins Montane Sagebrush Steppe	same	CES304.785		S3S4	G304 Intermountain Mountain Big Sagebrush Shrubland & Steppe	
Inter-Mountain Basins Playa	same	CES.304.786	S1	S3	G538 North American Desert Alkaline-Saline Herbaceous Wetland & Playa	
Inter-Mountain Basins Semi-Desert Grassland	*not included*	*CES304.787*		*Q*	*G311 Intermountain Semi-Desert Grassland*	WANHP has not observed this system in WA. However, if it does occur in Washington it would not be distributed as currently depicted on the Ecological Systems map (Sayre et al. 20009).
Inter-Mountain Basins Semi-Desert Shrub-Steppe	same	CES304.788	S1	S1S2	G310 Intermountain Semi-Desert Shrubland & Steppe	What is included as Inter-Mountain Basins Mixed Salt Desert Scrub on the Ecological Systems map (Sayre et

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
						al. 2009) is actually this Ecological System.
Inter-Mountain Basins Wash	same	CES304.781	S3	S3	G559 Cool Semi-Desert Shrub & Herb Wash-Arroyo	
Modoc Basalt Flow Vernal Pool	same	CES204.996	S2	S1	G529 Oregon-Washington-British Columbia Vernal Pool	
North American Arid West Emergent Marsh	same	CES300.729	S2	S1S2	G531 Arid West Interior Freshwater Emergent Marsh	
North American Glacier and Ice Field	North American Alpine Ice Field	CES300.728		S3?	n/a	
North Pacific Active Volcanic Rock and Cinder Land	North Pacific Volcanic Rock and Cinder Land	CES204.092		S5	G318 North Vancouverian Montane Massive Bedrock, Cliff & Talus	
North Pacific Alpine and Subalpine Bedrock and Scree	same	CES204.853		S4?	G319 North Pacific Alpine-Subalpine Bedrock & Scree	
North Pacific Alpine and Subalpine Dry Grassland	same	CES204.099		S4S5	G271 Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow	
North Pacific Avalanche Chute Shrubland	same	CES204.854		S4	G305 Central Rocky Mountain High Montane Mesic Shrubland; G322 Vancouverian Wet Shrubland	
North Pacific Bog and Fen	same	CES204.063	S2	S2	G284 North Pacific Bog & Acidic Fen; G285 North Pacific Neutral-Alkaline Fen	
North Pacific Broadleaf Landslide Forest and Shrubland	same	CES204.846	S2S3	S2S3	G237 North Pacific Red Alder - Bigleaf Maple - Douglas-fir Forest	
North Pacific Coastal Cliff and Bluff	same	CES204.094		S4	G554 North Pacific Coastal Scrub & Herb Cliff & Bluff	
North Pacific Coastal Interdunal Wetland	same	CES204.062	S1	S2	G517 Vancouverian Freshwater Wet Meadow & Marsh	

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-Field and Meadow	same	CES204.862		S4	G317 North Pacific Alpine-Subalpine Dwarf-Shrubland & Heath; G320 North Pacific Alpine-Subalpine Turf & Herbaceous Meadow	
North Pacific Dry Douglas-fir-(Madrone) Forest and Woodland	same	CES204.845	S2	S2S3	G800 Southern Vancouverian Dry Douglas-fir - Madrone Woodland; G205 Vancouverian Dry Coastal & Lowland Beach Pine Forest & Woodland	
North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest	Same	CES204.098		S5	G241 North Pacific Maritime Silver Fir - Western Hemlock Forest	
North Pacific Hardpan Vernal Pool	same	CES204.859	S2S3	S1	G529 Oregon-Washington-British Columbia Vernal Pool	
North Pacific Hardwood-Conifer Swamp	same	CES204.090	S2	S2S3	G256 North Pacific Maritime Hardwood-Conifer Swamp; G610 North Pacific Maritime Poor Fen & Bog Forest & Woodland	
North Pacific Herbaceous Bald and Bluff	same	CES204.089	S3	S2	G488 Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie	
North Pacific Hypermaritime Shrub and Herbaceous Headland	same	CES204.088		S3S4	G488 Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie	
North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest	same	CES204.842	S1S2	S2	G751 North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest	
North Pacific Intertidal Freshwater Wetland	same	CES204.875	S1	S1S2	G517 Vancouverian Freshwater Wet Meadow & Marsh; G254 North Pacific Lowland Riparian Forest & Woodland	
North Pacific Lowland Mixed Hardwood-Conifer Forest	*not included*	*CES204.073*		*Q*	*G237 North Pacific Red Alder - Bigleaf Maple - Douglas-fir Forest*	WANHP is of the opinion that this system, as mapped in Washington, reflects

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
						early seral stands or recently disturbed areas associated with the North Pacific Maritime Dry-Mesic and Mesic-Wet Douglas-fir-Western Hemlock Forest systems or occurrences of the North Pacific Broadleaf Landslide Forest and Shrubland.
North Pacific Lowland Riparian Forest and Shrubland	same	CES204.869	S2	S2	G254 North Pacific Lowland Riparian Forest & Woodland; G322 Vancouverian Wet Shrubland	
North Pacific Maritime Coastal Sand Dune and Strand	same	CES200.881	S1	S1	G498 North Pacific Maritime Coastal Scrub & Herb Beach & Dune; G205 Vancouverian Dry Coastal & Lowland Beach Pine Forest & Woodland	
North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest	same	CES204.001	S2S3	S2S3	G240 North Pacific Maritime Douglas-fir - Western Hemlock Forest	
North Pacific Maritime Eelgrass Bed	same	CES200.882	S3	S1	G373 Temperate Pacific Seagrass	
North Pacific Maritime Mesic Subalpine Parkland	same	CES204.837		S4	G245 North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island	
North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest	same	CES204.002		S3S4	G240 North Pacific Maritime Douglas-fir - Western Hemlock Forest	
North Pacific Mesic Western Hemlock-Silver Fir Forest	same	CES204.097		S5	G241 North Pacific Maritime Silver Fir - Western Hemlock Forest	

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
North Pacific Montane Massive Bedrock, Cliff and Talus	same	CES204.093		S4S5	G318 North Vancouverian Montane Massive Bedrock, Cliff & Talus	
North Pacific Montane Riparian Woodland and Shrubland	same	CES204.866	S4	S4	G507 North Pacific Montane Riparian Woodland; G322 Vancouverian Wet Shrubland	
North Pacific Montane Shrubland	same	CES204.087	S3S4	S3?	G305 Central Rocky Mountain High Montane Mesic Shrubland	
North Pacific Mountain Hemlock Forest	same	CES204.838		S4S5	G245 North Pacific Mountain Hemlock - Silver Fir Forest & Tree Island	
North Pacific Oak Woodland	same	CES204.852	S1	S1	G206 Cascadian Oregon White Oak - Conifer Forest & Woodland	
North Pacific Seasonal Sitka Spruce Forest	North Pacific Hypermaritime Sitka Spruce Forest	CES204.841	S1S2	S2	G751 North Pacific Western Hemlock - Sitka Spruce - Western Red-cedar Seasonal Rainforest	
North Pacific Serpentine Barren	same	CES204.095		S4	G573 Southern Vancouverian Cliff, Scree & Rock Vegetation	
North Pacific Shrub Swamp	same	CES204.865	S3	S3	G322 Vancouverian Wet Shrubland; G256 North Pacific Maritime Hardwood-Conifer Swamp; G610 North Pacific Maritime Poor Fen & Bog Forest & Woodland	
North Pacific Wooded Volcanic Flowage	same	CES204.883		S4	G240 North Pacific Maritime Douglas-fir - Western Hemlock Forest	
Northern Columbia Plateau Basalt Pothole Pond	same	CES304.058	S1S2	S1S2	G531 Arid West Interior Freshwater Emergent Marsh	
Northern Rocky Mountain Avalanche Chute Shrubland	same	CES306.801	S1	S1	G305 Central Rocky Mountain High Montane Mesic Shrubland	
Northern Rocky Mountain Conifer Swamp	same	CES306.803	S3	S3S4	G505 Rocky Mountain & Great Basin Swamp Forest	
Northern Rocky Mountain Dry-Mesic	same	CES306.805		S3S4	G210 Central Rocky Mountain Douglas-fir - Pine Forest	

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
Montane Mixed Conifer Forest						
Northern Rocky Mountain Foothill Conifer Wooded Steppe	same	CES306.958		S3S5	G213 Central Rocky Mountain Ponderosa Pine Woodland & Savanna	
Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland	same	CES306.804	S2	S2S3	G796 Northern Rocky Mountain Lowland & Foothill Riparian Forest; G506 Rocky Mountain & Great Basin Montane Riparian Forest	
Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland	same	CES306.040		S3S4	G273 Central Rocky Mountain Lower Montane, Foothill & Valley Grassland	
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	same	CES306.802		S3S4	G217 Central Rocky Mountain Interior Western Red-cedar - Western Hemlock Forest; G211 Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest	
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	same	CES306.994		S4?	G272 Central Rocky Mountain Montane-Foothill Deciduous Shrubland	
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	same	CES306.030	S2	S2	G213 Central Rocky Mountain Ponderosa Pine Woodland & Savanna	
Northern Rocky Mountain Subalpine Deciduous Shrubland	same	CES306.961		S4	G305 Central Rocky Mountain High Montane Mesic Shrubland	
Northern Rocky Mountain Subalpine Woodland and Parkland	same	CES306.807		S4	G223 Northern Rocky Mountain Whitebark Pine - Subalpine Larch Woodland	
Northern Rocky Mountain Subalpine-	same	CES306.806		S3S4	G267 Central Rocky Mountain Montane Grassland	

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
Upper Montane Grassland						
Northern Rocky Mountain Western Larch Savanna	same	CES306.837	S1	S1	G211 Central Rocky Mountain Mesic Grand Fir - Douglas-fir Forest	
Northern Rocky Mountain Wooded Vernal Pool	*not included*	*CES304.060*		*U*	*G505 Rocky Mountain & Great Basin Swamp Forest*	Vernal pools near Spokane (e.g, Turnbull NWR) may fit this Ecological System. The pools in these areas aren't treed but occur in a forested/wooded landscape. More inventory and assessment of these pool are needed before classifying them as this system type. Until such research is conducted those vernal pools are included as part of the Columbia Basin Vernal Pool system.
Rocky Mountain Alpine Bedrock and Scree	same	CES306.809		S4?	G571 Rocky Mountain Alpine Bedrock & Scree	
Rocky Mountain Alpine Dwarf-Shrubland	same	CES306.810		S4	G316 Rocky Mountain & Sierran Alpine Dwarf-Shrubland	
Rocky Mountain Alpine Fell-Field	same	CES306.811		S4	G314 Rocky Mountain & Sierran Alpine Turf & Fell-Field	
Rocky Mountain Alpine Turf	Rocky Mountain Dry Tundra	CES306.816		S4	G314 Rocky Mountain & Sierran Alpine Turf & Fell-Field	
Rocky Mountain Alpine-Montane Wet Meadow	same	CES306.812	S3	S2S3	G520 Vancouverian & Rocky Mountain Subalpine & Alpine Snowbed, Wet Meadow & Dwarf-	

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
					Shrubland; G521 Vancouverian & Rocky Mountain Montane Wet Meadow & Marsh	
Rocky Mountain Aspen Forest and Woodland	same	CES306.813	S2	S2	G222 Rocky Mountain Subalpine-Montane Aspen Forest & Woodland	
Rocky Mountain Cliff, Canyon and Massive Bedrock	same	CES306.815		S4S5	G565 Rocky Mountain Cliff, Scree & Rock Vegetation	
Rocky Mountain Lodgepole Pine Forest	same	CES306.820		S3S4	G220 Rocky Mountain Lodgepole Pine Forest & Woodland	
Rocky Mountain Poor-Site Lodgepole Pine Forest	*not included*	*CES306.960*		*NR*	*G220 Rocky Mountain Lodgepole Pine Forest & Woodland*	Does not occur in Washington although it had been listed for WA in the past.
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	same	CES306.828		S3S5	G219 Rocky Mountain Subalpine Dry-Mesic Spruce - Fir Forest & Woodland; Western Interior Sub-boreal Spruce - Fir Forest	
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	same	CES306.830		S5	G218 Rocky Mountain Subalpine Moist Spruce - Fir Forest & Woodland	
Rocky Mountain Subalpine-Montane Fen	same	CES306.831	S3	S2S3	G515 Rocky Mountain Acidic Fen; G516 Rocky Mountain Neutral-Alkaline Fen	
Rocky Mountain Subalpine-Montane Mesic Meadow	same	CES306.829		S3S5	G271 Rocky Mountain Subalpine-Montane Mesic Herbaceous Meadow	
Rocky Mountain Subalpine-Montane Riparian Shrubland	same	CES306.832	S3	S3	G527 Western Montane-Subalpine Riparian & Seep Shrubland	
Rocky Mountain Subalpine-Montane Riparian Woodland	same	CES306.833	S4	S4	G506 Rocky Mountain & Great Basin Montane Riparian Forest	
Temperate Pacific Freshwater Aquatic Bed	same	CES200.876	S3	S3S4	G544 Western North American Temperate Freshwater Aquatic Bed	

NatureServe Ecological System (2014)	Name in Appendix B	Code	Final Rank	Prelim Ranks	Equivalent USNVC Group(s)	Comments
Temperate Pacific Freshwater Emergent Marsh	same	CES200.877	S2	S2S3	G531 Arid West Interior Freshwater Emergent Marsh	
Temperate Pacific Freshwater Mudflat	same	CES200.878	S1	S1S2	G525 Temperate Pacific Freshwater Wet Mudflat	
Temperate Pacific Intertidal Flat	same	CES204.879	S3S4	S3S4	G385 North American Pacific Intertidal Algal Flat	
Temperate Pacific Subalpine-Montane Wet Meadow	same	CES200.998	S4	S4	G521 Vancouverian & Rocky Mountain Montane Wet Meadow	
Temperate Pacific Tidal Salt and Brackish Marsh	same	CES200.091	S2	S2	G499 Temperate Pacific Tidal Salt & Brackish Marsh	
Willamette Valley Upland Prairie and Savanna	same	CES204.858	S1	S1	G488 Southern Vancouverian Shrub & Herbaceous Bald, Bluff & Prairie	
Willamette Valley Wet Prairie	same	CES204.874	S1	S1	G517 Vancouverian Freshwater Wet Meadow & Marsh	

Literature Cited

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, VA.

Faber-Langendoen, D., J. Nichols, L. Master, K. Snow, A. Tomaino, R. Bittman, G. Hammerson, B. Heidel, L. Ramsay, A. Teucher, and B. Young. 2012. NatureServe Conservation Status Ranking System: Methodology for Rank Assignment. NatureServe, Arlington, VA. Online: http://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusmethodology_jun12_0.pdf

Master, L. L., D. Faber-Langendoen, R. Bittman, G. A. Hammerson, B. Heidel, L. Ramsay, K. Snow, A. Teucher, and A. Tomaino. 2012. NatureServe Conservation Status Factors. NatureServe, Arlington, Virginia, U.S.A. Online: http://www.natureserve.org/sites/default/files/publications/files/natureserveconservationstatusfactors_apr12_1.pdf

Regan, T.J., L.L. Master, and G. Hammerson. 2004. Capturing expert knowledge for threatened species assessments: a case study using NatureServe conservation status ranks. Acta Oecologica 26: 95-107.

Rocchio, F.J. and R.C. Crawford. 2008. Draft Field Guide to Washington's Ecological Systems. Draft report prepared by the Washington Natural Heritage Program, Washington Department of Natural Resources. Olympia, WA.

Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Appendix A Conservation Status Ranks Excel Database

Copies of the Conservation Status Rank calculators that were used to assign ranks for this project were provided along with this report.

The file names are:

1. “WA_wetland_conservation_status_rank_calculator.xlsm”

2. “WA_upland_conservation_status_rank_calculator.xlsm”

Appendix B Conservation Status Ranks Reports

Ecological system conservation status ranking reports are included here (listed in alphabetical order).

Element State Rank Report - Draft

Scientific Name: ***Columbia Basin Foothill and Canyon Dry Grassland*** **Elcode:** CES304.993

Common Name: Columbia Basin Foothill and Canyon Dry Grassland **Subnational ID:** 18305

Descriptors

Element Description: The Columbia Basin Foothill and Canyon Dry grasslands occur on steep open slopes, from 300-5000 feet (90 to 1525 m) elevation in the canyons and valleys of the Columbia Basin, particularly along the Snake River canyon and large tributaries. These grasslands were originally described by Tisdale (1986) along the lower foothill slopes of the Blue Mountains in Oregon, and along the main stem of the Columbia River into SE Washington. They typically occur at and well below lower treeline.
Landform settings of this grassland are primarily long, steep slopes of 100 m to well over 400 m in length, with colluvial soils derived from residuum and having patchy, thin, wind-blown surface deposits (Tisdale and Bramble-Brodahl 1983). Slope failures and soil creep are common processes. Saturated soil layers over frozen soil are related to most soil slips (Tisdale 1986). Perennial bunchgrasses and forbs (usually over 25% cover) dominate these grasslands. Bare ground, gravel and rock between bunches are common features due to soil movement and sun exposure. Biological soil crust cover is usually present but generally decreases with increasing vascular plant cover, elevation, loose surface rock, and coarseness of soil (Belnap et al. 2001). Dry occurrences of this grassland are open with spaces between mid-tall deep-rooted bunchgrass (Pseudoroegneria spicata or Aristida purpurea var. longiseta) along with Poa secunda, Lupinus spp., Balsamorhiza sagittata, Phlox colubrina, Erigeron pumilus, and Opuntia polyacantha. These species are joined by other mid-tall deep-rooted bunchgrasses (Festuca idahoensis and Koeleria macrantha) on more moist sites (north aspects or higher elevations) often with a heavy litter cover. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns. Annual precipitation is low 5- 10 inches (12-25 cm) that occurs mostly in the winter, primarily as rain. Fire frequency is presumed to be less than 20 years; the return interval may have been as low as 5-10 years (Landfire 2007. Biophysical Setting Model 0811340). Elk, deer and bighorn sheep are native large grazers in the canyon who used particularly in winter and spring (Tisdale 1986).

Rank

S Rank: S1S2 **S Rank Date:** 24-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Limited distribution, somewhat protect from conversion to to steepness of slopes and remote location. ery Degradation in condition is the major cause of conservation need. Mid slopes always look better than upper or lower slopes. South aspects tend to be cheatgrass and other annual bromes, Poa bulbosa, yellowstar thistle, knapweeds, hypericum are commonly seen on northly aspects and terracettes are common. The current ecological integrity of these grasslandas in the upper elevation range of this system (where is merges with lower montane grasslands) is not well known. The hot, dry canyons tend to be dominated by nonnative or weedy native species. Shrubs invade moister sites.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Cassidy 1997 mapped 209,000 ha (2,090 sqkm) of the canyon grassland zone; she undermapped the tributary canyon in to the Snake in Asotin to Columbia counties.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) overestimated 2,340 sqkm due to erroneously including areas that are actually Columbia Basin Steep and Grasslan along Cascade and Okanogan foothills. Cassidy (1997) estimated 60% of canyon zone was grassland "most of the native cover has been replaced by species that increase under grazing"

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** BE = Very small to good (<41%)

Comments: Used best professional judgment. Field experience suggest there has been very little conversion but widespread degradation in condition. Mid slopes always look better than upper or lower slopes. South aspects tend to be cheatgrass and other annual bromes, Poa bulbosa, yellowstar thistle, knapweeds, hypericum are commonly seen on northly aspects and terracettes are common. Accessibility is difficult even for reconniassance of canyons.

Number Protected EOs:

Comments:

Threats

Scientific Name: ***Columbia Basin Foothill and Canyon Dry Grassland*** **Elcode:** CES304.993

Common Name: Columbia Basin Foothill and Canyon Dry Grassland **Subnational ID:** 18305

Threats: BC = High - medium

Comments: Mid slopes of many areas remain in good condition and are self protected if steep and long treks for livestock.Mid slopes of many areas remain in good condition and are self protected if steep and long treks for livestock.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: BD = High - low
Comments: steep slopes provide some protection

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: BD = High - low
Comments: steep slopes provide some protection

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low
Comments: drier slopes nore invaded, erosion

Threat Category: 7.1 - Fire & fire suppression Level of Threat: CD = Medium - low
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: AC = Very high - medium
Comments: Annual grasses, knapweed etc

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: AC = Very high - medium
Comments:

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: C = Medium
Comments: shrub invasion in to more moist portions.

Trends

Short-term Trend: E = Decline of 30-50%

Comments: weed spp replacing or dominating natives

Long-term Trend: BE = Decline of 30-90%

Comments: dam construction, weed/shrub invasion

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Belnap, J., J. Kaltenecker, R. Rosentreter, J. Williams, S. Leonard, and D. Eldridge. 2001. Biological Soil Crusts: Ecology and Management. Technical Report 1730-2, United States Department of the Interior. 110 pp.

Cassidy, K.M. 1997. Land Cover of the State of Washington, Volume 1.Washington State Gap Analysis - Final Report. Washington Cooperative Fish and Wildlife Research Unit, University of Washington, Seattle, Washington. Volumes 1-5 (1,450 pp.).

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Tisdale, E. W. 1982. Grasslands of western North America: The Pacific Northwest bunchgrass. Pages 223-245 in: A. C. Nicholson, A. Mclean, and T. E. Baker, editors. Grassland Ecology and Classification Symposium, Kamloops, BC.

Tisdale, E.W. 1986. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Bulletin No. 40. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow. 42 pp.

Scientific Name: ***Columbia Basin Foothill and Canyon Dry Grassland*** **Elcode:** CES304.993

Common Name: Columbia Basin Foothill and Canyon Dry Grassland **Subnational ID:** 18305

Tisdale, E.W. and M. Bramble-Brodahl. 1983. Relationships of Site Characteristics to Vegetation in Canyon Grasslands of West-central Idaho and Adjacent Areas. J. of Range Mgmt. 36(6):775-778.

Version

Version Author: Rex Crawford **Version Date:** 24-Oct-2014

Internal Notes:

Scientific Name: ***Columbia Basin Foothill Riparian Woodland and Shrubland*** **Elcode:** CES304.768

Common Name: Columbia Basin Foothill Riparian Woodland and Shrubland **Subnational ID:** 19370

Descriptors

Element Description: This system is found in low-elevation canyons and draws, on floodplains, steep-sided canyons, or narrow V-shaped valleys with rocky substrates. This includes both perennial and intermittent streams. Sites are typically subject to temporary flooding during spring or late winter runoff. Overbank flooding and some gravel areas are required for regeneration of these riparian forests and woodlands, especially for cottonwoods. Large bottomlands may have large occurrences, but most have been cut over or cleared for agriculture. Beavers crop younger cottonwood and willows and frequently dam side channels. Important and diagnostic trees include Populus balsamifera ssp. trichocarpa, Alnus rhombifolia, Populus tremuloides, Celtis laevigata var. reticulata, Betula occidentalis, or Pinus ponderosa. Important shrubs associated with smaller streams include Crataegus douglasii, Philadelphus lewisii, Cornus sericea, Salix lucida ssp. lasiandra, Salix eriocephala, Rosa nutkana, Rosa woodsii, Amelanchier alnifolia, Prunus virginiana, and Symphoricarpos albus (Crawford 2003).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of riparian areas in eastern Washington. Human land uses both within the riparian area as well as in adjacent and upland areas have fragmented many riparian reaches which has reduced connectivity between riparian patches and riparian and upland areas. Adjacent and upstream land uses also have the potential to contribute excess nutrients into riparian areas. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrology regime. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. Grazing is a major influence in altering structure, composition, and function of the system (Kaffman et al 2004). In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses particularly on fine-textured soils. Undesirable forb species, such as Urtica and Equisetum, increase with livestock use. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. All of these stressors have resulted in many riparian areas being incised, supporting altered riparian plant communities, as well as numerous non-native species. This system has also decreased in extent due to agricultural development, roads, dams and other flood-control activities.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This ecological system has experience dramatic decline in extent due to woody vegetation removal for fuel, building materials, and to clear areas for agriculture. Water use and management in the Columbia Basin has likely affected some areas as well. Livestock grazing, both historical and contemporary, continue to degrade any remaninng occurrences. Field observations agree with the S1 Rank.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: This system consts of forests and woodlands along streams within the Columbia Basin. Extent of the Columbia Basin in Washington is 56,573 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 78,432 acres (~317 km2) while National Wetland Inventory (NWI) maps estimated 19,645 acres (~80 km2) of palustrine forested or palustrine scrub-shrub (these two categories match up very closely with this system). Spot checking of both maps suggests the Ecological System map estimate overestimates because it maps in areas outside the conceptual extent of this sytem. However, the Ecological System map does appear to more accuratley map this sytem in areas where it is expected to be found (NWI map misses many occurrences). Thus, the NWI estimate is assumed to be an underestimate. Thus, the "H=100-500 km2" rating was selected.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are 25 element occurrences in the Washington Natural Heritage Program's database. Crawford (2003) had 115 vegetation plots that are part of this sytem. Its not clear how many of those may have overlapped as part of the same 'occurrence' since that study was focused on collecting data for plant association classification. In other words, more than one plant association occurrence could be part of a single occurrence of this system. The lower range of "C=21-80" was chosen based on these variable estimates and the author's field observations.

Population Size: =

Scientific Name: ***Columbia Basin Foothill Riparian Woodland and Shrubland*** **Elcode:** CES304.768

Common Name: Columbia Basin Foothill Riparian Woodland and Shrubland **Subnational ID:** 19370

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** C = Small (5-10%)

Comments: Of the 25 element occurrences in the Washington Natural Heritage Program's database, 15 are of good excellent integrity. However, the majority of those have a range rank of good/fair, indicating they are of borderline good condition. As such, the "C=4-12" rating was selected. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 44% of all forested/scrub-shrub wetlands within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Field observations suggest that almost every site has been impacted by livestock grazing, removal of woody vegetation (U. of WA, Rural Heritage Photo collection: http://www.washingtonruralheritage.org/cdm/landingpage/collection), invasive species, and water manipulation. The "C=5-10%" rating was selected for "percent area occupied with good ecological integrity".

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: There are numerous threat to extant occurrences including clearing for agriculture, livestoc grazing, water management, and invasive species (Phalaris arundianceae).

Threat Category:	1 - Residential & commercial development	Level of Threat:	D = Low
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.1 - Annual & perennial non-timber crops	Level of Threat:	D = Low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			
Threat Category:	9 - Pollution	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.3 - Agricultural & forestry effluents	Level of Threat:	C = Medium
Comments:			

Trends

Short-term Trend: D = Decline of 50-70%

Scientific Name: ***Columbia Basin Foothill Riparian Woodland and Shrubland*** **Elcode:** CES304.768

Common Name: Columbia Basin Foothill Riparian Woodland and Shrubland **Subnational ID:** 19370

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. That analysis showed that ~90% of this Ecological System has been lost (~317km left of original 3,206 km2) . Historical photos of areas in the Columbia Basin from the University of Washington Rural Washington Heritage collection (http://www.washingtonruralheritage.org) suggest a similar scale of losss. A few historical photos near Odessa showed Crab Creek being complety dominated by woody vegetation . Today that area is mostly void of woody vegettation along the creek due to being cleared for agriculture and possibly as a wood source in early settlement periods. It is assumed here that similar removal of woody vegetation occurred elsewhere in the basin. In addition, nonnative species (Phalaris arundianceae), woody vegetation removal, roads, development, agriculture, and livestock grazing have resulted degradation of many extant occurrences. It is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames. Most impacts were likely changes in ecological condition and conversion (from forested wetland to pasture, agricultural field, etc.).

Long-term Trend: D = Decline of 50-70%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. That analysis showed that ~90% of this Ecological System has been lost (~317km left of original 3,206 km2) . Historical photos of areas in the Columbia Basin from the University of Washington Rural Washington Heritage collection (http://www.washingtonruralheritage.org) suggest a similar scale of losss. A few historical photos near Odessa showed Crab Creek being complety dominated by woody vegetation . Today that area is mostly void of woody vegettation along the creek due to being cleared for agriculture and possibly as a wood source in early settlement periods. It is assumed here that similar removal of woody vegetation occurred elsewhere in the basin. In addition, nonnative species (Phalaris arundianceae), woody vegetation removal, roads, development, agriculture, and livestock grazing have resulted degradation of many extant occurrences. It is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames. Most impacts were likely changes in ecological condition and conversion (from forested wetland to pasture, agricultural field, etc.).

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Crawford, R.C. 2003. Riparian Vegetation Classification of the Columbia Basin, Washington. Report for BLM, Spokane District, TNC. and EPA. Wa. Dept. Natural Resources. Natural Heritage Program, Olympia WA. 98 pp.plus tables.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Scientific Name: ***Columbia Basin Foothill Riparian Woodland and Shrubland*** **Elcode:** CES304.768

Common Name: Columbia Basin Foothill Riparian Woodland and Shrubland **Subnational ID:** 19370

Version

Version Author: Joe Rocchio **Version Date:** 05-Mar-2015

Internal Notes:

Scientific Name: ***Columbia Basin Palouse Prairie*** **Elcode:** CES304.792

Common Name: Columbia Basin Palouse Prairie **Subnational ID:** 18255

Descriptors

Element Description: The associated climate of the Palouse Prairie is generally warm to hot, dry summers and cool, wet winters. Annual precipitation is high, 38-76 cm (15-30 inches). It was characterized by dense bunchgrass cover on a dune-like topography composed of loess hills and plains over basalt informally called the Palouse loess (Busacca et al., 1992). The soils were typically deep, well-developed, and old. A frequent, non-lethal fire regime (Morgan and other 1996), along with soil drought and herbivory, retards woody species invasion can result in a patchy distribution of shrubs and trees. The most droughty sites produce little and discontinuous fuel and likely have much longer fire regimes. Isolation of grassland patches by fragmentation may also limit seed dispersal of native shrubs leading to persistence of the grassland. Elk and deer are native large grazers used the Palouse, particularly in spring. Once a matrix system, today the Palouse is a large patch system as result of landscape conversion to agriculture (Black and others 1998). Remnant prairies are now typically associated with small, steep and rocky sites or small, isolated sites within an agricultural landscape
Characteristic species are Festuca idahoensis and Pseudoroegneria spicata (typically ssp. inerme) with Hesperostipa comata, Koeleria macrantha, Leymus cinereus, or Poa secunda. Shrubs commonly found include Rosa spp., Symphoricarpos albus, Prunus virginiana, Eriogonum heraceloides, Amelanchier alnifolia,and Crataegus douglasii. Past land use, excessive grazing, and invasion by introduced annual species have resulted in a broad conversion to agriculture or steppe with shrubs and annual grasslands dominated by Artemisia spp., Ericameria nauseosa, Chrysothamnus viscidiflorus, and Bromus tectorum, Ventenata dubia, Poa bulbosa.The primary land uses that alter the natural processes of the Columbia Plateau Palouse Prairie system are associated with agricultural and livestock practices, exotic species, fire regime alteration, direct soil surface disturbance, and fragmentation. Excessive grazing stresses the system through soil disturbance increasing the probability of establishment of native disturbance increasers and annual grasses, particularly exotic annual bromes (Bromus commutatus, japonicus, mollis, tectorum) and Ventenata dubia on more xeric sites and exotic perennial grasses Arrhenatherum elatius, Bromus inermis, Phleum pratense, and Poa pratensis on more mesic sites. Other exotic species threatening this ecological system through invasion and potential complete replacement of native species include Hypericum perfoliatum, Potentilla recta, Euphorbia esula, and knapweeds, especially Centaurea biebersteinii (= Centaurea maculosa). Persistent grazing will further diminish native perennial cover, expose bare ground, and increase exotics (Johnson and Swanson 2005). Grazing effects are usually concentrated in less steep slopes although grazing does create contour trail networks that can lead to addition slope failures. Fire suppression leads to deciduous shrubs, Symphoricarpos spp., Physocarpus malvaceus, Holodiscus discolor, and Ribes spp. and in some areas trees (Pinus ponderosa and Pseudotsuga menziesii) to increase. Johnson and Swanson (2005) note that Festuca idahoensis decreases following fire but following a flush of annuals sites regain pre-fire cover of Festuca after a few years.

Rank

S Rank: S1 **S Rank Date:** 04-Nov-2014 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Over 90% of original prairie converted to agricultural uses; remnants subject to weed invasion and native shrub invasion and other isolation impacts. Many consider it functionally extirpated.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Cassidy et al. (1996) 4700 sqkm as occurring within the area geographic mapped as Palouse prairie in Washington by Daubenmire (1988).

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map estimates 343 sqkm occurring in Washington. However, this is overmapped beyond range of type. For example, it is mapped as occurring in Dougals, Lincoln and Spokane counties where grassland there are likely either Columbia Basin Steppe and Grassland, Columbia Basin Foothill and Canyon Grassland.

Population and EOs

Number of EOs: A = 1 - 5

Comments: 21 WANHP association element occurrences at 16 sites. There are no A-rank sites and only 2 B-rank sites.

Population Size: =

Comments:

Number of Viable EOs: B = Very few (1-3) **% of Range with Good Viability:**

Scientific Name: ***Columbia Basin Palouse Prairie*** **Elcode:** CES304.792

Common Name: Columbia Basin Palouse Prairie **Subnational ID:** 18255

Comments: Four element occurrences in Washington none really viable as they are all very small size. Only 4% of area with >80% Landscape Condition Model index score (Comer and Hak 2009), indicating very little in good ecological condition.

Number Protected EOs:

Comments:

Threats

Threats: AB = Very high - high

Comments: Fire suppression, isolation and framentation effects have led to invasion of native woody species and exotic invasives. Agricultural drift of fertilizer and pesticides are also threats.Fire suppression, isolation and framentation effects have led to invasion of native woody species and exotic invasives. Agricultural drift of fertilizer and pesticides are also threats.

Threat Category:	3 - Energy production & mining	Level of Threat:	Negligible
Comments:			
Threat Category:	3.3 - Renewable energy	Level of Threat:	Negligible
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	AC = Very high - medium
Comments:	due to fragmentation shrub and tree invasion		
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	AC = Very high - medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.2 - Problematic native species/diseases	Level of Threat:	B = High
Comments:			

Trends

Short-term Trend: F = Decline of 10-30%

Comments: Some attention is being paid to avoiding further loss of habitat but degradation continues.

Long-term Trend: A = Decline of >90%

Comments: Since 1900, 94% percent of the Palouse grasslands have been converted to crop, hay, or pasture lands (Black et al. 1998). 82% decrease over 200 years estimated from NatureServe's Ecological Systems map compared to LANDFIRE Biphysical Settings map.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Black, A.E., E. Strand, R. G. Wright, J. M. Scott, P. Morgan and C. Watson. 1998. Land use history at multiple scales: implications for conservation planning. Landscape and Urban Planning 43(1): 49-63.

Scientific Name: ***Columbia Basin Palouse Prairie*** **Elcode:** CES304.792

Common Name: Columbia Basin Palouse Prairie **Subnational ID:** 18255

Busacca, A.J. and McDonald, E.V., 1994. Regional sedimentation of late Quaternary loess of the Columbia Plateau: sediment source areas and loess distribution patterns. Bull. Washington Div. Geol. Earth Resources 80: 181-190

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

Daubenmire, R. 1988. Steppe vegetation of Washington. Washington State University Cooperative Extension Service Publication EB1446. (Revised from and replaces Washington Agricultural Experiment Station Publication XT 0062.) 131 pp.

Johnson, C.G. and D.K. Swanson. 2005. Bunchgrass communites of the Blue and Ochoco Mountains: A guide for managers. Gen. Tech. Rep. PNW-GTR-641 Portland Oregon. 119p.

Lichthardt, J. and R.K. Moseley. 1997. Status and conservation of the Palouse grassland in Idaho. Conservation Data Center, Idaho Department of Fish and Game, Boise. 28 pp. plus appendices.

Morgan, P., S. Bunting, A.E. Black, T. Merrill, S. Barrett. 1998. Past and present fire regimes in the interior Columbia River basin. In: Fire management underfire (adapting to change); proc. of the 1994 Interior West Fire Council Meeting. International Associatiion of Wildland Fire, Fairfield, WA: 77-82.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Tisdale, E.W. 1961. Ecologic changes in the Palouse. Northw. Sci. 35(4):134-138.

Tisdale, E.W. 1983. Grasslands of western North America: the Pacific Northwest bunchgrass type. Proceedings British Columbia Ministry of Forestry.

Version

Version Author: Rex Crawford **Version Date:** 04-Nov-2014

Internal Notes:

Scientific Name: ***Columbia Plateau Low Sagebrush Steppe*** **Elcode:** CES304.080

Common Name: Columbia Plateau Low Sagebrush Steppe **Subnational ID:** 18417

Descriptors

Element Description: The matrix or large patch Columbia Plateau Low Sagebrush Steppe ecological system occurs in a variety of shallow-soil habitats throughout eastern Oregon, northern Nevada, southern Idaho and eastern Washington. This system is dominated by Artemisia arbuscula. Of the four subspecies of A.arbuscula only subspecies arbuscula is in Washington. It appears on isolated ridges near or above lower treeline in Chelan, Kittitas and Yakima counties and not particularly commonly. In Washington, it forms stands on mountain ridges and flanks and broad terraces, ranging from 3280-4500 feet (1000 to 1400 m) elevation surrounded by Pseudotsuga menziesii and Pinus ponderosa forests. Substrates are shallow, fine-textured soils, poorly drained clays, and shallow soil areas, almost always very stony, characterized by recent rhyolite or basalt. It grows with Artemisia rigida and Artemisia tridentata ssp. wyomingensis or vaseyana with an understory of Festuca idahoensis, Poa secunda, Pseudoroegneria spicata, and Koeleria macrantha. Other shrubs and dwarf-shrubs present may include Purshia tridentata and Eriogonum spp. Many forbs also occur and may dominate the herbaceous vegetation, especially at the higher elevations. The space between vascular plants may support a biological crust that has low cover even without disturbance. Biological crust cover generally decreases with increasing disturbance of soil surface, vascular plant cover, elevation, loose surface rock, and coarseness of soil so that its presence and diversity indicate high integrity relative to anthropogenic disturbances. Johnson and Swanson (2005) indicate that bare ground even in least disturbed sites is 0-25% cover.

Fire influences the density and distribution of shrubs. In general, fire increases the abundance of herbaceous perennials and decreases the abundance of woody plants. The fire interval for this system is 110 years (Landfire 2007). Anecdotal observations indicate that these patches often are not burned during surrounding forest fires. However, recovery of this system after fire may take 325–450 years (Baker 2006). Low sagebrush steppe in Washington can be confused remotely the mountain sagebrush steppe and must be determine on-the-ground.

Rank

S Rank: S1S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: General lack of knowledge of type and it is rare in WA. I assume it has a similar decline in condition as shrubsteppe.

Range

Range Extent: C = 250-1000 square km (about 100-400 square miles)

Comments: Low sagebrush is reported in Okanogan and Garfield counties, however I question whether these are accurate identifications (mountain sagebrush is more likely) and even if correct, it is unlikely that the system is present in these areas.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimated 49 sqkm as occurring in Washington. This is definitely an overestimate. Based on field observations, the systems does not occur north of Colockum. No information about whether it is in the Satus Mts. Johnathan Soll survey has 3 sites (WANHP plot database), Saltrom and Easterly (1995, 1996) questions identifcation of this type on Yakima Training Center and Quilomene Wildlife Area.

Population and EOs

Number of EOs: B = 6 - 20

Comments: Two occurrences in WANHP and field observations suggest less than 10.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** BD = Very small to moderate (<21%)

Comments: Based on field observations of how similar sites react to disturbance.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: With fires occuring in Colockum area it would be worth looking at effects on this system. Johnson and Swanson (2005) say low sagebrush can be eliminated by fire.Much uncertainity due to rarity. Exotic weed invasion is the biggest threat.

Scientific Name: ***Columbia Plateau Low Sagebrush Steppe*** **Elcode:** CES304.080

Common Name: Columbia Plateau Low Sagebrush Steppe **Subnational ID:** 18417

Threat Category: 2 - Agriculture & aquaculture Level of Threat: CD = Medium - low
Comments: most I know of is on Colockum, YTC and Yakama res

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: CD = Medium - low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: BC = High - medium
Comments: BPJ don't know know much about this on site

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BD = High - low
Comments: this is foothills where exotic are less

Trends

Short-term Trend: AE **=** Decline of >30%

Comments: Known occurrences are unlikely to be converted to other land uses. If they react similarly to big sagebrush dry sites, conversion to exotic grasses could happen.

Long-term Trend: U = Unknown

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Johnson, C.G. and D.K. Swanson. 2005. Bunchgrass communites of the Blue and Ochoco Mountains: A guide for managers. Gen. Tech. Rep. PNW-GTR-641 Portland Oregon. 119p.

Salstrom, D. and R. Easterly. 1995. Plant Community Inventory of the Yakima Training Center. Prepared for The Nature Conservancy, Washington Field Office, Contract Number WAFO-021090. SEE Botanical Consulting.

Salstrom, D. and R. Easterly. 1996. Plant Community Mapping on the Upper Quilomene Wildlife Area. Prepared for The Nature Conservancy, Washington Field Office, Contract Number WAFO-012596. SEE Botanical Consulting.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Columbia Plateau Scabland Shrubland*** **Elcode:** CES304.770

Common Name: Columbia Plateau Scabland Shrubland **Subnational ID:** 18310

Descriptors

Element Description:

Rank

S Rank: S5 **S Rank Date:** 20-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates (Sayre et al. 2009) 1500 sqkm in Columibia Basin.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Overlaying NatureServe's Ecological Systems map (Sayre et al. 2009) with NatureServe's Landscape Condition Model suggest that not much areas of this system is degraded. Field observations generaly agree with this. These sites are generally more resilient to grazing due to not offfering much forage and because there is minimal soil development allowing invasive species to invade. However, some of sites are dominated by invasives annuals like Bromus tectorum, B. japonicus, etc.

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low

Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low

Comments: mostly trailing thru

Threat Category: 3 - Energy production & mining Level of Threat: D = Low

Comments: Wind farms and infrastructure

Threat Category: 3.3 - Renewable energy Level of Threat: CD = Medium - low

Comments: Wind Farms

Trends

Short-term Trend: F = Decline of 10-30%

Comments: I suspect expanding windfarm will impact this is syste.

Long-term Trend: G = Relatively Stable (<=10% change)

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments: Extremely droughty and thus would take long recover from disturbances.

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Scientific Name: ***Columbia Plateau Scabland Shrubland*** **Elcode:** CES304.770

Common Name: Columbia Plateau Scabland Shrubland **Subnational ID:** 18310

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 20-Oct-2014

Internal Notes:

Scientific Name: ***Columbia Plateau Steppe and Grassland*** **Elcode:** CES304.083

Common Name: Columbia Plateau Steppe and Grassland **Subnational ID:** 18419

Descriptors

Element Description: This steppe system occurs over large areas, occasionally entire landforms, and is an alternative state of the Inter-Mountain Basins Big Sagebrush Steppe ecological system type where a frequent fire (< 20 years) or fire severity resulted in an absence or very low cover of deep-rooted, fire intolerant shrubs (Laycock 1991). Notably Artemisia tridentata, Artemisia tripartita and Purshia tridentata are absent and are unlikely to re-establish due to lack of seed source. Columbia Steppe and Grassland is dominated by perennial bunchgrasses and forbs (>25% cover), and can have very little exposed bare ground due to mosses and lichens carpeting the area between plants. Associated graminoids include Achnatherum hymenoides, Elymus elymoides, Elymus lanceolatus ssp. lanceolatus, Hesperostipa comata, Festuca idahoensis, Koeleria macrantha, Poa secunda, and Pseudoroegneria spicata. Common forbs are Phlox hoodii, Arenaria spp., and Astragalus spp. Areas with deeper soils are rare because of conversion to other land uses. Shrubs such as Chrysothamnus viscidiflorus, Ericameria nauseosa, or Tetradymia spp. may be present in burned or grazed stands. Biological soil crust is very important in this ecological system. Soils are variable, ranging from relatively deep, fine-textured often with coarse fragments, non-saline, and often with a biological soil crust, to stony volcanic-derived clays, to alluvial sands. Burrowing animals and their predators likely played important roles in creating small-scale patch patterns. Columbia Steppe and Grassland soils are deep to shallow (over 6 inches) and non-saline, often with a biological soil crust. Greater crust cover occurs on north- and east-facing slopes at mid elevations with stable, silt-loam or calcareous soils where not disturbed (Tyler 2006) or where vascular cover and litter are not limiting. Tyler (2006) found that shrub-steppe plots were generally correlated with biological soil crust variables, while grass-steppe plots were generally aligned with Bromus tectorum and Salsola. He stated that pattern reflected that grass-steppe habitats on Yakima Firing Range mostly resulted from the conversion of shrub-steppe habitats by past wildfire. Fire return interval for productive shrub steppe is 12-15 years (fire regime I) and 50-100 years (fire regime II) in less productive areas or alternatively Baker (2006) concludes that Wyoming sagebrush fire rotations are 100-240 years (fire regime V). Grassland or steppe fire intervals are 1-23 years (Perryman 2001). Where fire frequency has allowed for shift to a native grassland condition maintained without significant shrub invasion over a 50 to 70 year interval is the Columbia Basin Steppe and Grassland system. Based on literature summarizing sagebrush recruitment, we estimate approximately 1 acre/2 years or approximately 25 acres in 50 years of natural sagebrush invasion in best conditions. We conclude 50 acres is a minimum persistent patch of bunchgrass steppe. For example, Perryman et al. (2001) calculated a mean recruitment interval of 2.3 (±0.7) years for sagebrush stands in Wyoming. Shrubs produce large quantities of small seeds beginning at 3 to 4 years of age. FEIS summarizes that approximately 90% of big sagebrush seed is dispersed within 30 feet (9 m) of the parent and few seeds are carried more than 100 feet (30 m) (http://www.fs.fed.us/database/feis/plants/shrub/arttrit).

Large native ungulate grazing in the Columbia Basin differed from that in the Great Plains grasslands in duration , seasonality, and severity. In general, grazing was dispersed and was during the winter and spring when forage was available. Davies and others (2009) conclude that sites with heavy litter accumulation, (e.g., ungrazed Artemisia tridentata ssp. wyomingensis/Festuca idahoensis – Achnatherium thurberiana community) are more susceptible to exotic annual invasion following fire than those with less litter accumulation. They note that introduced species and changes in climate can change ecosystem response to natural disturbance regimes.

Rank

S Rank: S2 **S Rank Date:** 23-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The uncertainity of the calculated rank reflects the possiblity that fire have removed shrubsteppe shrubs and incrased the area occupied. Fire effects and site disturbances that promote annual grass invasion are major threats that can irreversibly alter the system. Fire effects and site disturbances that promote annual grass invasion are major threats that can irreversibly alter the system.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: As defined, this is a steady state of Big Sagebrush Steppe ecological system state-transition Model. It is where fire has eliminated shrubs from shrubsteppe and as a result it form complexes with Foothill, Valley and Dry Canyon grassland types.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) over mapped into mountains particularly in Blues. They mapped 1250sqkm on Basin.

Scientific Name: ***Columbia Plateau Steppe and Grassland*** **Elcode:** CES304.083

Common Name: Columbia Plateau Steppe and Grassland **Subnational ID:** 18419

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: Good areas on YTC (although more frequent fire are leading to more cheatgrass) and northern Basin. Western Governers Association Ranking Project (2013) classified 20% of area with >80% LCM index score, estimated from NatureServe Landscape condition model overlain on current distribution from the US Systems map

Number Protected EOs:

Comments:

Threats

Threats: AB = Very high - high

Comments: Fire effects and site disturbances that promote annual grass invasion .Fire effects and site disturbances promote annual grass invasion.

Threat Category: 1 - Residential & commercial development Level of Threat: D = Low
Comments: especially around tri-cities

Threat Category: 2 - Agriculture & aquaculture Level of Threat: BD = High - low
Comments: northern basin and foothills more resilient

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: BD = High - low
Comments: BPJ

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low
Comments: post fire extreme on drier, suppression increase shrubs

Threat Category: 7.1 - Fire & fire suppression Level of Threat: CD = Medium - low
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: AC = Very high - medium
Comments: site dependent but typically problems

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: AC = Very high - medium
Comments:

Trends

Short-term Trend: DH **=** Decline of <70% to increase of <25%

Comments: WGA ranking - as defined, this is a fire created grassland within shrubsteppe therefore fire suppression causes decline while may fire increase area. Under current abundance (last 50 yrs) of invasive annual grasses fires may result in conversion to annual grasses rather than bunchgrass.

Long-term Trend: DH = Decline of <70% to increase of <25%

Comments: WGA ranking - 55% decrease over 200 years estimated from US Systems map compared to LANDFIRE BpS map, I assume with fires in basin that there has been some conversion of shrub steppe to steppe and grassland. Percent increase is a guess.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***Columbia Plateau Steppe and Grassland*** **Elcode:** CES304.083

Common Name: Columbia Plateau Steppe and Grassland **Subnational ID:** 18419

References

Citation

Baker, W.L. 2006. Fire and Restoration of Sagebrush Ecosystems. Wildlife Society Bulletin: 34(1):177-185.

Davies, K.W., T.J. Svejcar and J.D. Bates. 2009. Interaction of historical and nonhistorical disturbances maintains native plant communities. Ecological Applications, 19(6), pp. 1536–1545

Laycock, W. A. 1991. Stable states and thresholds of range condition on NorthAmerican rangelands. J. Range Management 44(5): 427-433.

Perryman, B. L., A. M. Maier, A. L. Hild and R. A. Olson. 2001. Demographic characteristics of 3 Artemisia tridentata Nutt. subspecies. Journal of Range Management 54: 166-170

Tyler, K.J. 2006. Biological Crusts: Analysis of Monitoring Techniques at the Yakima Training Center, Washington. M.S. Thesis Central Washington University, Ellensberg, Wa. 117p.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Columbia Plateau Vernal Pool*** **Elcode:** CES304.057

Common Name: Columbia Plateau Vernal Pool **Subnational ID:** 18307

Descriptors

Element Description: The Columbia Plateau Vernal Pool small patch system occurs throughout the exposed volcanic scablands on the Columbia Plateau in Washington, Oregon, and northern Nevada. Washington occurrences are concentrated in the Channeled Scablands and glaciated areas in Spokane, Lincoln, Douglas, southern Okanogan, Grant, Whitman and Adams counties. They are often found within a mounded or biscuit-swale topography within Artemisia shrub-steppe, bunchgrass steppe or rarely Pinus ponderosa savanna. They are characterized by freshwater inundation for much of the winter and spring, followed by dramatic lowering of the water table at the approach of summer, such that soils are dry in the summer. They are found in isolated small depressions with no inflow or outflow and a restrictive subsurface soil layer (clay or bedrock). Vegetation is dominated primarily by annual forbs.

The Columbia Plateau Vernal Pool system occurs as shallow ephemeral wetlands in very small (3 square meters or 32 sq. ft.) to rarely large depressions (260 ha or 1 square mile). Bjork and Dunwiddie (2004) measured 242 vernal pools in Washington to be between 3 sq m. and 4610 sq. m. (1.1 ac) with a 1590 sq. m (0.4 acre) average. Vernal pools mostly are located on massive basalt flows exposed by Pleistocene floods but also occur on andesite or rhyodacite caprock. Often perched above the surrounding landscape, vernal pools are generally not subject to runoff from major stream systems. Climatically, the system is defined by wet winters (November through January) and severe summer drought (July-September), although May or June can be wet. Pool inundation primarily results from direct precipitation and varies yearly and seasonally, and with the size of the small upland watershed associated with a vernal pool or in some cases, surface runoff from adjacent pools or wetlands. Inundation is highly irregular, sometimes not occurring for several years. Depressions usually (but not always) fill with water during winter and spring and generally dry well within 9 months. In exceptional times they can remain inundated for two consecutive years. Soil texture is typically silty clay, sometimes with sandy margins.

The periodic inundation and drying leads to development of concentric zones of different plants as the pools dries (Crowe and other 1994). Characteristic plants species of this system are predominantly annual and diverse. Floristically this system is akin to the California vernal pool flora (approximately one-third); however, many of the most abundant species are not reported in Californian pools (Bjork and Dunwiddie 2004). Characteristic species include Callitriche marginata, Camissonia tanacetifolia, Elatine spp., Epilobium densiflorum (= Boisduvalia densiflora), Eryngium vaseyi, Juncus uncialis, Myosurus X clavicaulis, Plagiobothrys spp., Polygonum polygaloides ssp. confertiflorum, Polygonum polygaloides ssp. polygaloides, Psilocarphus brevissimus, Psilocarphus elatior, Psilocarphus oregonus, and Trifolium cyathiferum (Bjork 1997; Bjork and Dunwiddie 2004). Artemisia ludoviciana ssp. ludoviciana can occur on better developed soils. When full, the pool's water column and saturated substrates support assemblages of macroinvertebrates as well as habitat for mobile invertebrates adapted to ephemeral wetlands. Fairy shrimps (Anostraca) are found in vernal pools along with birds and amphibians. Pools provide water storage and support nitrogen transformation.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of vernal pools on the Columbia Basin. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. In general, excessive livestock use leads to a shift in plant species composition. Several exotic species can invade this habitat with grazing or other soil disturbance. Native species, such as Juncus bufonis and Polygonum aviculare increase with excessive livestock use and Eleocharis spp. decrease (Brown 2001). Vernal pool invasibility depends on multiple biotic and physical factors including hydrologic regime , soil nutrient properties, the native plant community, site disturbance history and climatic variability (Environmental Science Associates 2007). Southern Oregon vernal pools showed a pattern noted in California vernal pools of non-native plant species occurring in higher abundance in the outer edge or "flank" zone of pools (Environmental Science Associates 2007). Invasion likely occurs as an indirect result of the prevalence of non-native upland plants in the surrounding uplands (Environmental Science Associates 2007). Zedler (1987) stated that "moderate cattle or horse grazing does not seem to pose much of a threat to the persistence of vernal pool plants despite the disruptive effect of trampling" . Brown (2001) following a 2-year study in eastern Washington found a significantly greater cover of "weedy species" in grazed vernal pools . Grazing livestock has been experimentally correlated with a significantly longer duration of vernal pool hydrology during dry-down stage, in comparison to ungrazed pools ((Environmental Science Associates 2007).

Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Several exotic species invade vernal pools particularly upper zones: Centaurea spp., Cirsium arvense, Descurainia sophia, Elytrigia repens, Phalaris arundinacea, Poa compressa, Poa pratensis, and Sisymbrium altissimum (Bjork and Dunwiddie 2004). Although most wetlands receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively. Even minor changes in the water table depth or duration of inundation can have profound effects on soil salinity, and consequently, wetland vegetation (Cooper and Severn 1992). Wetland animals, such as waterbirds, amphibians, or invertebrates are affected changes in hydrology.<br

Scientific Name: ***Columbia Plateau Vernal Pool*** **Elcode:** CES304.057

Common Name: Columbia Plateau Vernal Pool **Subnational ID:** 18307

/>

Rank

S Rank: S2S3 **S Rank Date:** 05-Oct-2012 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system is geographically limited but relativley common within the areas in which it occurs. Although there has not been much direct loss of area of vernal pools most have been degraded by livestock grazing and roads. The reason the rank adjusted was to account for the difficulty of determining was constitute and occurrence . Most of the pools are very small and occur in high concentrations in certain locations. Often adjacent pools are hydrologically connected via swales or shallow water movement. Thus, distinguishing between ecologically distinct pools or pool complexes is very difficult in areas where pools are concentrated.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: This ecological system is limited to the channeled scablands within the Columbia Basin where they occur in swales and depressions with hardpan or occassionally clay substrates. The system is primarily found in Adams, Douglas,Grant, Lincoln,Okagnogan, and Spokane counties where it is found on impervious basalt outcrops exposed by the Missoula floods (Bjork and Dunwiddie 2004). The largest concentration is the area of Swanson Lake State Wildlife Area (Bjork and Dunwiddie 2004). Extent was measured to be ~15,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 111 acres (~0.45 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to the Columbia Basin ecoregion within Washington. Next, basalt flows from WA DNR's 1:100K Surface Geology layer were selected within the three channellend scabland tracts where most vernal pools are found (Grand Coulee tract; Telford-Crab Creek tract; and Cheney-Palouse tract). NWI wetlands (only palustrine emergent wetlands were included) occuring on basalt within these three tracts were selected and represent a NWI estimate of vernal pools. The result was 47,657 acres (~193 km2) of wetlands with moderate probability of being vernal pools. However, this value likely includes other wetlands such as Inter-Mountain Basin Alkaline Closed Depression, Inter-Mountain Basin Playa, and North American Arid Freshwater Emergent Marsh). Bjork and Dunwiddie (2004) esimate vernal pool densities exceed 200 per square-mile section in some areas. The average size of eastern Washignton vernal pools was estimated to be 1,592 m2 (~0.4 acre). Thus, in areas with the highest densities of pool approximately 80 acres per square mile were noted (Bjork and Dunwiddie 2004). Based on these variable estimates, the "F=5-20 km2" estimate was chosen.

Population and EOs

Number of EOs: D = 81 - 300

Comments: The number of occurrences is complex question due to the very small scale of individual pools and because many of these pools are hydrologically connected via intervening swales that often exhibit vernal pool characteristics themselves. That said, there are 31 occurrences of both vernal pool plant communities (2) and vernal pool rare plants (29). A few additional vernal pool communities were recently identified. The "D=81-300" value was chosen based on the density estimates of 200 pools per square mile by Bjork and Dunwiddie (2004) in areas with the highest density.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 56% of potential vernal pools (see comments for area of occupancy metrics) within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 56% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. Grazing has reduced quality of many sites and nonnative species affect the periphery of many vernal pools. Based on all this information, the rating "D= 11-20%" was chosen for 'percent area occupied' with good ecological integrity.Most pools are in a landscape which has or is currently grazed.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Scientific Name: ***Columbia Plateau Vernal Pool*** **Elcode:** CES304.057

Common Name: Columbia Plateau Vernal Pool **Subnational ID:** 18307

Comments: Bjork and Dunwidde (2004) note that eastern Washington vernal pools are less threatened than California vernal pools. They note that development and agriculture are not important threats due to eastern Washington pools occuring on basalt outcrops. Threats from nonnative species are less pronounced in eastern Washington vernal compared to California pools (Bjork and Dunwiddie 2004). That said, grazing occurs across most of the range of this systems and impacts, albeit generally not serious, have been observed at most pools visited. In these areas, invasive species are typical around pool edges, species diversity of vernal pool annuals appears to be less than in grazed sites, and the covern of perennial species can sometimes increase due to grazing.. Some roads also impound and/or restrict water flow in vernal pools.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: C = Medium
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: C = Medium
Comments: Grazing is widespread throughout the range of this system.

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments: Roads can result in direct loss of vernal pools and/or impound water and restrict water movement in vernal pools.

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: Bjork and Dunwiddie (2004) note that few eastern Washington vernal pool are dominated by nonnatives.

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: D = Low
Comments: Perennial species tend to increase with grazing (Bjork 1997)

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: Direct loss of this sytem has likely been minimal due to the location of these wetlands on basalt outcrops and areas of thin soils which are not desireable areas for development or agriculture. Thus, the rating chosen reflects assumed changes in ecological integrity, primarily due to livestock grazing and road impacts. Livestock grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar. Invasive species are not as problematic as in other wetlands types and are primarily limited to the outer edges of pools where upland species like Bromus tectorum or Ventenata dubia are found.

Long-term Trend: E = Decline of 30-50%

Comments: Direct loss of this sytem has likely been minimal due to the locaiton of these wetlands on basalt outcrops and areas of thin soils which are not desireable areas for development or agriculture. Thus, the rating chosen reflects assumed changes in ecological integrity, primarily due to livestock grazing and road impacts. Livestock grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar. Invasive species are not as problematic as in other wetlands types and are primarily limited to the outer edges of pools where upland species like Bromus tectorum or Ventenata dubia are found.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***Columbia Plateau Vernal Pool*** **Elcode:** CES304.057

Common Name: Columbia Plateau Vernal Pool **Subnational ID:** 18307

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Bjork, C. R. 1997. Vernal pools of the Columbia Plateau of eastern Washington. Report to the Washington Field Office of The Nature Conservancy. 29 pp. plus 7 appendices.

Bjork. C.R. And P. W. Dunwiddie. 2004. Floristics and Distribution of Vernal Pools on the Columbia Plateau of eastern Washington. RHODORA 106 (928): 327–347

Crowe, E. A., A. J. Busacca, J. P. Reganold, and B. A. Zamora. 1994. Vegetation zones and soil characteristics in vernal pools in the Channeled Scabland of eastern Washington. Great Basin Naturalist 54: 234–247

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 02-Mar-2015

Internal Notes:

Scientific Name: ***Columbia Plateau Western Juniper Woodland and Savanna*** **Elcode:** CES304.082

Common Name: Columbia Plateau Western Juniper Woodland and Savanna **Subnational ID:** 18420

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 16-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The system is highly restricted in WA. It is not clear if it occurred in the state pre-settlement (fire restricted?) but now appears to be increasing. However, habitat is limited by agriculture.

Range

Range Extent:

Comments: Range within Washington is estimated to be from eastern Klickitat County to southern Benton County (excludes Juniper Dunes Wilderness Area in Franklin County).

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Based on author's experience, extent and probable habitat occurs along mid length of a few drainages into the Columbia River. It is observable on on some adjacent plateaus.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** DE = Moderate to good (11-40%)

Comments: Author has mostly observed that midslopes are lightly grazed and there appear to be scattered juniper in what is presumed to be annual grassland in the vicinity of known juniper stands.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments:

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	3 - Energy production & mining	Level of Threat:	Negligible
Comments:			
Threat Category:	3.3 - Renewable energy	Level of Threat:	Negligible
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	Not a Threat
Comments:			
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	Not a Threat
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	C = Medium
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	C = Medium
Comments:	cheatgrass and some Cynosurus		

Trends

Short-term Trend: =

Comments:

Long-term Trend: H = Increase of 10-25%

Comments:

Scientific Name: ***Columbia Plateau Western Juniper Woodland and Savanna*** **Elcode:** CES304.082

Common Name: Columbia Plateau Western Juniper Woodland and Savanna **Subnational ID:** 18420

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 15-Oct-2014

Internal Notes:

Scientific Name: ***East Cascades Mesic Montane Mixed-Conifer Forest and Woodland*** **Elcode:** CES204.086

Common Name: East Cascades Mesic Montane Mixed-Conifer Forest and Woodland **Subnational ID:** 18422

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 16-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: relatively restricted range to more maritime climate along east Cascades, vulnerable to landscape level disturbances, defoliator insects, fire and more management to control roads increased potential for exotic plants although none currently known.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) map 3340sqKM. Map looks over estimated at low elevations and into Okanogan Co.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: assumed most of mapped area is unlogged. Although as measure of likely not logged 47% of mapped area beyond 800ft of road

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: fire suppression and increased pathogens

Threat Category:	1 - Residential & commercial development	Level of Threat:	D = Low
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	Negligible
Comments:			
Threat Category:	1.3 - Tourism & recreation areas	Level of Threat:	D = Low
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	B = High
Comments:			
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	B = High
Comments:			

Scientific Name: ***East Cascades Mesic Montane Mixed-Conifer Forest and Woodland*** **Elcode:** CES204.086

Common Name: East Cascades Mesic Montane Mixed-Conifer Forest and Woodland **Subnational ID:** 18422

Trends

Short-term Trend: **=**

Comments:

Long-term Trend: **=**

Comments:

Other Factors

Intrinsic Vulnerability: **=**

Comments: climate changes that effect water availability

Environmental Specificity: **=**

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***East Cascades Oak-Ponderosa Pine Forest and Woodland*** **Elcode:** CES204.085

Common Name: East Cascades Oak-Ponderosa Pine Forest and Woodland **Subnational ID:** 18423

Descriptors

Element Description: This system dominates in areas between shrub steppe at lower elevations and conifer-dominated woodlands or forest above. Elevations range from 460 to 1920 m. They occur in slopes ranging from steep, lower slopes to more moderate slopes on dry benches. Substrates are usually very gravelly, stony coarse loams derived from basalt colluvium. Most occurrences of this system are dominated by a mix of Quercus garryana and Pinus ponderosa or Pseudotsuga menziesii. Scattered Pinus ponderosa or Pseudotsuga menziesii can comprise the upper canopy over Quercus garryana trees but only occur in favorable microsites and do not regenerate well. Clonal Quercus garryana can create dense patches across a grassy landscape or can dominate open woodlands or savannas. The understory may include dense stands of shrubs or, more often, be dominated by grasses, sedges or forbs. Shrub-steppe shrubs may be prominent in some stands and create a distinct tree / shrub / sparse grassland habitat, including Purshia tridentata, Artemisia tridentata, Artemisia nova (not in Washington), and Chrysothamnus viscidiflorus. Understories are generally dominated by herbaceous species, especially graminoids. Mesic sites have an open to closed sodgrass understory dominated by Calamagrostis rubescens, Carex geyeri, Carex rossii, Carex inops, or Elymus glaucus. Drier savanna and woodland understories typically contain bunchgrass steppe species such as Festuca idahoensis or Pseudoroegneria spicata. Common exotic grasses that often appear in high abundance are Bromus tectorum, Cynosurus echinata and Poa bulbosa. These woodlands occur at the lower treeline/ecotone between Artemisia spp. or Purshia tridentata steppe or shrubland and Pinus ponderosa and/or Pseudotsuga menziesii forests or woodlands. In the Columbia River Gorge, this system appears as small to large patches in transitional areas in the Little White Salmon and White Salmon river drainages in Washington and Hood River, Rock Creek, Mosier Creek, Mill Creek, Three-mile Creek, Fifteen Mile Creek, and White River drainages in Oregon. Quercus garryana can create dense patches often associated with grassland or shrubland balds within a closed Pseudotsuga menziesii forest landscape. Commonly the understory is shrubby and composed of Ceanothus integerrimus, Holodiscus discolor, Symphoricarpos albus, and Toxicodendron diversilobum and similar to the North Pacific Oak Woodland ecological system.

East Cascades Oak-Pine Forest and Woodland is characterized by frequent (5-30 year fire return interval) low intensity ground fires that maintain the open savanna structure that characteristic of most of this system (Landfire. 2007. Biophysical Setting Model 0110600: East Cascades Oak-Ponderosa Pine Forest and Woodland, fire regime I). Fire severity increases with density of understory shrubs and canopy trees. Soil drought plays a role, maintaining an open tree canopy in part of this dry woodland habitat. Increasing timber harvest or altered fire regime can result in lower densities of large live trees and increasing dominance of smaller size classes and sprouting clumps which creates conditions that support cloning of oak and invasion by conifers resulting in denser stands. In Klickitat County, dense stands of stunted oak indicate effects of fire exclusion in this community type (M. Vander Haegen, WDFW; pers. comm. 9/2/2010 as cited in Evans 2010). Decades of fire suppression have led to invasion by Pinus ponderosa in favorable sites along lower treeline and by Pseudotsuga menziesii in the gorge and other oak patches on xeric sites in the east Cascade foothills. Where this system occurs on river terraces and other more mesic sites, fuel loads are increased and a mixed severity fire regime prevails, with return intervals of 50-60 years. Thus, canopy cover can both increase or decrease outside the historic range of variability due to altered fire regime, timber harvest, and grazing.

Rank

S Rank: S1S2 **S Rank Date:** 15-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Limited distribution subject to conditoin changes with fire and fire suppression. The drier portions of system, oak sprouting increases tree density and reduces/eliminates understory. Mesic portions increase in conifers. Fire increase exotic grasses. 2012 WGA Grank information

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Exterior point-to-point area bounding NatureServe 2009 mapping of system where I know aak is located.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) over estimated (663sqk) by half to third. Mapped along rivers and north into Chelan Co looks like orchards.

Population and EOs

Number of EOs: =

Comments:

Scientific Name: ***East Cascades Oak-Ponderosa Pine Forest and Woodland*** **Elcode:** CES204.085

Common Name: East Cascades Oak-Ponderosa Pine Forest and Woodland **Subnational ID:** 18423

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** CD = Small to moderate percentage (5-20%)

Comments: Abundance of exotic grasses follow fire and intense grazing; 36% of mapped beyond 800ft of road although that includes mislabel polygons. From 2012 WGA Grank - 1% of area with >80% LCM index score, estimated from NatureServe Landscape condition model overlain on current distribution from the US Systems map.

Number Protected EOs:

Comments:

Threats

Threats: AB = Very high - high

Comments: The drier portions of system, oak sprouting increases tree disity and reduces/eliminates understory. Mesic portions increase in conifers with fire suppression. Fire increase exotic grasses.The drier portions of system, oak sprouting increases tree disity and reduces/eliminates understory. Mesic portions increase in conifers. Fire increase exotic grasses. sing conifers

Threat Category:	1 - Residential & commercial development	Level of Threat:	D = Low
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	1.3 - Tourism & recreation areas	Level of Threat:	D = Low
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:	increases exotic plants		
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	D = Low
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	B = High
Comments:			
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	B = High
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	C = Medium
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	BC = High - medium
Comments:	annuals in drier, pereenial grasses in moist		

Trends

Short-term Trend: E = Decline of 30-50%

Comments:

Long-term Trend: F = Decline of 10-30%

Comments: 49% decrease over 200 years estimated from US Systems map compared to LANDFIRE BpS map

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Scientific Name: ***East Cascades Oak-Ponderosa Pine Forest and Woodland*** **Elcode:** CES204.085

Common Name: East Cascades Oak-Ponderosa Pine Forest and Woodland **Subnational ID:** 18423

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

John, T., D. Tart, and R. Clausnitzer. 1988. Forest associations of the Yakama Indian Reservation. Draft. Yakama Indian Nation. Toppenish, WA. 133 pp.

Lillybridge, T. R., B. L. Kovalchik, C. K. Williams, and B. G. Smith. 1995. Field guide for forested plant associations of the Wenatchee National Forest. USDA Forest Service General Technical Report PNW-GTR-359, Pacific Northwest Research Station, Portland. Portland, OR. 335 pp.

Maertens, T.B. 2008. The Growth-Climate Relationship of Oregon White Oak (Quercus garryana). M.S. Thesis, University of Guelph. Guelph, Ontario.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 15-Oct-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Alkaline Marsh and Flats*** **Elcode:** CES304.998

Common Name: Inter-Mountain Basins Alkaline Closed Depression and Playa **Subnational ID:** 19369

Descriptors

Element Description: The Inter-Mountain Basins Playa and the Inter-Mountain Basins Alkali Closed Depression ecological systems occur throughout much of the cool arid and semi-arid regions of the Columbia Plateau and Great Basin either as a large or small patch type. They almost always appear within a shrub steppe or semi-desert landscape. The Inter-Mountain Basins Playa and the Inter-Mountain Basins Alkali Closed Depression ecological systems are found in closed depressions or in terminal basins and differ by: 1) vegetation cover (Playa is typically sparse to patchily vegetated, generally <10% plant cover while Alkali Closed Depression is moderately to densely covered by herbaceous plants), 2) soil chemistry (playas are considered more saline than alkaline closed depressions), and 3) hydrological regime (playas are more intermittently flooded; closed depressions are more seasonally to semi-permanently flooded).

Precipitation and runoff characteristics in contributing basins are important to system function . During high precipitation years Inter-Mountain Basins Playa systems may have water for 3 to 4 months and during dry years not retain any standing water. Water usually does not percolate because of an impermeable layer . Water loss is primarily through evaporation that results in a high concentration of salts in the upper soil profile. Some playas are influenced by groundwater and have minor surface flooding (Rocchio 2006). Those playas have open water early in the season and as the water evaporates salt crust is left on the soil surface from the salts dissolved in the water. This environment supports a flora adapted to seasonal soil saturation and saline conditions. Species composition varies with soil salinity and moisture and usually displays vegetation zones (Rocchio 2006). The Inter-Mountain Basins Playa system almost always has an unvegetated or sparsely vegetated center at its lowest elevation. Mud flats may appear with the salt flats. A few plants such as Salicornia spp. can appear on salt flats but they mostly lack vegetation. Schoenoplectus acutus, typically without Typha latifolia due to its lower salt tolerance, can establish where flooding occurs 3 or more months. Eleocharis palustris can occur in areas inundated for 1 to 3 months. Amphiscirpus nevadensis and Juncus balticus can grow in areas of high water tables and saline soils. Saline wet meadow plants such as Distichlis spicata and Juncus balticus are found in seasonally saturated soils (Rocchio 2006).

NatureServe (2007) defines the Inter-Mountain Basins Alkali Closed Depression ecological system as occurring in seasonally to semi-permanently flooded depressions that usually retain water into the growing season and dry completely only during droughts. They are located in basins with internal drainage and many are associated with groundwater (springs). Soils are alkaline to saline clays with hardpans. Seasonal drying exposes mudflats which are often colonized by pioneering species, such as Hordeum jubatum. Salt crust may sporadically occur on the soil surface. Species that typify this system are halophytic species such as Distichlis spicata, Puccinellia lemmonii, Poa secunda, Muhlenbergia spp., Leymus triticoides (= Elymus triticoides), Schoenoplectus maritimus, Schoenoplectus americanus, Triglochin maritima, and Salicornia spp. This system often occurs along the margins of perennial lakes with extremely low-gradient shorelines. This system is very similar to Western Great Plains Closed Depression Wetland (NatureServe 2007).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of playas on the Columbia Basin. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roads or removing vegetation on adjacent slopes) results in changes in the amount and pattern of herbaceous wetland habitat. In general, excessive livestock use leads to a shift in plant species composition. Native species, such as Juncus balticus, increase with excessive livestock use. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Several exotic species invade playas including Cardaria spp., Chenopodium glaucum, C. rubra, (Salsola spp.), Bassia hyssopifolia, and Kochia scoparia. Although most wetlands receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively. In addition, recent Supreme Court decisions exclude many, if not most occurrences of this system, from protection under the Clean Water Act (Haukos and Smith 2003). Minor changes in the water table depth or duration of inundation can have profound effects on soil salinity , and consequently, wetland vegetation (Cooper and Severn 1992). Wetland animals, such as waterbirds, amphibians, or invertebrates are affected changes in hydrology .

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system is found throughout the Columbia Basin. There is a high denseity of occurrences in northern Douglas County, where past glaciation left many lanforms suitable for the development of this sytem. Alterations in hydrology associated with dams, irrigation, and road have resulted in some direct conversion of this wetland system to other types (such as North American Arid Freshwater Emergent Marsh). Grazing is widespread in many occurrences and continues to impact ecological integrity of sites.

Scientific Name: ***Inter-Mountain Alkaline Marsh and Flats*** **Elcode:** CES304.998

Common Name: Inter-Mountain Basins Alkaline Closed Depression and Playa **Subnational ID:** 19369

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Within Washington, this ecological system is limited to the Columbia Basin. Although the same could be found throughout the Basin it is most common in northern Douglas County, Swanson Lakes area of Lincoln County and the Lower Crab Creek area. This systems was lumped with Inter-Mountain Basin Playa in Crawford and Rocchio (2008). However, it is being assessed here as an individual ecological system. Playas and alkaline depressions often co-occur, with alkaline depression vegetation ringing around a central playa zone. However, the two can occur independently of each other, with alkaline depressions occurring more commonly by itself. These alkaline wetlands are primarily found in depressions, sometimes along riparian terraces, and occassiconaly in areas with groundwater discharge. There is a high denseity of occurrences in northern Douglas County, where past glaciation left many lanforms suitable for the development of this system.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 2,953 acres (~12 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to the Columbia Basin ecoregion within Washington. Next, NWI codes were used to identify wetland polygons that have a high probability of including this ecological system (e.g., palustrine emergent wetlands with intermittent or seasonal flooding).The results showed that 68,144 acres (~275 km2) of such palustrine emergent wetlands occur within the Columbia Basin ecoregion within Washington. However, this value includes other wetlands such as Inter-Mountain Basin Playa, North American Arid Freshwater Emergent Marsh, or Columbia Plateau Vernal Pool). The "G=20-100km2" estimate was chosen to represent the range of estimates highlighted above.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are less than 13 element occurrences in WNHP's database but based on personal observations this sytem is somewhat abundant in northern Douglas County. The "C=21-80" was determined to be the best estimate of occurrences based on this information.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: WANHP has 13 element occurrences that are either this systems or Inter-Mountain Basins Playa and thus the "C=4-12" rating was chosen for the 'number of occurrences' with good ecological integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 38% of palustrine emergent wetlands with intermittent or seasonal flooding within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 38% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. Rocchio and Crawford (2009) in a study of wetland ecological integrity of northern Douglas County sampled 60 sites of this system. They found that all 60 had an overall ecological integrity rating of "good" but 66% of those sites had fair integrity of onsite biotic condition. Harris (1954) noted that irrigation and dams associated with the Columbia Basin Irrigation project had the potential to change the hydrology of many wetlands, including this ecological system. Introducting irrigaiton water onto alkaline depressions could change overall hydorlogical patterns and subsequently change water chemistry. Wasterwater from irrigation has also created wetlands (including those that resemble this sytem) in areas where they would otherwise not be found. Field observations confirm that both wetland conversion and creation has resulted from irrigation wastewater. Grazing has reduced quality of many sites and groundwater withdrawal and other hydrological impacts are also responsible for degradation of many occurrences. Groundwater discharge from irrigation practices have likley changed hydrological regimes of many of these wetlands, especially in the potholes region. Based on all this information, the rating "E= 11-20%" was chosen was chosen for 'percent area occupied' with good ecological integrity.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Scientific Name: ***Inter-Mountain Alkaline Marsh and Flats*** **Elcode:** CES304.998

Common Name: Inter-Mountain Basins Alkaline Closed Depression and Playa **Subnational ID:** 19369

Comments: Water management from dams and irrigation have likely altered the hydrological regime and water chemistry of many occurrences, especially within the geographic range of the Columbia Basin Irrigation Project. Grazing impacts many other occurrences. Trampling by livestock destroys the surface salt crusts and can result in increased cover of native increaser species like Juncus balticus and Distichlis spicata and/or decrease germination and survival of native halophytes (based on personal observations of decreased cover of halophytes in heavily grazed sites). It is not known how trampling may alter substrate conditions for invertebrates, especially those preferred by shorebirds such as avocets.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: B = High
Comments:

Threat Category: 2.1 - Annual & perennial non-timber crops Level of Threat: C = Medium
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: B = High
Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: C = Medium
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: C = Medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments:

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: C = Medium
Comments: grazing often results in native "increaser" species dominating these sites

Trends

Short-term Trend: F = Decline of 10-30%

Comments: Direct loss of this sytem has mostly been due to past water management activiites. Sites where this system occur generally are in areas not suitable for desireable for development and/or agriculture. However, livestock grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar.

Long-term Trend: F = Decline of 10-30%

Comments: Some direct loss has likely occurred due to water management from dams and irrigation have altered the hydrological regime and water chemistry of many occurrences, especially within the geographic range of the Columbia Basin Irrigation Project. Roads may have degraded many occurrences. Grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***Inter-Mountain Alkaline Marsh and Flats*** **Elcode:** CES304.998

Common Name: Inter-Mountain Basins Alkaline Closed Depression and Playa **Subnational ID:** 19369

References

Citation

Rocchio, F.J. 2006. Intermountain Basins Playa Ecological System Ecological Integrity Assessment. Colorado Natural Heritage Program Colorado State University Fort Collins, CO.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Joe Rocchio **Version Date:** 02-Mar-2015

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Active and Stabilized Dune*** **Elcode:** CES304.775

Common Name: Inter-Mountain Basins Active and Stabilized Dune **Subnational ID:** 18311

Descriptors

Element Description: This system is characterized by active or stabilized dunes and sandsheets and has patchy or sparse vegetation. Four simple dune types have been observed in Washington: (1) Longitudinal dunes, which form when there is a small to moderate supply of sand, much wind and little vegetation; (2) Transverse dunes, which form when there is a copious sand supply, little to moderate wind and little vegetation; (3) Parabolic or U-shaped dunes, which form when there is a moderate supply of sand, wind and vegetation; and (4) Climbing dunes, which climb the windward side of hills as sand sheets. This system is composed of unvegetated to moderately vegetated (<10-30% plant cover), active and stabilized dunes and sandsheets. Vegetation cover is related to the amount of annual rainfall and rate of evapo-transpiration. Species occupying these environments are often adapted to shifting, coarse-textured substrates (usually quartz sand) and form patchy or open grasslands, shrublands or steppe, and occasionally woodlands.
This system includes multiple plant associations that represent a range of conditions from sparse (<20%) to moderate (> 60%) vegetation cover and are often found together in fine scale spatial mosaics. Plant species composition often relates to the degree of sand stabilization / vegetation cover and position on a particular dune. Psoralidium lanceolatum, an herb and Achnatherum hymenoides, a bunchgrass typically dominate the initial stages of stabilization and are also commonly found on dunes with a wide range of stabilization / vegetation. Prior to stabilization shrubs tended to be sparse while Elymus lanceolatus, a rhizomatous grass, and herbs Corispermum sp., Rumex venosus and Phacelia hastata are common. With increased sand stabilization shrubs Ericameria nauseosa, Chrysothamnus viscidiflorus, Purshia tridentata, and Artemisia tridentata ssp. wyomingensis are often present to dominant. Eriogonum niveum is common when gravel is present. With shrubs, herbs Oenothera pallida, Penstemon acuminatus, Phacelia hastata, Balsamorhiza careyana, Pteryxia terebinthina, Hymenopappus filifolius, Erigeron filifolius and grass Koeleria macrantha are common and contribute little to total vegetation cover although at times cover of these herbs can be locally significant. Pinus ponderosa or Juniperus occidentalis trees can be members of dune vegetation. Exotic annuals, Bromus tectorum, Salsola kali and Sisymbrium altissimum are common and at times abundant. Where dunes have overridden or partially covered “normal” soil, Pseudoroegneria spicata, Poa secunda or other shrub steppe species are often present.

Rank

S Rank: S1 **S Rank Date:** 22-Jun-2007 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Estimate based on range outlined in the Hallock et al. (2007) dune map.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 436 sqkm. Hallock et al. (2007) note that, as of 2006, there was approximately106,953 acres.

Population and EOs

Number of EOs: B = 6 - 20

Comments: WANHP has 20 element occurrences.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:**

Comments: Of the 20 element occurrences, 8 are ranked AB or B.

Number Protected EOs:

Comments:

Threats

Threats: AB = Very high - high

Comments: Exotic grasses have stablized many formerly active dunes. The Columbia River Irrigation Project has increased water table creating inter-dunal wetland and ponds that stabilized dune movement. Active converson of dunes to agriculture and excessive recreation are localized serious threats.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low

Comments:

Scientific Name: ***Inter-Mountain Basins Active and Stabilized Dune*** **Elcode:** CES304.775

Common Name: Inter-Mountain Basins Active and Stabilized Dune **Subnational ID:** 18311

Threat Category: 2.1 - Annual & perennial non-timber crops Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: CD = Medium - low
Comments:

Threat Category: 6.1 - Recreational activities Level of Threat: CD = Medium - low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low
Comments: Irrigation waste water stabilizes dunes, fragments, changes dune processes.

Threat Category: 7.2 - Dams & water management/use Level of Threat: C = Medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BC = High - medium
Comments: Cheatgrass covers sand sheet stabilizes dunes

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: BC = High - medium
Comments:

Trends

Short-term Trend: D **=** Decline of 50-70%

Comments: Hallock et al. (2007) note that total extent of inland sand dune systems has declined from approximately 448,177
acres in the early 1970s to 106,953 ac by 2006, a loss of 76%.

Long-term Trend: C = Decline of 70-80%

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Hallock, L.A., R.D. Haugo, and R. Crawford. 2007. Conservation Strategy for Washington State Inland Sand Dunes. Washington Natural Heritage Program, Washington Department of Natural Resources, Olympia, WA. Natural Heritage Report 2007-05.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 31-Oct-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Big Sagebrush Steppe*** **Elcode:** CES304.778

Common Name: Inter-Mountain Basins Big Sagebrush Steppe **Subnational ID:** 19363

Descriptors

Element Description: Landforms that support shrub steppe are a mosaic of patch types or plant associations that reflect differences in site (soil/precipitation zone) and fire effects. Soils are deep (over 6 inches) to shallow and non-saline. The space between vascular plants usually supports a biological soil crust that can cover up to 90% or more without disturbance. Biological soil crust cover generally decreases with vascular plant cover, elevation, increasing disturbance of soil surface, loose surface rock, and coarseness of soil so that its presence and diversity better indicates integrity. Greater biological crust cover occurs on north- and east-facing slopes at mid elevations with stable, silt-loam or calcareous soils where not disturbed (Tyler 2006) or where vascular cover and litter are not limiting. Tyler (2006) found that shrub-steppe plots were generally correlated with biological soil crust variables while grass-steppe plots were generally with Bromus tectorum and Salsola kali. That pattern reflected the conversion of shrub-steppe habitats by past wildfire to grass-steppe habitats on Yakima Firing Range (Tyler 2006).
This ecological system is dominated by perennial bunchgrasses and forbs (>25% cover) with Artemisia tridentata (ssp. tridentata, xericensis, and wyomingensis), Artemisia tripartita, and/or Purshia tridentata shrubs in an open to moderately dense (5-30% cover) shrub layer. Shrubs can be represented only as seedlings. Associated graminoids can include Pseudoroegneria spicata, Poa secunda, Poa cusickii, Koeleria macrantha Hesperostipa comata, and Achnatherum thurberiana. More moist climatic areas support closed to nearly closed grasslands with Festuca idahoensis or F. washingtonica., higher forb diversity, Carex filifolia an important rhizomatous species, the shrubs Artemisia tripartita ssp. tripartita, Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis, and/or Purshia tridentata and have fewer southern Great Basin characteristic species than on lower precipitation or shallow, more skeletal soil sites. The latter areas typically have more Bromus tectorum in all seres than the more moist versions of this system that are generally more robust to vegetation disturbance. Rasmussun and others (2001) summarizes that depending upon site potential, when sagebrush cover reaches 5-7% herbaceous biomass production begins to decline and herbaceous density begins to decline when sagebrush cover is 12-15%.
The natural fire regime of this ecological system maintains a patchy distribution of shrubs, so the general aspect of the vegetation is that of grassland. Fire most obviously influences the density and distribution of shrubs. In general, fire increased abundance of herbaceous perennials and decreased woody plants. Fire return interval for productive shrub steppe is 12-15 years (fire regime I) and 50-100 years (fire regime II) in less productive areas or alternatively Bukowski and Baker (2013) concludes that Artemisia tridentata spp. wyomingensis steppe fire rotations are 171-342 years (fire regime V). Grassland or steppe fire intervals are 1-23 years. Where fire frequency has allowed for shift to a native grassland condition maintained without significant shrub invasion over a 50 to 70 year interval, the area would be considered Columbia Basin Steppe and Grassland system. Rocky sites have longer fire and support higher shrub cover and lower absolute bunchgrass cover intervals than those on finer textured soils. Pre-settlement large native ungulate grazing in the Columbia Basin differed from that in the Great Plains grasslands in duration , seasonality, and severity. In general, pre-settlement grazing was dispersed and occurred during the winter and spring when forage was available. Growing season is typically around six-weeks. Davies and others (2009) conclude that sites with heavy litter accumulation, (ungrazed Artemisia tridentata ssp. wyomingensis/ Festuca idahoensis – Achnatherium thurberiana community) are more susceptible to exotic annual invasion following fire than those with less litter accumulation. They note that introduced species and changes in climate can change ecosystem response to natural disturbance regimes.

Rank

S Rank: S2 **S Rank Date:** 23-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Wide distribution but large areas are in poor to fair condition. Good to excellent condition areas are frequent in Fescue types along the northern Columbia Basin counties but rare in bluebunch wheatgrass and needlegrass types because of weed invasion. I lean to S2 due to general invasibility of the shrubsteppe and because of the abundance and distribution of aggressive, invasive species. I lean to S2 due to general invasibility of the shrubsteppe and because of the abundance and distribution of aggressive, invasive species.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: Estimated to be around 44,000 sq km.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 10,600 sq km as occurring in Washington. The map seems overestimate in SE WA, Spokane, Steven and Ferry counties and I suspect they mis-map montane shrubsteppe as Inter-mountain shrubsteppe.

Scientific Name: ***Inter-Mountain Basins Big Sagebrush Steppe*** **Elcode:** CES304.778

Common Name: Inter-Mountain Basins Big Sagebrush Steppe **Subnational ID:** 19363

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: The Landscape Condition Model (Comer and Hak 2009) suggests18% of area mapped (Sayre et al. 2009) has >80% Landscape Condition Model index score, indicating that those areas are in excellent/good condition. WA DNR's shrub steppe inventory suggested that 25-35% of shrub-steppe on DNR lands are in good-excellent condition.

Number Protected EOs:

Comments:

Threats

Threats: AC = Very high - medium

Comments: Variable reaction to stressors depending on plant association and locale. Exotic plant invasions following site disturbance or fire are a threat. Conversion of this type to agriculture and development continue on private lands and in some cases on state and federal for renewable energy facilites.

Threat Category: 1 - Residential & commercial development Level of Threat: D = Low

Comments: Tri-cities, wenatchee mostly although isolated residential development continues in the vicinity of Spokane, Ellensburg.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: BD = High - low

Comments: Depends on plant association and operators. It can be done with impacts that maintain sites current condition, my experience that changes with the weather.

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: BD = High - low

Comments:

Threat Category: 3 - Energy production & mining Level of Threat: D = Low

Comments: Wind farms

Threat Category: 3.3 - Renewable energy Level of Threat: D = Low

Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: D = Low

Comments: Yakima Training Center, ATV, motorcyles, etc

Threat Category: 6.1 - Recreational activities Level of Threat: D = Low

Comments:

Threat Category: 7 - Natural system modifications Level of Threat: BD = High - low

Comments: all of the dry end post-fire is usually conversion

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BD = High - low

Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BD = High - low

Comments: highly susceptible to invasion particualry dry

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: BD = High - low

Comments:

Trends

Short-term Trend: E = Decline of 30-50%

Comments: Fire and expanding vineyard production and wind energy sites result in direct loss of shrub-steppe. Exotic grasses such as cheatgrass, ventenata, Poa bulbosa and invasive forbs have increased and become more prevalent in the last 50 years.

Long-term Trend: E = Decline of 30-50%

Comments: A comparision of Ecological Systems map (Sayre et al. 2009) with LANDFIRE's Biophysical Unit maps suggests 28% decrease over 200 years. This is much higher in the Columbia Basin. Vander Haegen and others. (2000) report less than 40% of orginal shrubsteppe remains in Washington.

Scientific Name: ***Inter-Mountain Basins Big Sagebrush Steppe*** **Elcode:** CES304.778

Common Name: Inter-Mountain Basins Big Sagebrush Steppe **Subnational ID:** 19363

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Bukowski, Beth E. and Baker, William L. 2013. Historical fire regimes, reconstructed from land-survey data, led to complexity and fluctuation in sagebrush landscapes. Ecological Applications 23:546–564

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

Davies, K.W., T.J. Svejcar and J.D. Bates. 2009. Interaction of historical and nonhistorical disturbances maintains native plant communities. Ecological Applications, 19(6), pp. 1536–1545

Faber-Langendoen, Don, Todd Keeler-Wolf, Del Meidinger, Dave Tart, Bruce Hoagland,Carmen Josse, Gonzalo Navarro, Serguei Ponomarenko, Jean-Pierre Saucier, Alan Weakley,and Patrick Comer. 2014. EcoVeg: a new approach to vegetation description and classification.Ecological Monographs 84:533–561.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rasmussen, G.A., M.P. O'Neil and L. Schmidt. 2001. Monitoring Rangelands: Interpreting What You See.Utah State University, Coop Extenstion. Report to EPA. Logan, UT. 51pp.

Tyler, K.J. 2006. Biological Crusts: Analysis of Monitoring Techniques at the Yakima Training Center, Washington. M.S. Thesis Central Washington University, Ellensberg, Wa. 117p.

Vander Haegen, W. M., F. C. Dobler, and D. J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in eastern Washington, USA. Conservation Biology 14:1145-1160.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Cliff and Canyon*** **Elcode:** CES304.779

Common Name: Inter-Mountain Basins Cliff and Canyon **Subnational ID:** 18312

Descriptors

Element Description:

Rank

S Rank: S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 38sqkm in Columbia Basin and 40 sqkm in adjacent foothills.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Adjacent landscapes have experience degradation but there are few direct impacts to this system.

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: Impacts from mining activities may be present in some locations. Impacts from upstream areas, such as irrigation seepage or adjacent habitats (e.g. invasives species) are possible.

Threat Category: 3 - Energy production & mining Level of Threat: D = Low
Comments: basalt coumn, talus mining

Threat Category: 3.2 - Mining & quarrying Level of Threat: D = Low
Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Scientific Name: ***Inter-Mountain Basins Cliff and Canyon*** **Elcode:** CES304.779

Common Name: Inter-Mountain Basins Cliff and Canyon **Subnational ID:** 18312

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Greasewood Flat*** **Elcode:** CES304.780

Common Name: Inter-Mountain Basins Greasewood Flat **Subnational ID:** 18264

Descriptors

Element Description: This system typically occurs near drainages on stream terraces and flats or may form rings around more sparsely vegetated playas. Seasonally high water tables and intermittent flooding is expected, however most sites remain dry at the soil surface through most growing seasons. Soils are typically saline and bare ground is a common feature. The water table remains high enough to maintain vegetation, despite salt accumulations. Wetland vegetation may concentrate near seeps/springs or in drainages where standing water is perennial. Saline soils and dominance by Sarcobatus vermiculatus distinguish this type from other ecological systems. The primary ecological process maintaining greasewood flat systems is an elevated groundwater table.Sarcobatus vermiculatus and Ericameria nauseosa are intolerant of periodic inundation and waterlogged soils and typically increase with water table drawdown (Cooper et al. 2006). Sarcobatus vermiculatus is an obligate phreatophyte and is able to tap into groundwater at great depth (>10 meters). Severe fires can kill Sarcobatus vermiculatus although it commonly sprouts after low- to moderate-severity fire (Anderson 2004). Fire regime for associated greasewood flat plant communities is generally less than 100 year return interval (Anderson 2004) although Landfire Model for Inter-Mountain Basins Greasewood Flat: BpS 0811530 (2007) applied fire regime V (200 + years) and assumed fire to be a minor driver within this system. Grazing and other disturbances can lead to biomass increases in the spring associated with an increase in Bromus tectorum and other fine fuel annuals which influence fire regime. Sarcobatus vermiculatus is noted to be important winter browse for domestic sheep, cattle, big game animals, as well, as jackrabbits (Anderson 2004). It provides quality forage throughout the growing season although it contains soluble sodium and potassium oxalates that may cause poisoning and death in domestic sheep and cattle (Anderson 2004). Livestock grazing is reported to decrease small mammal numbers in Sarcobatus vermiculatus / Distichlis stricta (=Distichlis spicata) vegetation in Nevada and adjacent California (Page and others 1978). Distichlis spicata is considered a grazing increaser. Grazing early when the upper part of the soil may be wet can sometimes cause compaction.

This system appears as an open to moderately dense shrubland dominated or codominated by Sarcobatus vermiculatus. It usually occurs as a mosaic of multiple plant associations. There may be interspersed patches of Distichlis spicata throughout the site. Other shrubs that may be present to co-dominant, listed in order of decreasing tolerance of a high water table or high salinity, are Krascheninnikovia lanata, Grayia spinosa, Ericameria nauseosa, and Artemisia tridentata ssp. tridentata. The herbaceous layer, when present, is usually dominated by graminoids, in order of decreasing tolerance of a high water table or high salinity, such as Distichlis spicata, Puccinellia spp., Eleocharis palustris, Leymus cinereus, and Pascopyrum smithii.

The primary land uses that alter the natural processes of this system are associated with alteration of hydrology, livestock practices, annual exotic species invasion, fire regime alteration, and fragmentation. Any activity resulting in hydrological alterations, sedimentation, nutrient inputs, and/or physical disturbance may negatively shift species composition and allow for non-native species establishment. Declining water tables create perennially dry soils, stop surface salt accumulation, and allow salts to leach deeper that create a drier, less saline soil resulting in a change in vegetation composition and pattern (Cooper et al. 2006). The tall perennial pepperwood (Lepidium latifolium), a nonnative invasive species decreases the abundance of shorter native grasses and forbs. The introduction of Bromus tectorum into these communities has altered fuel loads and fuel distribution. Fire drastically alters the community composition because salt-desert shrubs are not adapted to periodic fire.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system is geographically limited and is never very abundant where it occurs. There are has been greater degradation in ecological integrity than there has been outright loss of area. Threats from nonnative species and continual grazing and the fact that most extant occurrences are small and fragmented suggest the S1 rank.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Within Washington, this ecological system is limited to the Columbia Basin, espeically the northern and central portion of the basin. It is most common in Bent, Grant, Franklin, Klickitat, and Walla Walla counties. The extent was mapped as 9.5 km2. The system often co-occurs with playas and alkaline depressions. Greasewood flats are commonly found around depressional alkaline wetlands where they occurs as a narrow band, along riparian terraces, and occassiconaly in areas with groundwater discharge.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***Inter-Mountain Basins Greasewood Flat*** **Elcode:** CES304.780

Common Name: Inter-Mountain Basins Greasewood Flat **Subnational ID:** 18264

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 1,146 acres (~4.5 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to the Columbia Basin ecoregion within Washington. Next, NWI codes were used to identify wetland polygons that have a high probability of including this ecological system (e.g., palustrine scrub-shrub wetlands with intermittent or seasonal flooding).The results showed that 2,723 acres (~12 km2) of such wetlands occur within the Columbia Basin ecoregion within Washington. However, a subjective check of areas known to be greasewood showed than NWI often mapped these areas as palustrine emergent or that NWI missed them completely. Field observations suggest that the NatureServe estimate is most accurate but is likely still an overestimate. The "E=2-5 km2" estimate was chosen to represent the range of estimates highlighted above.

Population and EOs

Number of EOs: B = 6 - 20

Comments: There are three element occurrences in the Washington Natural Heritage Program database. There are additional small examples of this type (many just fragments) scattered around the basin but most are isolated and/or have been reduced in extent.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** B = Very small (<5%)

Comments: Some occurrences have been fragmented by roads and most have been degraded by livestock grazing. Nonnative species like Bromus tectorum can survive in many stands of this system and is widespread in many occurrences. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 35% of palustrine scrub-shrub wetlands with intermittent or seasonal flooding within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 35% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. Grazing and/or presence of nonnative invasive species has reduced quality of almost every site visited by the author. Based on all this information, the rating "B=<5%" was chosen for 'percent area occupied' with good ecological integrity.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Grazing and/or presence of nonnative invasive species has reduced quality of almost every site visited by the author. Roads fragment occurrences.

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	B = High
Comments:			
Threat Category:	2.1 - Annual & perennial non-timber crops	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			

Scientific Name: ***Inter-Mountain Basins Greasewood Flat*** **Elcode:** CES304.780

Common Name: Inter-Mountain Basins Greasewood Flat **Subnational ID:** 18264

Trends

Short-term Trend: E **=** Decline of 30-50%

Comments: Some direct loss has likely occurred due to agriculture and limited development (e.g. near Soap Lake). Roads have fragmented some occurrences. Grazing is widespread in many areas, both historically and on the contemporary landscape. Nonnative species like Bromus tectorum can survive in many stands of this system and is widespread in many occurrences. Nonnatives such as cheatgrass are able to get a foothold in these communities when surface salt and/or microbiotic crusts are trampled allowing nonnative annual species to germinate and persist. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar.

Long-term Trend: E = Decline of 30-50%

Comments: Some direct loss has likely occurred due to agriculture and limited development (e.g. near Soap Lake). Roads have fragmented some occurrences. Grazing is widespread in many areas, both historically and on the contemporary landscape. Nonnative species like Bromus tectorum can survive in many stands of this system and is widespread in many occurrences. Nonnatives such as cheatgrass are able to get a foothold in these communities when surface salt and/or microbiotic crusts are trampled allowing nonnative annual species to germinate and persist. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Anderson, Michelle D. 2004. Sarcobatus vermiculatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).

Cooper, D, Sanderson J, Stannard D, Groeneveld D. 2006. Effects of long-term water table drawdown on evapotranspiration and vegetation in an arid region phreatophyte community. Journal of Hydrology 325: 21-34.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 02-Mar-2015

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Montane Sagebrush Steppe*** **Elcode:** CES304.785

Common Name: Inter-Mountain Basins Montane Sagebrush Steppe **Subnational ID:** 18314

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments: This system occurs over a wide range but is spotty within it.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 207 sqkm occuring in Washington. Although some areas may be overmapped (i.e. near Spokane) overall seems like a reasonable estimate.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** DE = Moderate to good (11-40%)

Comments: NatureServe's Landscape Condition Model (Comer and Hak 2009) overlain on the Ecological Systems map suggests that 20% of area had >80% LCM index score (i.e. = good condition). In Washington, I've obsered small patches in good condition while larger patches in the Loomis State Forest area are of less quality due to heavier grazing occurring there.

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: grazing can be an issue

Threat Category: 2 - Agriculture & aquaculture Level of Threat: CD = Medium - low

Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: CD = Medium - low

Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: Negligible

Comments: Poa pratensis

Trends

Short-term Trend: F = Decline of 10-30%

Comments:

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: 3% increase over 200 years estimated from Ecological Systems map compared to LANDFIRE Biophysical Settings map

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Scientific Name: ***Inter-Mountain Basins Montane Sagebrush Steppe*** **Elcode:** CES304.785

Common Name: Inter-Mountain Basins Montane Sagebrush Steppe **Subnational ID:** 18314

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland*** **Elcode:** CES304.772

Common Name: **Subnational ID:** 20490

Descriptors

Element Description:

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Naturally rare in Washington and observations indicate change in vegetation due to invasive species .

Range

Range Extent: C = 250-1000 square km (about 100-400 square miles)

Comments: species distribution in Wa is between 500-1000sqkm

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: My estimate from jet boat ride from OR to Heller Bar on Snake; only saw it within 2-3 mi of OR, maybe on Grand Ronde. Maybe be "Along FS Road 46 5.6 miles north of Godman Springs, Blue Mountains, Columbia County, WA" as indicated Burke Museum herbarium site.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** C = Small (5-10%)

Comments: From what I've seen on Snake and lower Grande Ronde Rivers, invasive annuals are dominants in understory. Johnsen and Simon (1987) state that livestock tend not to use these site due to rugged/ steep conditions.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: Negligible

Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: Negligible

Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: D = Low

Comments: couple of site I saw were used by boaters

Threat Category: 7 - Natural system modifications Level of Threat: C = Medium

Comments: Johnson indictes fire kills non-sprouter cercocarpos & seedling rare

Threat Category: 7.1 - Fire & fire suppression Level of Threat: C = Medium

Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BC = High - medium

Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: BC = High - medium

Comments: low elevation along river cheatgrass and other invasives. High elevation types??

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***Inter-Mountain Basins Mountain Mahogany Woodland and Shrubland*** **Elcode:** CES304.772

Common Name: **Subnational ID:** 20490

Environmental Specificity: B = Narrow. Specialist or community with key requirements common.

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Playa*** **Elcode:** CES304.786

Common Name: Inter-Mountain Basins Playa **Subnational ID:** 18266

Descriptors

Element Description: The Inter-Mountain Basins Playa occurs throughout much of the cool arid and semi-arid regions of the Columbia Plateau and Great Basin either as a large or small patch type.

The system is found in closed depressions or in terminal basins. Playas are intermittently flooded or supported by shallow groundwater discharge and typically have sparse to patchily vegetated, generally <10% plant cover and highly saline soils which, without direct soil disturbance have a soil crust on the surface.

 Precipitation and runoff characteristics in contributing basins are important to system function. During high precipitation years Inter-Mountain Basins Playa systems may have water for 3 to 4 months and during dry years not retain any standing water. Water usually does not percolate because of an impermeable layer. Water loss is primarily through evaporation that results in a high concentration of salts in the upper soil profile. Some playas are influenced by groundwater and have minor surface flooding (Rocchio 2006). Those playas have open water early in the season and as the water evaporates salt crust is left on the soil surface from the salts dissolved in the water. This environment supports a flora adapted to seasonal soil saturation and saline conditions. Species composition varies with soil salinity and moisture and usually displays vegetation zones (Rocchio 2006). The Inter-Mountain Basins Playa system almost always has an unvegetated or sparsely vegetated center at its lowest elevation. Mud flats may appear with the salt flats. A few plants such as Salicornia spp. can appear on salt flats but they mostly lack vegetation. Schoenoplectus acutus, typically without Typha latifolia due to its lower salt tolerance, can establish where flooding occurs 3 or more months. Eleocharis palustris can occur in areas inundated for 1 to 3 months. Amphiscirpus nevadensis and Juncus balticus can grow in areas of high water tables and saline soils. Saline wet meadow plants such as Distichlis spicata and Juncus balticus are found in seasonally saturated soils (Rocchio 2006).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of playas on the Columbia Basin. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roads or removing vegetation on adjacent slopes) results in changes in the amount and pattern of herbaceous wetland habitat. In general, excessive livestock use leads to a shift in plant species composition. Native species, such as Juncus balticus, increase with excessive livestock use. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Several exotic species invade playas including Cardaria spp., Chenopodium glaucum, C. rubra, (Salsola spp.), Bassia hyssopifolia, and Kochia scoparia. Although most wetlands receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively. In addition, recent Supreme Court decisions exclude many, if not most occurrences of this system, from protection under the Clean Water Act (Haukos and Smith 2003). Minor changes in the water table depth or duration of inundation can have profound effects on soil salinity, and consequently, wetland vegetation (Cooper and Severn 1992). Wetland animals, such as waterbirds, amphibians, or invertebrates are affected changes in hydrology.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system is found throughout the Columbia Basin. There is a high denseity of occurrences in northern Douglas County, where past glaciation left many lanforms suitable for the development of this sytem. Alterations in hydrology associated with dams, irrigation, and road have resulted in some direct conversion of this wetland system to other types (such as North American Arid Freshwater Emergent Marsh). Grazing is widespread in many occurrences and continues to impact ecological integrity of sites.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Within Washington, this ecological system is limited to the Columbia Basin. Although the same could be found throughout the Basin it is most common in northern Douglas County, Swanson Lakes area of Lincoln County and the Lower Crab Creek area. This systems was lumped with Inter-Mountain Basin Alkaline Closed Depression in Rocchio and Crawford (2008). However, it is being assessed here as an individual ecological system. Playas and alkaline depressions often co-occur, with playa vegetation in the central, lowest, most saline zone. However, the two can occur independently of each other, with alkaline depressions occurring more commonly by itself. Playas are primarily found in depressions, sometimes along riparian terraces, and occassiconaly in areas with groundwater discharge. There is a high denseity of occurrences in northern Douglas County, where past glaciation left many lanforms suitable for the development of this system.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***Inter-Mountain Basins Playa*** **Elcode:** CES304.786

Common Name: Inter-Mountain Basins Playa **Subnational ID:** 18266

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 2,953 acres (~9 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to the Columbia Basin ecoregion within Washington. Next, NWI codes were used to identify wetland polygons that have a high probability of including this ecological system (e.g., palustrine emergent wetlands with intermittent or seasonal flooding). The results showed that 68,144 acres (~275 km2) of such palustrine emergent wetlands occur within the Columbia Basin ecoregion within Washington. However, this value includes other wetlands such as Inter-Mountain Basin Alkaline Closed Depression, North American Arid Freshwater Emergent Marsh, or Columbia Plateau Vernal Pool). Regardless, the assumption is that this system would be a small percentage of the esimated 275 km2 by NWI and is probably less than the 9km2 mapped by NatureServe. The "F=5-20km2" estimate was chosen to represent this conclusion.

Population and EOs

Number of EOs: B = 6 - 20

Comments: There are less than 13 element occurrences in WNHP's database but based on personal observations this sytem is much less abundant than alkaline closed depressions. The "B=6-20" was determined to be the best estimate of occurrences based on this information.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: WANHP has 13 element occurrences that are either this systems or Inter-Mountain Basins Alkaline Closed Depression and thus the "C=4-12" rating was chosen for the 'number of occurrences' with good ecological integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 38% of palustrine emergent wetlands with intermittent or seasonal flooding within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 38% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. Rocchio and Crawford (2009) in a study of wetland ecological integrity of northern Douglas County sampled 13 sites of this system. They found that all 13 had an overall ecological integrity rating of "good" but 50% of those sites had fair integrity of onsite biotic condition. Harris (1954) noted that irrigation and dams associated with the Columbia Basin Irrigation project had the potential to change the hydrology of many wetlands, including this ecological system. Introducting irrigation water onto alkaline depressions could change overall hydorlogical patterns and subsequently change water chemistry. Wasterwater from irrigation has also created wetlands (including those that resemble this sytem) in areas where they would otherwise not be found. Field observations confirm that both wetland conversion and creation has resulted from irrigation wastewater. Grazing has reduced quality of many sites and groundwater withdrawal and other hydrological impacts are also responsible for degradation of many occurrences. Groundwater discharge from irrigation practices have likley changed hydrological regimes of many of these wetlands, especially in the potholes region. Based on all this information, the rating "E= 11-20%" was chosen for 'percent area occupied' with good ecological integrity.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Water management from dams and irrigation have likely altered the hydrological regime and water chemistry of many occurrences, especially within the geographic range of the Columbia Basin Irrigation Project. Grazing impacts many other occurrences. Trampling by livestock destroys the surface salt crusts and can result in increased cover of native increaser species like Juncus balticus and Distichlis spicata and/or decrease germination and survival of native halophytes (based on personal observations of decreased cover of halophytes in heavily grazed sites). It is not known how trampling may alter substrate conditions for invertebrates, especially those preferred by shorebirds such as avocets.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: B = High
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: B = High
Comments: little vegetation grows in playas, but grazing can homogenize species composition even more; cow pies might affect chemistry.

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Scientific Name: ***Inter-Mountain Basins Playa*** **Elcode:** CES304.786

Common Name: Inter-Mountain Basins Playa **Subnational ID:** 18266

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments: can impound water in basins longer than naturally would occur

Threat Category: 7 - Natural system modifications Level of Threat: C = Medium
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: C = Medium
Comments: some have been excavated to provie watering holes for cattle;

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: white top; kochia

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: C = Medium
Comments:

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: Direct loss of this sytem has mostly been due to past water management activiites. Sites where this system occur generally are in areas not suitable for desireable for development and/or agriculture. However, livestock grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar.

Long-term Trend: F = Decline of 10-30%

Comments: Some direct loss has likely occurred due to water management from dams and irrigation have altered the hydrological regime and water chemistry of some occurrences, especially within the geographic range of the Columbia Basin Irrigation Project. Grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Harris, S.W. 1954. Ecological study of the waterfowl of the potholes area, Grant County, Washington. Am. Midland Nat. 52(2):403-432.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J. 2006. Intermountain Basins Playa Ecological System Ecological Integrity Assessment. Colorado Natural Heritage Program Colorado State University Fort Collins, CO.

Rocchio, F.J. and R.C. Crawford. 2009. Assessment of Ecological Characteristics and Ecological Integrity of Wetlands in Northern Douglas County, Washington. Report Prepared for The Nature Conservancy of Washington. Washington Department of Natural Resources, Natural Heritage Program. Natural Heritage Report 2009-11. Olympia, WA

Scientific Name: ***Inter-Mountain Basins Playa*** **Elcode:** CES304.786

Common Name: Inter-Mountain Basins Playa **Subnational ID:** 18266

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 02-Mar-2015

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Semi-Desert Shrub-Steppe*** **Elcode:** CES304.788

Common Name: Inter-Mountain Basins Semi-Desert Shrub-Steppe **Subnational ID:** 18268

Descriptors

Element Description: Soils are deep to shallow, well-drained, non-saline, often calcareous and typically with a biological soil crust. They apparently are associated with the Ringold Formation on slopes. The woody layer is often a mixture of shrubs and dwarf-shrubs, although it may be dominated by a single shrub species. Characteristic species include Grayia spinosa or Krascheninnikovia lanata with Ericameria nauseosa. Artemisia tridentata may be present but typically does not dominate although it will increase with disturbance. On stonier sites, Salvia dorrii can be present to common. In Washington, the Artemisia tridentata / Poa secunda association can occur in this system when in association with semi-desert vegetation. This semi-arid shrub-steppe is typically an open shrub to moderately dense woody layer and a strong graminoid layer (>25% cover but rarely closed). Characteristic grasses include Achnatherum hymenoides, A. thurberiana, Elymus elymoides, Poa secunda, Sporobolus airoides, and Hesperostipa comata. The most widespread species are Poa secunda and Pseudoroegneria spicata (not dominant). Annual grasses, especially the exotics Bromus tectorum, may be present to abundant. Forbs are generally of low importance and are highly variable across the range but may be diverse in some occurrences for example; Helianthus cusickii and Sphaeralcea munroana can be abundant. The general aspect of occurrences may be either open shrubland with patchy grasses or patchy open herbaceous layers.

Disturbance may be important in maintaining the woody component. Greater biological soil crust cover occurs on north- and east-facing slopes at mid elevations with stable, silt-loam or calcareous soils where not disturbed (Tyler 2006) or where vascular cover and litter are not limiting. The natural fire regime of this ecological system is assumed to be similar to the Big Sagebrush Steppe Ecological Systems although both Grayia spinosa and Krascheninnikovia lanata are capable of sprouting following fire. Fire maintains a patchy distribution of shrubs, so the general aspect of the vegetation is that of grassland. Where fire frequency has allowed for shifts to a native grassland condition, maintained without significant shrub invasion over a 50- to 70-year interval, the area would be considered Inter-Mountain Basins Semi-Desert Grassland. Fire most obviously influences the density and distribution of shrubs. In general, fire increases the abundance of herbaceous perennials and decreases woody plants.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Uncommon to limited range. High invasion potential from cheatgrass following site disturbance. Following fire or site disturbance, annuals replace perennials. Largest known occurrence on Hanford Monument burned and is now weed dominated (Evans and Lih 2005). Much of likely historical range is in irrigation agriculture. This was mapped very differently by NatureServe and by Landfire and neither matched known locations . What NatureServe mapped as Salt Desert better fit Semi-Desert and that includes dry ARTR, GRSP, KRLA on Ringold and glacial lake flood deposits and old sand deposits which could be part of dune system.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Potential extent estimated by NRCS to be in areas receiving less than 8 inch precipitation.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: I think NatureServe's Ecological Systems map (Sayre et al. 2009) mis-mapped this as Intermountain Basin Salt Desert Scrub (82sqkm) within Washington. The author believes that Intermountain Basin Salt Desert Scrub does not occur in Washington. The NatureServe map shows Salt Desert Scru as occurring on a mix of Ringold Formation or glacial flood lake deposits and sand sheets. This is likely an overestimate of the extent of semi-desert shrub-steppe. The definition of semi-desert shrub-steppe used here is described in the WANHP EIA:http://www1.dnr.wa.gov/nhp/refdesk/communities/pdf/eia/imb_semi_steppe.pdf Most observations occur (occurred) on Yakama Nation, Hanford area. Other locations with EULA/POSE and HECO, GRSP/POSE and ARTR-GRSP/AGSP in Qunicy Basin and perhaps Grand Coulee may be part of this system. Hanford Monument maps less than 600 ac (24 sqkm) of these types (Evans and Lih 2005). Four times that amount seems like a reasonable but extreme estimate.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Scientific Name: ***Inter-Mountain Basins Semi-Desert Shrub-Steppe*** **Elcode:** CES304.788

Common Name: Inter-Mountain Basins Semi-Desert Shrub-Steppe **Subnational ID:** 18268

Number of Viable EOs: **% of Range with Good Viability:** AD = None to moderate (0 or <21%)

Comments: Everything I've seen is not very good ecological condition.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: High invasion potential from cheatgrass following site disturbance. Following fire, annual species replace perennials.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: BC = High - medium
Comments: reduces veg cover disrupts crust weeds increase

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: BC = High - medium
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: B = High
Comments: if enough fuel to burn increases wees

Threat Category: 7.1 - Fire & fire suppression Level of Threat: B = High
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments:

Trends

Short-term Trend: D = Decline of 50-70%

Comments:

Long-term Trend: D = Decline of 50-70%

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Evans, J.R. and M.P. Lih. 2005. Recovery and Rehabilitation of Vegetationon the Fitzner-Eberhart Arid Lands Ecology Reserve, Handford Reach National Monument, Following the 24 Command Fire. Final Report 2001-2004, prepared by The naure COnswerancy of Washington for the USFWS. File Copy. 253pp.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Tart, D. 1986-1990. Rangeland ecological sites of the Yakama Indian Reserevation. Unpublished draft descriptions. file copies.

Scientific Name: ***Inter-Mountain Basins Semi-Desert Shrub-Steppe*** **Elcode:** CES304.788

Common Name: Inter-Mountain Basins Semi-Desert Shrub-Steppe **Subnational ID:** 18268

Version

Version Author: Rex Crawford **Version Date:** 14-Nov-2014

Internal Notes:

Scientific Name: ***Inter-Mountain Basins Wash*** **Elcode:** CES304.781

Common Name: Inter-Mountain Basins Wash **Subnational ID:** 18313

Descriptors

Element Description: This system includes sparsely vegetated streambanks in which the component vegetation is distinct from vegetation in surrounding uplands. The system is restricted to intermittently flooded streambeds and banks. Soils are variable but are generally less alkaline than those found in the Inter- Mountain Basins Alkaline Closed Depression, Playa, or Greasewood Flat systems. Cover of vegetation is sparse (generally <10% plant cover) and streambanks are often lined with shrubs such as Sarcobatus vermiculatus, Ericameria nauseosa, Artemisia tridentata ssp. tridentata, and Philadelphus lewisii that form relatively dense stringers in open dry uplands. Shrubs form a continuous or intermittent linear canopy in and along drainages but do not extend out into flats. Typically, patches of saltgrass meadow occur where water remains for the longest periods.

Invasive, exotic shrubs such as Tamarix spp. and other exotics such as halogeton, Russian thistle (Salsola kali), tall tumblemustard (Sisymbrium altissimum), and cheatgrass may be present to dominant in these washes where disturbed. These non-native species can replace native grasses and change the structure of the native habitat.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Very little is known about this system. However, field observations suggest that the system is localized, relatively uncommon, likely has not experienced widespread loss, but some occurrences may have experienced degradation from nonnative species.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: This system occurs in intermittent channels with sparse vegetation. The extent of the system is within the Columbia Basin was measured as approximately 35,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) did not explicitly map this system and National Wetland Inventory (NWI) maps were difficult to filter in order to provide a meaningful estimate. Thus, this estimate is based on field observations of the author.

Population and EOs

Number of EOs: B = 6 - 20

Comments: There are no element occurrences in the Washignton Natural Heritage Program database. Inventory efforts have not focused on this ecological system. The estimate is based on the few observations made by the author.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: There are no data to make confidence estimates. However, these are sparsely vegetated sites that are experience periodic flooding disturbances. Roads may cross some washes but their imapacts are likely localized. Nonnative species may be the most significant threat but it is not known to what degree current examples have been impacted.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Roads may cross some washes but their imapacts are likely localized. Nonnative species may be the most significant threat but it is not known to what degree current examples have been impacted.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments:

Scientific Name: ***Inter-Mountain Basins Wash*** **Elcode:** CES304.781

Common Name: Inter-Mountain Basins Wash **Subnational ID:** 18313

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium

Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: C = Medium

Comments:

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: There are no data to make reliable estimates. However, it is very likely this system has experience much direct loss. Most change is likely due to changes in ecological integrity (primarily due to nonnative species).

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: There are no data to make reliable estimates. However, it is very likely this system has experience much direct loss. Most change is likely due to changes in ecological integrity (primarily due to nonnative species).

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***Modoc Basalt Flow Vernal Pool*** **Elcode:** CES204.996

Common Name: Modoc Basalt Flow Vernal Pool **Subnational ID:** 18306

Descriptors

Element Description: The Modoc Basalt Flow Vernal Pool system occurs as shallow ephemeral wetlands in very small (3 square meters or 32 sq. ft.) to rarely large depressions (260 ha or 1 square mile). Bjork and Dunwiddie (2004) measured 242 vernal pools in Washington to be between 3 sq m. and 4610 sq. m. (1.1 ac) with a 1590 sq. m (0.4 acre) average. Vernal pools mostly are located on massive basalt flows exposed by Pleistocene floods but also occur on andesite or rhyodacite caprock. Often perched above the surrounding landscape, vernal pools are generally not subject to runoff from major stream systems. Climatically, the system is defined by wet winters (November through January) and severe summer drought (July-September), although May or June can be wet. Pool inundation primarily results from direct precipitation and varies yearly and seasonally, and with the size of the small upland watershed associated with a vernal pool or in some cases, surface runoff from adjacent pools or wetlands (Environmental Science Associates 2007). Inundation is highly irregular, sometimes not occurring for several years. Depressions usually (but not always) fill with water during winter and spring and generally dry well within 9 months. In exceptional times they can remain inundated for two consecutive years. Soil texture is typically silty clay, sometimes with sandy margins. The periodic inundation and drying leads to development of concentric zones of different plants as the pools dries (Crowe and other 1994). Characteristic plants species of this system are predominantly annual and diverse. When full, the pool's water column and saturated substrates support assemblages of macroinvertebrates as well as habitat for mobile invertebrates adapted to ephemeral wetlands (Environmental Science Associates 2007). Fairy shrimps (Anostraca) are found in vernal pools along with birds and amphibians (Environmental Science Associates 2007). Pools provide water storage and support nitrogen transformation (Environmental Science Associates 2007).

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This is a very geographically limited system in Washington. However, most pools have likely been impacted by past and/or current livestock grazing. Logging impacts pools in the lower forest zone. Roads may impact some pools.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: This system is limited to very small depressions and swales in Klickitat County. The vernal pools can be found on the exposed basalt outcrops along the Columbia Gorge (especially abundant within and near Horsethief State Park) or at slightly higher elevations within the ponderosa pine zone. Extent was measure to be approximately 5,500 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) did not explicitly map this system. Estimates were made using NWI maps by clipping NWI wetlands to Klickitat county. Most of the county's geology is comprised of basalt flows so geology was not a useful filter. Instead, NWI hydrological modifers indicating temporary, seasonal, or intermittent flooding were used to filter palustrine emergent and palustrine unconsolidated bottom wetlands as an esimate for this system. The result was 2,750 acres (~11 km2) of wetlands with moderate probability of being vernal pools. Field observations by the author suggest pool densities are low and localized. Thus, the NWI estimate is believed to still represent an significant overestimate occuped area. The "B=0.1-0.5 km2" estimate most closely matches field observations chosen.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are a few plant association and rare plant element occurrences associated with this system. Additional occurrences are expected on the landscape (based on aerial photo interpretation), especially in the lower forest zone (e.g., near Klickitat Canyon Natural Resources Conservation Area).

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** E = Good (21-40%)

Scientific Name: ***Modoc Basalt Flow Vernal Pool*** **Elcode:** CES204.996

Common Name: Modoc Basalt Flow Vernal Pool **Subnational ID:** 18306

Comments: A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that 28% of potential vernal pools had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 28% may be a slight overestimate. Grazing has reduced quality of many sites and nonnative species affect the periphery of many vernal pools. Based on all this information, the rating "E=11-20%" was chosen for 'percent area occupied' with good ecological integrity.Most pools are in a landscape which has or is currently grazed.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Livestock grazing and nonnative species such as Ventenata dubia impact many sites . Loggging around pools within forested zones can change local sediment and hydrology patterns as well as change shading.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: B = High
Comments:

Threat Category: 2.1 - Annual & perennial non-timber crops Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: B = High
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments: Vetenata dubia can be common around pool edges.

Trends

Short-term Trend: F = Decline of 10-30%

Comments: Bjork and Dunwidde (2004) note that eastern Washington vernal pools are less threatened than California vernal pools. They note that development and agriculture are not important threats due to eastern Washington pools occuring on thin soils and/or rocky outcrops. Very little direct loss of these pools has likely occurred . Threats from nonnative species are less pronounced in eastern Washington vernal compared to California pools (Bjork and Dunwiddie 2004). That said, grazing occurs across most of the range of this system and impacts, albeit generally not serious, have been observed at most pools visited. In these areas, invasive species are typical around pool edges, species diversity of vernal pool annuals appears to be less than in grazed sites, and the covern of perennial species can sometimes increase due to grazing.. Some roads also impound and/or restrict water flow in vernal pools. The rating reflects changes in ecological integrity.

Long-term Trend: F = Decline of 10-30%

Comments: Bjork and Dunwidde (2004) note that eastern Washington vernal pools are less threatened than California vernal pools. They note that development and agriculture are not important threats due to eastern Washington pools occuring on thin soils and/or rocky outcrops. Very little direct loss of these pools has likely occurred . Threats from nonnative species are less pronounced in eastern Washington vernal compared to California pools (Bjork and Dunwiddie 2004). That said, grazing occurs across most of the range of this system and impacts, albeit generally not serious, have been observed at most pools visited. In these areas, invasive species are typical around pool edges, species diversity of vernal pool annuals appears to be less than in grazed sites, and the covern of perennial species can sometimes increase due to grazing.. Some roads also impound and/or restrict water flow in vernal pools. The rating reflects changes in ecological integrity.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Scientific Name: ***Modoc Basalt Flow Vernal Pool*** **Elcode:** CES204.996

Common Name: Modoc Basalt Flow Vernal Pool **Subnational ID:** 18306

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Bjork, C. R. 1997. Vernal pools of the Columbia Plateau of eastern Washington. Report to the Washington Field Office of The Nature Conservancy. 29 pp. plus 7 appendices.

Bjork. C.R. And P. W. Dunwiddie. 2004. Floristics and Distribution of Vernal Pools on the Columbia Plateau of eastern Washington. RHODORA 106 (928): 327–347

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 03-Mar-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North American Alpine Ice Field*** **Elcode:** CES300.728

Common Name: North American Alpine Ice Field **Subnational ID:** 18262

Descriptors

Element Description:

Rank

S Rank: S3? **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments: Washington is the second most glaciated state in the US, with 449 km2 of glaciers and perennial snow and ice features. Aerial photography ranging from 1943 to 1987 was investigated to determine range extent (Fountain et al. 2007).

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayer et al. 2009) estimated 315 sqkm of this type in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** DF = Moderate to excellent (>10%)

Comments: Metrics to rank ecological condition have not been developed. Other than impacts from climate change, little impact is expected. Little impact other than warming. Ice worm populations in North Cascades seem stable (http://www.nichols.edu/departments/glacier/iceworm.htm).

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: Glaciers are primarily sensitive to winter snowfall and summer temperature. Winter snowpack on April 1 has declined markedly over the long term whether you begin the comparison in 1934, 1944, 1950 or 1966. The change ranges from a decline of 23 to 48% at the five North Cascade snow measurement sites of the USDA that have existed for the entire period (Fish Lake, Lyman Lake, Miners Ridge, Rainy Pass and Stevens Pass). These long term declines have occurred despite an increase in winter precipitation. Since 1980 snowpack has not declined.

Threat Category: 11 - Climate change & severe weather Level of Threat: B = High

Comments: Glaciers are primarily sensitive to winter snowfall and summer temperature. Winter snowpack on April 1 has declined markedly over the long terms whether you begin the comparison in 1934, 1944, 1950 or 1966. The change ranges from a decline of 23 to 48% at the five North Cascade snow measurement sites of the USDA that have existed for the entire period. (Fish Lake, Lyman Lake, Miners Ridge, Rainy Pass and Stevens Pass) Since 1980 snowpack has not declined. The long term declines occurred despite an increase in winter precipitation.

Trends

Short-term Trend: D = Decline of 50-70%

Comments: North Cascade glacier retreat is rapid and ubiquitous. All 47 monitored glaciers are currently undergoing a significant retreat and four of them have disappeared (Pelto 2008).

Long-term Trend: F = Decline of 10-30%

Comments: In the North Cascades National Park, glacier area decreased by 7% from 1958 to 1998 (Granshaw and Fountain, 2006; Granshaw, 2002). Smaller glaciers lost significantly more area than larger glaciers. The well-studied South Cascade Glacier shrank by 22% during this time period (USGS), while the Blue Glacier in Olympic National Park saw a terminus retreat of 2% between 1957 and 1997 (Conway et al., 1999). The glaciers on Mount Rainier decreased in area by 21% between 1913 and 1994 (Nylen, 2004).

Scientific Name: ***North American Alpine Ice Field*** **Elcode:** CES300.728

Common Name: North American Alpine Ice Field **Subnational ID:** 18262

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Granshaw, F.D. 2002. Glacier change in the North Cascades National Park complex, Washington State, USA, 1958–1998. M.S Thesis, Portland State University.

Granshaw, F.D. and A.G. Fountain. 2006. Glacier change (1958-1998) in the North Cascades National Park Complex, Washington, USA. Journal of Glaciology, Vol. 52, No. 177.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Nylen, T. H., 2004, Spatial and temporal variations of glaciers (1913-1994) on Mt. Rainier and the relation with climate. M.S. Geology, Portland State University.

Pelto, M.S. 2008. Glacier annual balance measurement, forecasting and climate correlations, North Cascades, Washington 1982-2006. The Cryosphere 2, 12-21.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***North American Arid West Emergent Marsh*** **Elcode:** CES300.729

Common Name: North American Arid West Emergent Marsh **Subnational ID:** 18315

Descriptors

Element Description: The system is typically surrounded by savanna, shrub steppe, steppe, or semi-desert vegetation. Natural marshes may occur in depressions in the landscape (ponds, kettle ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes are also referred to as sloughs). Marshes are frequently or continually inundated, with water depths up to 2 m. Water levels may be stable, or may fluctuate 1 m or more over the course of the growing season. Water chemistry may be alkaline or semi-alkaline, but the alkalinity is highly variable even within the same complex of wetlands. Marsh development along riparian areas is driven by the magnitude and frequency of flooding, valley and substrate type, and beaver activity. Seasonal and episodic flooding scour depressions in the floodplain, create side channels and floodplain sloughs, and force channel migration which can result in oxbows. Marsh vegetation establish in these landforms if there is semi-permanent to permanent water contained within them. Marshes also occur near the fringes of lakes and ponds where their development is dictated by the shoreline gradient and fluctuation of lake or pond levels. Relatively flat or gently sloping shorelines support a much larger marsh system than a steep sloping shoreline. Water is at or above the surface for most of the growing season but in some areas can water levels fluctuate with dramatic drawdowns exposing bare soil by later summer. The frequency and magnitude of water level fluctuations determine the extent of each marsh zone (floating, submerged, emergent, etc.). Water level fluctuations also support the development of different marsh zones (floating, submergent, emergent, etc.) which vary according to the degree of inundation. Soils have characteristics that result from long periods of anaerobic conditions in the soils (e.g., gleyed soils, high organic content, redoximorphic features) and can be mineral or organic. Hydrophytic vegetation dominates these wetlands. Common emergent and floating vegetation includes species of Scirpus and/or Schoenoplectus, Typha, Juncus, Potamogeton, Polygonum, Nuphar, and Phalaris. This ecological system may also include areas of relatively deep water with floating-leaved plants (Lemna, Potamogeton, and Brasenia) and submergent and floating plants (Myriophyllum, Ceratophyllum, and Elodea.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of marshes in eastern Washington. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader. Human land uses both within the marshes as well as in adjacent upland areas have reduced connectivity between wetland patches and upland areas. Land uses in contributing the watershed have the potential to contribute excess nutrients into to the system which could lead to the establishment of non-native species and/or dominance of native increasing species. In general, excessive livestock or native ungulate use leads to a shift in plant species composition. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Although most wetlands receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively. A keystone species, the beaver, has been trapped to near extirpation in parts of the Pacific Northwest and its population has been regulated in others. Herbaceous wetlands (including freshwater emergent marsh) have decreased along with the diminished influence of beavers on the landscape. However, in the Columbia Basin of eastern Washington, the abundance of marshes has increased in many areas due to the amount of irrigation water being used across the landscape. This ‘wastewater’ emerges in various locations to form herbaceous marshes and wet meadows.

Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in species composition and wetland extent. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader in roadside ditches. Severe livestock grazing and trampling can decrease the abundance of native sedge and grass species, increase the abundance of nonnative and native, weedy species. As mentioned above, irrigation wastewater has also played a role in altering the natural range of variation of many marshes in the basin. This wastewater has created new wetlands in some areas and increased flow volume in others, which could lead to corresponding changes in species composition.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system remains widespread on the landscape; however, almost all occurrences have been impacted and many are completely dominated by Phalaris arundinaceae. Grazing, hydrological alterations, and invasion by nonnative and invasive species are primary reasons for widespread degradation of this sytem.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Scientific Name: ***North American Arid West Emergent Marsh*** **Elcode:** CES300.729

Common Name: North American Arid West Emergent Marsh **Subnational ID:** 18315

Comments: This system is found throughout the Columbia Basin at and below lower treeline in depressions, along streamsides, and in areas of seasonal groundwater discharge.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 9,946 acres (~40 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to the Columbia Basin ecoregion within Washington. All palustrine emergent polygons have the potential to be this system. There is 99,348 acres (~402 km2) of such wetlands within the Columbia Basin ecoregion within Washington. However, this estimate also includes occurrences of Inte-Mountain Basins Playa, Inter-Mountain BAsins Alkaline Closed Depression, and Columbia Basin Vernal Pool. North American Arid Freshwater Marsh would be expected to comprise a majority of the estimate (surely at least a 1/4 of the total) as it is the most common of those four wetland types in the study area. Based on this information the "H100-500km2" estimate was chosen.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 5 element occurrences in the Washington Natural Heritage Program database. However, numerous other occurrences have been observed. The "D=81-300" was chosen to represent the abundance of this type that has been observed in the field.

Population Size: =

Comments:

Number of Viable EOs: B = Very few (1-3) **% of Range with Good Viability:** B = Very small (<5%)

Comments: No element occurrences in the WA NHP database have excellent/good integrity but a few have a rank of "E" (e.g., not enough information is available to rank the occurrences). The "B=very few (1-3)" was chosen to reflect the possibility of a few occurrences having good integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 43% of palustrine emergent wetlands within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 43% is assumed to be an significant overestimate of the area of this Ecological System with good/excellent integrity. Grazing, hydrological impacts, and/or presence of nonnative invasive species has reduced quality of almost every site visited by the author. Based on all this information, the rating "B=<5%" was chosen for 'percent area occupied' with good ecological integrity.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: A large variety of stressors impact this system ranging from development, grazing, agriculture, roads, invasive species, livestock grazing, and water quality issues.

Threat Category:	1 - Residential & commercial development	Level of Threat:	C = Medium
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	D = Low
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.1 - Annual & perennial non-timber crops	Level of Threat:	D = Low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			

Scientific Name: ***North American Arid West Emergent Marsh*** **Elcode:** CES300.729

Common Name: North American Arid West Emergent Marsh **Subnational ID:** 18315

Threat Category: 7 - Natural system modifications Level of Threat: C = Medium
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: C = Medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments: Phalaris arundinacea; Phragmites; Poa pratensis

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: C = Medium
Comments: Typha latifolia

Threat Category: 9 - Pollution Level of Threat: C = Medium
Comments:

Threat Category: 9.1 - Domestic & urban waste water Level of Threat: C = Medium
Comments:

Trends

Short-term Trend: E **=** Decline of 30-50%

Comments: Some direct loss has likely occurred due to water management from dams, agriculture, development, and road construction but there is no data to estimate how much. However, grazing and the spread of invasive species, espeically Phalaris arundinaceae, have degraded almost every occurrence of this system in the Columbia Basin. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar. The rating chosen here is primarily based on changes in ecological integrity rather than direct loss.

Long-term Trend: E = Decline of 30-50%

Comments: Some direct loss has likely occurred due to water management from dams, agriculture, development, and road construction but there is no data to estimate how much. However, grazing and the spread of invasive species, espeically Phalaris arundinaceae, have degraded almost every occurrence of this system in the Columbia Basin. Wetland regulations don't address stressors that impact quality thus, it is likely long- and short-term trends in ecological integrity are similar. The rating chosen here is primarily based on changes in ecological integrity rather than direct loss.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 03-Mar-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Alpine and Subalpine Bedrock and Scree*** **Elcode:** CES204.853

Common Name: North Pacific Alpine and Subalpine Bedrock and Scree **Subnational ID:** 18424

Descriptors

Element Description:

Rank

S Rank: S4? **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:** 3-Feb-2005

State Exemplary Site:

Rank Reasons: European study indicate rapid colonization of scree by plants may represent decline.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) map 204 sqkm

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:**

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: no known; uncertain if increase in area with glacier retreat will be offset with transition to vegetated surface

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: BC = Moderately vulnerable to not intrinsically vulnerable.

Comments:

Environmental Specificity: A = Very narrow. Specialist or community with key requirements scarce.

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Scientific Name: ***North Pacific Alpine and Subalpine Bedrock and Scree*** **Elcode:** CES204.853

Common Name: North Pacific Alpine and Subalpine Bedrock and Scree **Subnational ID:** 18424

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Alpine and Subalpine Dry Grassland*** **Elcode:** CES204.099

Common Name: North Pacific Alpine and Subalpine Dry Grassland **Subnational ID:** 18425

Descriptors

Element Description:

Rank

S Rank: S4S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 31-Mar-2005

State Exemplary Site:

Rank Reasons: I did not assess climate change which likely would lower rank.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map estimated 402 sqkm in Washington, mostly in North Cascades National Park.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments: many areas NP without livestock grazing

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: D = Low
Comments:

Threat Category: 7.1 - Fire & fire suppression Level of Threat: D = Low
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: Poa pratensis

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: D = Low
Comments: goats in olympics

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***North Pacific Alpine and Subalpine Dry Grassland*** **Elcode:** CES204.099

Common Name: North Pacific Alpine and Subalpine Dry Grassland **Subnational ID:** 18425

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 31-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Avalanche Chute Shrubland*** **Elcode:** CES204.854

Common Name: North Pacific Avalanche Chute Shrubland **Subnational ID:** 18293

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimateds 517 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Avalanche control around roads and ski areas may have impacted some areas .

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: avalanches are mainly governed by temperature flucuations, heavy precipitations and wind regimes, they are likely to be strongly influenced by climatic flucuations. Eckert et al 2008. BPJ - change of snowpack amounts and timing will likely change associated biota.

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown
Comments: snow pack changs

Threat Category: 11.3 - Temperature extremes Level of Threat: Unknown
Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: Negligible
Comments: ski areas

Threat Category: 6.1 - Recreational activities Level of Threat: Negligible
Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Scientific Name: ***North Pacific Avalanche Chute Shrubland*** **Elcode:** CES204.854

Common Name: North Pacific Avalanche Chute Shrubland **Subnational ID:** 18293

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Eckert, N., E. Parent, M. Naaim, and D. Richard. 2008. Bayesian stochastic modelling for avalanche predetermination: from a general system framework to resturn period computations. Stochastic Environmental Research and Risk Assessment. Vol. 22, Issue 2, pp. 185-206

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Bog and Fen*** **Elcode:** CES204.063

Common Name: North Pacific Bog and Fen **Subnational ID:** 18309

Descriptors

Element Description: The North Pacific Bog and Fen ecological system is composed of peatlands that occur as small patches along the Pacific coast from southeastern Alaska to northern California , in and west of the coastal mountain summits including the Puget Sound lowlands. Elevations are mostly under 457 m (1500 feet), and annual precipitation ranges from 890-3050 mm (35-120 inches). The system is found in river valleys, around lakes and marshes, behind coastal sand dunes, or on slopes. It generally forms in glacial scours, kettles, isolated oxbows, and old lake beds. Near the coast, organic soils typically have an abundance of sodium cations from oceanic precipitation. Topography is mostly flat with only localized hummock development. Initial development of most bogs and fens found in Washington occurred soon after the retreat of the last glacial phase.
Bogs and fen differ from other wetland in having a substrate composed of organic material, typically in the form of peat and muck. The origin of the peat can be <i>Sphagnum</i> moss, <i>Hypnum</i> ssp., 'brown' mosses, sedges, or woody species. The relative degree of decomposition of these histosol soils is distinguished as being either fibric (peat), hemic, and sapric (muck) in nature. Riggs (1956; 1958) noted that, in Washington, peat accumulates at an approximate rate of 1 inch/40 years and that peat depth in Washington's peatlands ranged from a few to over 50 feet.
Both fen and bogs are collectively called peatlands. Historically, many different criteria have been used to distinguish different types of peatlands such as fen and bog , including water chemistry, floristics, hydrology, and topography. Although there is some correspondence between these approaches, they are not always consistent which has resulted in much confusion about the precise definitions of a fen versus a bog. One of the common approaches is to classify peatlands according to pH and associated vegetation. For example, bog (very acidic) – poor fens – rich fens – extreme rich fens (very basic). Generally speaking, mineratrophic groundwater (discharges from bedrock or mineral substrates) occurs within the rooting zone of fens whereas in bogs peat has accumulated deep enough so that the rooting zone is above the influence of mineratrophic groundwater, limiting hydrological sources to precipitation. As such, "true" bogs are only found in areas of high precipitation. These hydrological differences result in chemical (pH and nutrient status) differences. Poor fens and bogs are often difficult to distinguish as they both have low pH (<5.5) and share many species such as <i>Sphagnum </i>moss and Ericaceous species. Fens are often dominated by "brown mosses", sedges, and graminoids and have circumneutral to basic pH (>5.5). In Washington, local researchers have suggested using the term "<i>Sphagnum</i>-dominated peatlands" to refer to 'bogs and poor fens' (Kulzer et al. 2001). Often bogs and fens may be intermixed with each other in the same wetland because of development in similar topography. Often, other wetland type can surround or occur adjacent to bogs and fens. However, bogs and fens can also be hydrologically isolated from each other and other wetland types.

Within the North Pacific Bog and Fen system, vegetation is usually a mix of conifer-dominated overstory, shrubs, and open <i>Sphagnum</i> or sedge lawns, often with small ponds and pools interspersed. Graminoids, evergreen or deciduous broadleaf shrubs, or evergreen needleleaf trees are commonly dominate. Many plant species are confined to this system. Some of the bog and fen plant associations, especially those in fens, also occur in Temperate Pacific Freshwater Marsh and North Pacific Shrub Swamp Ecological Systems. Many species common to boreal continental bogs and fens, such as <i>Ledum groenlandicum, Vaccinium uliginosum, Myrica gale, Andromeda polifolia, Vaccinium oxycoccos, Equisetum fluviatile, Comarum palustre</i>, and <i>Drosera rotundifolia </i>are common. However, the presence of Pacific coastal species, including <i>Pinus contorta </i>var.<i> contorta, Picea sitchensis, Tsuga heterophylla, Ledum glandulosum, Thuja plicata, Gaultheria shallon, Spiraea douglasii, Carex aquatilis </i>var.<i> dives, Carex obnupta, Carex pluriflora, Sphagnum pacificum, Sphagnum henryense</i>, and <i>Sphagnum mendocinum</i>, provide a unique floristic character to this ecological system. Other common species include <i>Kalmia microphylla, Dulichium arundinaceum, Eriophorum </i>ssp<i>., </i>and a variety of sedges (<i>Carex </i>ssp.).

The accumulation of undecomposed or slightly decomposed organic matter contributed by <i>Sphagnum</i> (poor fens and bogs) or sedges, shrubs, and/or brown mosses (fens) is the primary ecological driver distinguishing fens and bogs from other wetland types. Stable groundwater, surface water, or precipitation inputs are crucial for continual integrity of these organic soils.

Fire is relatively rare in these systems, although Native Americans were known to use fire in peatlands found on the coast of the Olympic peninsula to maintain and encourage growth of usable plants.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of peatlands in western Washington . Conversion of peatlands for agriculture has resulted in significant loss of peatland extent. These areas are often cultivated for blueberries, cranberries, etc.

Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed (fens) or surrounding landscape can also have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in species composition and wetland extent. Water diversions and ditches can have a substantial impact on the hydrology as well as biotic integrity of peatland. For example, if the water table is lowered, peat oxidization and subsequent decomposition occurs thereby reducing peat depth, altering hydrological patterns, and resulting in a change of species composition. Conversely, increased surface flow into a bog or fen could result in the site being converted into a new wetland type that reflects the new hydrology, e.g., marsh. Since fens are reliant on groundwater any disturbances that

impact water quality or quantity are a threat. These threats include groundwater pumping, mining, and improper placement of septic systems, water diversions, dams, roads, etc.

Human land uses in adjacent upland areas have reduced connectivity between wetland patches and upland areas. Land uses in contributing the watershed (e.g., logging, roads, development, etc.) have the potential to contribute excess nutrients into to the system which could lead to the establishment of non-native species and/or dominance of native increasing species. In general, excessive livestock or native ungulate use leads to a shift in plant species composition. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Although most wetlands receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively. Peat mining can have a substantial impact on bogs and fens. Given the slow accumulation rates of peat, once it is mined (i.e. removed) the fen or bog cannot be restored to historic conditions in a time frame relevant to management activities. The removal of peat alters the subsurface hydrological storage capacity of the peatland and tends to channelize surface flow which might result in further degradation. Peat mining can also decrease species diversity and alter species composition. When upland forest areas adjacent to bogs and fens are logged, decreases in evaporation rates and increased surface flow from such areas can contribute excess water into the peatland. Such impacts could have negative consequences to hydrological regime of the peatland resulting in changes of decomposition and species composition. Likewise, roads in a peatland's watershed can have similar deleterious effects on the hydrological regime as well as increasing sediment, contaminant, and nutrient inputs into a peatland. Increased nutrients (wherever the source) can alter species composition and, in Sphagnum-dominated peatlands, result in the loss of Sphagnum.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Although there are many element occurrences but most are small and many have been degraded due to development and logging. On the outer coast, elk have been noted as impacting many sites due to intensive trampling which has resulted in the spread of nonnative species in some areas. Logging and roads have isolated many of these peatlands which restricts connectivity of some ecological and biological processes. Some forested peatlands have been selectively logged.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: These peatlands are found across western Washington from the lowland to the Cascade Crest . However, they are most abundant in the lowlands where they occur in depressions, around pond/lake shorelines, in groundwater discharge areas and sometime along slow moving creeks. There are two main concentrations of peatlands in the lowland: (1) glaciated regions of the Puget lowlands and (2) the outer coastal strip where they primarily occur in old dunal troughs or on alpine glacier outwash and till. They are also found in the montane regions where they primarily occur along river valley, depressions, and points of groundwater discharge. The Ecological System includes herbaceous, shrubland and woodland vegetation.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: The NatureServe Ecological System map (Sayre et al. 2009) mapped 7,828 acres (31 km2) in western Washington. Rigg (1958) estimated 41,142 acres (166 km2) of peat deposits in western Washington. However, that number could include areas with peat that no longer support native vegetation (e.g., agricultural fields) or have since been mined (Kulzer et al. 2001). Rigg also noted that the estimate did not includes all the deposits known to occur in the state. Nonetheless, it is the most thorough, statewide inventory of peatlands that has been conducted in Washignton . However, Bell (2002) estimated that 69% of the peatlands Rigg identiifed in King County have been lost. Given that King County has experiend some of the most intense development pressure of any other county it is unlikely that simliar loss has occurred throughout the range of this wetland type. However, significant loss has very likely occurred within the greater Puget lowland region. As such, the conservative estimate of "G=20-100km2" was chosen to represent current occupancy.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 274 element occurrences in WNHP's database, however many of those occur at the same peatland complex. Kulzer et al. (2001) estimated ~250 "sphagnum-dominated" peatlands in the lowlands; Rigg (1958) reported on 267 peat "areas". The rating chosen may be a conservative estimate. However, if there are more than 300 occurrences it is likely not very many above that number.

Population Size: =

Scientific Name: ***North Pacific Bog and Fen*** **Elcode:** CES204.063

Common Name: North Pacific Bog and Fen **Subnational ID:** 18309

Comments:

Number of Viable EOs: F = Very many (>125) **% of Range with Good Viability:** E = Good (21-40%)

Comments: Of the 274 element occurrences in WNHP's database, 230 have excellent to good integrity. The majority of peatlands identified by Rigg (1958) and Kulzer et al. (2001) are in Puget Sound region where agriculture and development pressure have been most severe. Past and contemporary logging has also impacted peatlands across western Washington. As such, an assumption was made that a significant portion of peatlands in the Puget Sound region have been impacted and consequently dont' have excellent to good integrity. A conservative estimate of "E=21-40% with excellent or good integrity" was chosen.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Agriculture, development, past peat mining, logging, roads, water quality alterations and to a lesser extent grazing threaten this system.

Threat Category: 1 - Residential & commercial development Level of Threat: B = High
Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: B = High
Comments:

Threat Category: 1.2 - Commercial & industrial areas Level of Threat: C = Medium
Comments:

Threat Category: 3 - Energy production & mining Level of Threat: C = Medium
Comments:

Threat Category: 3.2 - Mining & quarrying Level of Threat: C = Medium
Comments: past peat mining in some areas--especially to make way for agriculture

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments:

Threat Category: 5 - Biological resource use Level of Threat: B = High
Comments:

Threat Category: 5.2 - Gathering terrestrial plants Level of Threat: Negligible
Comments: salal, cranberries, beargrass, Ledum picking

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High
Comments: many wooded peatlands have been logged or high-graded

Threat Category: 7 - Natural system modifications Level of Threat: D = Low
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: D = Low
Comments: some outlets/inlets have been managed

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: invasive species are only an issue around the margins of bogs (Iris pseudacoros, etc.)

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: D = Low
Comments: some species can increase due to stressors such as Spiraea douglasii, Juncus effusus, etc.

Threat Category: 9 - Pollution Level of Threat: C = Medium
Comments:

Threat Category: 9.1 - Domestic & urban waste water Level of Threat: C = Medium
Comments:

Trends

Short-term Trend: E **=** Decline of 30-50%

Scientific Name: ***North Pacific Bog and Fen*** **Elcode:** CES204.063

Common Name: North Pacific Bog and Fen **Subnational ID:** 18309

Comments: Development has impacted extent; alterations to hydryology and sedimentation have impacted many sites; most "decline" is likely degradation of integrity rather than another 50% loss///It is not known how much wetland regulations slowed the direct loss of this wetland type from the Washington landscape but direct loss of bogs and fens are likel minimal under contemporary regulations. However, these peatlands continue to be degraded from adjacent land uses, especially in the Puget lowlands where development pressure continues to increase. Adjacent development can change local hydrological patterns, result in sedimentation and/or nutrient loading, and provide vectors for nonnative species. Roads can have similar impacts.

Long-term Trend: E = Decline of 30-50%

Comments: Agriculture had the initial heavy impact on loss of extent; this "decline" is meant to capture the majority of loss of extent before regulations kicked in. ///Prior to wetland regulations, many direct losses of these peatlands occured due to agriculture, logging and development. The only statewide estimate of wetland loss is from Dahl (1990) which estimated that WA has lost 31% of its historical wetland acreage. It is not known how much of this loss included this ecological system. In addition to outright loss, many occurrences of this ecological system have undergone extensive degradation due to stressors such as logging, ditching, draining, nonnative species, agriculture and development. Changes in ecological integrity have occurred due to hydrological alterations, invasive species, structural change (logging) and sediment/nutrient alterations.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Bell, J.M. 2002. An Assessment of Selected Sphagnum-dominated Peatlands of King County, WA, and Their Decline. M.S. Thesis. Evergreen State College. Olympia, WA.

Dahl, T.E. 1990. Wetland Losses in the United States 1780's to 1980's. U.S. Dept. of the Interior, Fish & Wildlife Service, Washington D.C.,13pp.

Kulzer, L., S. Luchessa, S. Cooke, R. Errington, and F. Weinmann. 2001. Characteristics of the Low-elevation Sphagnum-dominated Peatlands of Western Washington: A Community Profile. Report Prepared for U.S. Environmental Protection Agency, Region 10.
http://www.kingcounty.gov/environment/waterandland/stormwater/documents/sphagnum-bogs.aspx

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rigg, G.B. and S.P. Gessel. 1956. Peat Deposits of the State of Washington. Soil Science Society Proceedings,

Rigg, G.E. 1958. Peat resources of Washington. Washington Dept. of Conser. Div. of Mines and Geol. Bull. 44. 272 p.

Version

Version Author: Joe Rocchio **Version Date:** 27-Feb-2015

Internal Notes:

Scientific Name: ***North Pacific Broadleaf Landslide Forest and Shrubland*** **Elcode:** CES204.846

Common Name: North Pacific Broadleaf Landslide Forest and Shrubland **Subnational ID:** 18292

Descriptors

Element Description: The North Pacific Broadleaf Landslide Forest and Shrubland ecological system occurs on steep slopes and bluffs that are subject to periodic mass movements. They are found in patches of differing age associated with different landslide events. It is a large and small patch system found throughout the northern Pacific mountains and lowlands, becoming less prominent in the northern half of this region. Occurring throughout western Washington, the North Pacific Broadleaf Landslide Forest and Woodland system typically appears within the matrix North Pacific Maritime Dry-Mesic and Wet-Mesic Douglas-fir Western Hemlock Forest systems landscape. It is associated with steep slopes (over 10%) and bluffs found in lowland areas and are characterized by slopes subjected to periodic landslides dominated by deciduous trees and shrubs (e.g. Acer macrophyllum and/or Alnus rubra). It also occurs on the shorelines of Puget Sound and adjacent marine waters (Chappell 2004). They can be associated with deep-seated landslides or ancient landslides and with mid-slope benches a common setting for slides for a variety of landslide types (http://www.ecy.wa.gov/programs/sea/landslides/about/about.html). Parent materials likely include glacial till, advance glacial outwash, and glacial lake and marine sediments. Seeps are frequent on these slopes, resulting in local wetter microsites. Conifers would be expected to increase in abundance without large slides and long-term substrate stability. Fire and wind also affect some of these forests.

In general, landslides increase the floristic and structural diversity of landscape and vegetation (Guariguata, M. 1990). Younger landslides have different vegetation on the slide than vegetation on the surrounding slopes. The vegetation consists of deciduous broadleaf forests, woodlands, or shrublands, sometimes with varying components of conifers that usually have less than 50% relative cover. Alnus rubra and Acer macrophyllum are the major tree species. Rubus spectabilis, Rubus parviflorus, Ribes bracteosum, and Oplopanax horridus are some of the major shrub species. Shrublands tend to be smaller in extent than woodlands or forests. Small patches of sparsely vegetated areas or herbaceous-dominated vegetation (especially Petasites frigidus) also often occur as part of this system. Vegetation on earthflows, once stable, may succeed to dominance by conifers. In coniferous forests, landslides typically are covered with deciduous trees for the first 100 years after the failure.

Rank

S Rank: S2S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Without a more comprehensive survey of distribution and condition a range rank is appropriate. This apparently is a relatively rare, small occurrence type that experiences some threat to processes and stand structure. One rare association (CEGL3334 Bigleaf Maple - Red Alder / Swordfern - Fringecup Community) is part this system along Puget Sound bluffs and banks. Comer and Hak (2009) estimates.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Spotty occurrences along river corridors and shorline of Puget Sound and across most of lowland western WA. Uncertain whether it ranges up into the Columbia River Gorge.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 127sqkm as occurring in Washington. This seems like a reasonable estimate, however, there is some uncertainty as to how this relates to mapped areas of mixed hardwood-conifer areas. I think Kagan mapped this based on a hardwood signature, elev and slopes steepness.

Population and EOs

Number of EOs: =

Comments: 4 WANHP association occurrences at four sites. No attempt at a comprehensive inventory of system has been made.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** BE = Very small to good (<41%)

Comments: I think most of the impacts are not in the occurrences rather in adjacent efforts to trucate processes . Comer and Hak (2009) Landscape Condition Model indicates that 1% of area with >80% LCM index score, indicating very little in good to excellent ecological condition. However, 39 % of mapped pixels (Sayre et al. 2009) are beyond 800ft of roads.

Number Protected EOs:

Comments:

Scientific Name: ***North Pacific Broadleaf Landslide Forest and Shrubland*** **Elcode:** CES204.846

Common Name: North Pacific Broadleaf Landslide Forest and Shrubland **Subnational ID:** 18292

Threats

Threats: C = Medium

Comments: Unsure extent of impacts along rivers in foothills. Changes in channel flooding with upstreams may have impacts on timing of slope failures.

Threat Category: 1 - Residential & commercial development Level of Threat: D = Low
Comments: think less on site impact more to processes drainage changes, bulkheads, etc.

Threat Category: 1.1 - Housing & urban areas Level of Threat: D = Low
Comments: think less on site impact more to processes drainge changes, bulkheads

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments: think less on site impact more to processes drainage changes, althought some roading acrosses slopes on Sound and some rives.

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments:

Threat Category: 5 - Biological resource use Level of Threat: D = Low
Comments: seen some high grading a few cuts on larger slopes (Oso)

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: D = Low
Comments: seen some high grading a few cuts on larger slopes (Oso)

Threat Category: 7 - Natural system modifications Level of Threat: D = Low
Comments: dams and flood control efforts effect toes

Threat Category: 7.2 - Dams & water management/use Level of Threat: D = Low
Comments: dams and flood control efforts effect toes

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: Negligible
Comments: invasives present, particularly in Sound. effects unknown

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: Negligible
Comments: invasives present effects unknown

Trends

Short-term Trend: E = Decline of 30-50%

Comments: Increase in human population across range may result in additional impacts.

Long-term Trend: F = Decline of 10-30%

Comments: 416% increase over 200 years estimated from Ecological Systems map (Sayre et al. 2009) compared to LANDFIRE Biophysical Unit map. (This might include all alde and maple stands).

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Chappell, C. B. 2004. Terrestrial plant associations of the Puget Trough ecoregion, Washington. Washington Natural Heritage Program, Washington Department of Natural Resources.

Scientific Name: ***North Pacific Broadleaf Landslide Forest and Shrubland*** **Elcode:** CES204.846

Common Name: North Pacific Broadleaf Landslide Forest and Shrubland **Subnational ID:** 18292

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Coastal Cliff and Bluff*** **Elcode:** CES204.094

Common Name: North Pacific Coastal Cliff and Bluff **Subnational ID:** 18426

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map estimates 0.75 sqkm as occurring in Washigton which is thought to be an underestimate to extent. Washington Dept. of Ecology's shoreline map of Puget Sound estimates 436 linear miles of feeder bluffs.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** E = Good (21-40%)

Comments: Washington Dept. of Ecology note that 44% of Puget Sound shoreline modified.

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: Puget Sound occurrences have more threats thatn Pacific coast occurrences. Much of the latter is protected within Olympic National Park and overall is exposed to much less development pressure than in the Puget Sound.

Threat Category: 1 - Residential & commercial development Level of Threat: CD = Medium - low

Comments: land clearing, water divertion and addition

Threat Category: 11 - Climate change & severe weather Level of Threat: Not a Threat

Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low

Comments: railroad follow shorline in south sound, roads from develpoments

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low

Comments: 34% of Puget Sound shoreline modified (WDNR 2007) Pacific shoreline less so, "substantial negative impacts"

Threat Category: 7.3 - Other ecosystem modifications Level of Threat: CD = Medium - low

Comments: 34% of Puget Sound shoreline modified (WDNR 2007) Pacific shoreline less so, "substantial negative impacts"

Trends

Short-term Trend: F = Decline of 10-30%

Comments:

Long-term Trend: E = Decline of 30-50%

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Scientific Name: ***North Pacific Coastal Cliff and Bluff*** **Elcode:** CES204.094

Common Name: North Pacific Coastal Cliff and Bluff **Subnational ID:** 18426

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***North Pacific Coastal Interdunal Wetland*** **Elcode:** CES204.062

Common Name: North Pacific Coastal Interdunal Wetland **Subnational ID:** 19376

Descriptors

Element Description: North Pacific Coastal Interdunal wetlands are located in small interdunal depressions to extensive deflation plains behind stabilized foredunes. They may be referred to as “dune slacks” and are common components of larger active and stabilized coastal barrier islands, spits, and coastal dunes occurring along the Pacific Coast. This small patch system ranges from southern Oregon to the Aleutian Islands in Alaska . Dune slacks are highly ranked in international conservation agenda due to frequent association with many rare and endangered plant species and their associated fauna (Grootjans et al. 2004). This small patch system is only found embedded within the North Pacific Maritime Coastal Sand Dune and Strand system.

North Pacific Coastal Interdunal wetlands typically occur behind stabilized foredunes. Foredunes are tall ridges created by sand-trapping vegetation with a swale between it and the next dune. As wind blows inland it erodes the sand behind foredunes down to the level of the water table. The swale or dune slack elevation varies with depth to water table as the sand is actively eroded by wind. When sand is wet, it is more resistant to further erosion and interdunal wetlands are able to develop. Winter precipitation increases the water table and inundates some communities to a depth of 1 m (3 feet) with fresh or brackish water. A variety of moisture and salinity gradients occur due to variations in the depth of sand and distance from estuaries or ocean water. Seasonal rise in the water table also causes vernal pools to form in forested sites on old deflation plains. In areas with many interdunal wetlands slight differences in water level may initiate groundwater flow from one wetland to another (Grootjans et al. 2004). Some wetlands are perched on an iron-cemented duripan, and groundwater may be charged with iron and pH ranges from 5.0-6.3 (6.9), with low conductivity. Soils are mineral sometimes with a thin organic layer (less than 40 cm (16 in)). This primarily freshwater wetland system is 1) not tidally-influenced although maritime water effects salinity and pH, 2) has a mineral soil sometimes with a thin organic layer and 3) is groundwater dependent with seasonal fluctuations. Under natural conditions, individual wetlands (slacks) are temporary being filled by sand or vegetation through succession to other wetland systems or isolated from the water table.

The physical forms of dunes have been altered by European beachgrass (Ammophila arenaria), which has been extensively planted for stabilization purposes and has also spread widely on its own. Ammophila arenaria foredune stabilization decreases sand supply to backdune areas that leads to soil formation and an increase in invasive and native grassland, coastal scrub, and wetlands (Wiedemann and Pickart 2004). Unstabilized sand is now a relatively rare condition primarily because of the introduction of this species and many deflation plains are much larger than their historical extent. It is not clear how this may affect vegetation patterns relative to historical conditions, however without dynamic dune systems, the diversity of structure within interdunal wetlands may homogenize, with shrubby and/or forested wetlands predominating.

Distinct landform and vegetation patterns are common to these dune systems. Depending on moisture and salinity gradients, North Pacific Coastal Interdunal wetlands are colonized by herbaceous species such as Carex obnupta, Argentina egedii, Juncus lesueurii, Juncus falcatus ssp. sitchensis, Juncus nevadensis, Equisetum variegatum and various other emergent species resembling wet meadows or marshes (Weideman 1984). Shrubs such as, Salix hookeriana and S. sitchensis can be present particularly in older wetlands that gain characteristics of shrub swamps (Christy et al. 1998, Weideman 1984). Older slacks with persistent freshwater (near lakes and ponds) support conifer swamps with Pinus contorta var. contorta, Picea sitchensis or Thuja plicata and, in some cases, develop peat over 40 cm and then represent the North Pacific Bog and Fen ecological system. Interdunal wetlands may occur in mosaics with forested swamps or rarely with Bogs and Fens.
.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Interdunal wetlands are geographically limited in extent being primarily found in southwest Washington coast from the Columbia River to just north of the Copalis River. The wetland type has experience direct loss due to development and cranberry production. Dams on the Columbia River and nonnative, Ammophila spp. infestations on sand dunes have altered sand dynamics which ultimately lead to new interdunal wetland formation. Thus, new habitat is rarely being formed. In addition to outright loss, many occurrences of this ecological system have undergone extensive degradation or change (being converted from one wetland type to another) due to stressors such as ditching, draining, nonnative species, nearby cranberry farms and development.

Range

Range Extent: B = 100-250 square km (about 40-100 square miles)

Comments: This system occurs on recent sand deposits along the outer coast of southwest Washington , from the mouth of the Colubmai River north to the Copalis River (Wiedemann 1984). A total extent of 280km2 was calculated. The lower rating was chosen since this calculation was pretty coarse.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***North Pacific Coastal Interdunal Wetland*** **Elcode:** CES204.062

Common Name: North Pacific Coastal Interdunal Wetland **Subnational ID:** 19376

Comments: This system was not explictly labeled on NatureServe's Ecological Systems map (Sayre et al. 2009). If included on the Ecological Systems map, individual interdunal wetlands are labeled as North Pacific Shrub Swamp, North Pacific Bog and Fen or Temperate Pacific Salt and Brackish Marsh. The National WEtland Inventory map and Cowardin classification did not use any codes that would allow a fitler to determine which are likely interdunal wetlands. However, using GIS the NWI map was intersected with beach deposits (derived from Washington Dept. of Natural Resources Surface Geology 1:100K map) which showed that there are 8,455 acres or 35 km2 of wetlands within the extent of this wetland type. Although these wetlands could be part of another Ecological System it is very likely that most are interdunal wetlands.

Population and EOs

Number of EOs: C = 21 - 80

Comments: The WNHP database only has 9 element ocurrences of this ecological system and are primarily limited to the Long Beach peninsula and small examples elsewhere. The intersection of the NWI map with beach deposits resulted in 814 individual NWI polygons. However, often multiple NWI polygons might fall within a single element occurrence due to differing approaches for drawing polygons. Thus, the 814 number isn't directly translatable to occurrences. Based on field experience, the "C=21-80" seems to be a reasonable estimate.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: All of the 9 element occurrences in WNHP's database are of excellent or good integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 88% of all palustrine wetlands occuring on beach deposits within the extent of this wetland type had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this analysis and field experience of the author, 88% is assumed to be an overestimate of the area with good/excellent integrity. Based on personal observations, cranberry production, development, roads, logging, stablized sand dynamics and nonnative species have impacted the majority of occurrences.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Threats are high within the extent of this wetland types. Dams on the Columbia River and nonnative, Ammophila spp. infestations on sand dunes have altered sand dynamics which ultimately lead to new interdunal wetland formation. Other stressors impact the integrity of extant interdunal wetlands.

Threat Category: 1 - Residential & commercial development Level of Threat: C = Medium
Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: C = Medium
Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: D = Low
Comments:

Threat Category: 6.1 - Recreational activities Level of Threat: D = Low
Comments: beach activities affect seasonally wet sites

Threat Category: 7 - Natural system modifications Level of Threat: C = Medium
Comments:

Threat Category: 7.3 - Other ecosystem modifications Level of Threat: B = High
Comments: changes to hydrological and sediment regimes, espeically along Columbia River

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: C = Medium
Comments: Ammophila infestations are widespread in seasonally wet sites;

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: D = Low
Comments: Some natives become more dominant with stressors

Scientific Name: ***North Pacific Coastal Interdunal Wetland*** **Elcode:** CES204.062

Common Name: North Pacific Coastal Interdunal Wetland **Subnational ID:** 19376

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: It is not known how much wetland regulations slowed the direct loss of this wetland type from the Washington landscape. Development pressure on the Long Beach peninsula has increased within the last 50 years. Even if regulations helped stem significant direct loss; development, agriculture, and timber activitiy have likely degraded ecological integrity of remaining interdunal wetlands due to alterations from ditching, increase sediment and hydrological inputs, draining, nonnative species, and nutrient loading.

Long-term Trend: E **=** Decline of 30-50%

Comments: There are no data sources with reliable estimates of loss of this ecological system (Landfire's Environmental Potential Map did not explicitly map this ecological system). Prior to wetland regulations, many losses could have occurred due to agriculture (cranberry production) and development. Dams on the Columbia River and nonnative, Ammophila spp. infestations on sand dunes have altered sand dynamics which ultimately lead to new interdunal wetland formation. Thus, new habitat is rarely being formed. In addition to outright loss, many occurrences of this ecological system have undergone extensive degradation or change (being converted from one wetland type to another) due to stressors such as ditching, draining, nonnative species, nearby cranberry farms and development.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Christy, J.A., J.S. Kagan, and A.M. Wiedemann. 1998. Plant associations of the Oregon Dunes National Recreation Area. Siuslaw National Forest, Oregon. US Department of Agriculture, Forest Service. PNW Region. Technical Paper R6-NR-ECOL-TP-09-98.

Grootjans, A.P., E.B. Adema, R.M. Bekker and E.J. Lammerts. 2004. Why Young Coastal Dune Slacks Sustain a High Biodiversity. 2004. in Coastal Dunes, Ecology and Conservation Ecological Studies 171. M.L.Martínez, N.P. Psuty (Eds.) Springer-Verlag

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Wiedemann, A.M. 1984. The ecology of Pacific Northwest coastal sand dunes: a community profile. USDI Fish and Wildlife Service, Washington, D.C.

Version

Version Author: Joe Rocchio **Version Date:** 26-Feb-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-field and Meadow*** **Elcode:** CES204.862

Common Name: North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-field and Meadow **Subnational ID:** 18295

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: only threat is climate change with tree invasion

Range

Range Extent:

Comments: Occurs at high elveations of Cascades and Olympic Mountains.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 157sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: 99% beyond 800ft of roads

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: I probably over estimated scope, climate will impact

Threat Category:	1 - Residential & commercial development	Level of Threat:	D = Low
Comments:			
Threat Category:	1.3 - Tourism & recreation areas	Level of Threat:	D = Low
Comments:			
Threat Category:	11 - Climate change & severe weather	Level of Threat:	BD = High - low
Comments:			
Threat Category:	11.1 - Habitat shifting & alteration	Level of Threat:	BD = High - low
Comments:			
Threat Category:	6 - Human intrusions & disturbance	Level of Threat:	D = Low
Comments:			
Threat Category:	6.1 - Recreational activities	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: F = Decline of 10-30%

Comments: tree invasion

Long-term Trend: F = Decline of 10-30%

Comments: tree invasion

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Scientific Name: ***North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-field and Meadow*** **Elcode:** CES204.862

Common Name: North Pacific Dry and Mesic Alpine Dwarf-Shrubland, Fell-field and Meadow **Subnational ID:** 18295

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Dry Douglas-fir-(Madrone) Forest*** **Elcode:** CES204.845

Common Name: North Pacific Dry Douglas-fir-(Madrone) Forest **Subnational ID:** 18291

Descriptors

Element Description: The North Pacific Dry Douglas-fir Forest and Woodland ecological system is a large and small patch system most common in the Puget Trough - Willamette Valley that occurs throughout western Washington and much of western Oregon. In Washington, it is most common in the Olympic rain shadow in the northern Puget Sound and on dry topo-edaphic locations across the lowland. In general, this system is associated with dry soils within relatively dry to mesic climates on sites up to about 1220 m (4000 feet) elevation. The vast majority of precipitation comes as rain during winter months and summer drought is the norm.
Historically, this system was either a part of larger forested landscapes (mostly with the North Pacific Maritime Dry-Mesic Douglas-fir Western Hemlock Forest system) or occupied sheltered topographic positions in prairie-dominated landscapes (with the North Pacific Oak Woodland or Willamette Valley Upland Prairie and Savanna system).

This is a forest or woodland system primarily dominated by the long-lived conifer Pseudotsuga menziesii. A discontinuous emergent layer of old Pseudotsuga menziesii often appears above a more continuous canopy layer of trees in moderately open stands that survived for several centuries in the presence of repeated fires (Chappell and Giglio 1999). The evergreen broadleaf Arbutus menziesii, the short-lived conifer Pinus contorta, the broadleaf deciduous Acer macrophyllum, and the shade-tolerant conifer Abies grandis are local dominant or co-dominant species. Abies grandis can be an important subcanopy or sapling tree. The understory consists of one or more dry-site shrub species such as Holodiscus discolor, Corylus cornuta var. californica, Symphoricarpos albus, or Mahonia nervosa, and graminoid species Festuca occidentalis (Chappell 2004). Historically, moderately frequent low to mixed-severity fires characterized this system that resulted in multiple cohort stands, with both even-aged and uneven-aged stands and a diversity of biological legacies (Chappell and Giglio 1999; Van Pelt 2007). Landfire Model 0110350 (2007) modeled this as a fire regime III system with 75% in late-seral structure (45% open), 20% mid-seral and 5% early seral in pre-settlement condition. In Puget Trough Douglas-fir—madrone forests, post-fire age classes are commonly 50–70, 110–140 and 250 or more years (Chappell and Giglio 1999). In Douglas-fir forests in the Elwha drainage of the Olympic Mountains the mean fire return intern is reported to be 99 years (Wendel and Zabowski 2010). Sites are too dry and warm or have been too frequently and extensively burned for anything more than small amounts of Tsuga heterophylla or Thuja plicata to be present. Arbutus menziesii dominance is favored by high-severity fires, and Pseudotsuga menziesii can be locally eliminated by logging and hot fire or repeated high-severity fires. Catastrophic winds, laminated root rot, Douglas-fir bark beetle, and other pathogens create gaps in the canopy creating heterogeneous stand structure.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: I think the area occupied is at low end of range, Chappell and others (2006) and his subsequent inventory is basis of ranking. Rank does not change even if number of current EOs is doubled. Most of the range is within the Puget Lowland where the majority of state population lives and converts land. Most current sites recieve some level of protection.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: Estimated at the lower end of rank range (around 20K sqkm).

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimated of 732sqkm seems to be an overestimate but still in this range, although much is degraded.

Population and EOs

Number of EOs: C = 21 - 80

Comments: 20 -25 association element occurrences, but size not considered when deciding whether a stand meets element occurrence specifications.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** C = Small (5-10%)

Comments: 10 sites with an element occurrence rank of A or B. Some of the system has been impacted by developed and many areas have been logged. Private timber companies likely spray reproduction of madrone when logged. 23% of mapped area (Sayre et al. 2009) are 800ft from roads and presumable unlogged.

Scientific Name: ***North Pacific Dry Douglas-fir-(Madrone) Forest*** **Elcode:** CES204.845

Common Name: North Pacific Dry Douglas-fir-(Madrone) Forest **Subnational ID:** 18291

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Most areas (around 20) with element occurrences somewhat protected from logging and legal floral and mushroom harvest.

Threat Category: 1 - Residential & commercial development Level of Threat: C = Medium
Comments: BPJ most of areas in forest management protected from development

Threat Category: 1.1 - Housing & urban areas Level of Threat: C = Medium
Comments: BPJ most of areas in forest management protected from development

Threat Category: 1.3 - Tourism & recreation areas Level of Threat: Negligible
Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments: Christmas tree if flat, most already convert

Threat Category: 2.2 - Wood & pulp plantations Level of Threat: D = Low
Comments: Christmas tree if flat, most already convert

Threat Category: 5 - Biological resource use Level of Threat: C = Medium
Comments: Most areas (around 20) with eos somewhat protected from logging and legal floral and mushroom harvest

Threat Category: 5.2 - Gathering terrestrial plants Level of Threat: D = Low
Comments: floral green harvesting, mushrooms

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High
Comments: Large woody debris/snags removed, soil disturbance, planting

Trends

Short-term Trend: E = Decline of 30-50%

Comments: Population growth in Puget lowland over past 50 yrs has converted and degraded sites.

Long-term Trend: C = Decline of 70-80%

Comments: Loss of large woody debris in stands, big trees have been high-graded/logged, conversion to plantions, increasing fire suppression impacts narrowing overal diversity.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Chappell, C. B. 2004. Terrestrial plant associations of the Puget Trough ecoregion, Washington. Washington Natural Heritage Program, Washington Department of Natural Resources.

Chappell, C. B., and D. F. Giglio. 1999. Pacific madrone forests of the Puget Trough, Washington. Pages 2-11 in: A. B. Adams and C. W. Hamilton, editors. The decline of Pacific madrone (Arbutus menziesii Pursh): Current theory and research directions. Center for Urban Horticulture, University of Washington, Save Magnolia's Madrones, and Ecosystems Database Development and Research, Seattle. 146 pp.

Scientific Name: ***North Pacific Dry Douglas-fir-(Madrone) Forest*** **Elcode:** CES204.845

Common Name: North Pacific Dry Douglas-fir-(Madrone) Forest **Subnational ID:** 18291

Chappell, C.B. 2006. Upland plant associations of the Puget Trough ecoregion, Washington. Natural Heritage Rep. 2006-01. Washington Department of Natural Resources, Natural Heritage Program, Olympia , Wash. [http://www1.dnr.wa.gov/nhp/refdesk/communities/pdf/intro.pdf].

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Van Pelt, R. 2007. Identifying Mature and Old Forests in Western Washington. Wa. Dept Natural Resources, Olympia Wa. 104p.

Wendel, R., and D. Zabowski. 2010. Fire History within the lower Elwah Watershed, Olympic national Park. Northwest Science 84(1):88-97

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest*** **Elcode:** CES204.098

Common Name: North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest **Subnational ID:** 18427

Descriptors

Element Description: The North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest ecological system forms the matrix forest in the mid-montane zones of western British Columbia, western Washington and much of western Oregon. In British Columbia and in the Olympic Mountains, it occurs only on the leeward side of the mountains. In the Washington Cascades, it occurs on both windward and leeward sides of the Cascades mountains. In Washington, this forested system dominates mid-montane zones of the Cascade and Olympic Mountains and very sporadically in the Willapa Hills. It generally occurs in an elevational band between Pseudotsuga menziesii - Tsuga heterophylla forests and Tsuga mertensiana forests. This system has a characteristically variable winter snowpack that typically lasts for 2 to 6 months and is sometimes referred to as the "rain-on-snow" zone because of the common occurrence of major winter rainfall on an established snowpack. Snowpack varies between 1 and 3.5 m (4-10 ft) and fog drip adds inches to yearly total precipitation (Henderson et al. 1989).

This system is characterized by having an overstory of Abies amabilis and/or Abies procera over 10% tree cover often with Tsuga heterophylla codominant and usually containing Pseudotsuga menziesii. Tsuga heterophylla and/or Abies amabilis dominate the canopy of late-seral stands, though Pseudotsuga menziesii and Chamaecyparis nootkatensis (especially at higher elevations) can be codominant. Abies procera forests (usually mixed with Abies amabilis) are included in this system and occur in the Cascades from central Washington to central Oregon . Pseudotsuga menziesii is a common species that regenerates after fires and therefore is frequent as a codominant, except at higher elevations. Abies lasiocarpa sometimes occurs as a codominant, along with other conifers such as Abies grandis and Picea engelmannii on the east side of the Cascades. Understory species that tend to be more common include Achlys triphylla, Mahonia nervosa, Xerophyllum tenax, Vaccinium membranaceum, Rhododendron macrophyllum, and Rhododendron albiflorum. Vaccinium alaskense is occasional and only dominates on more moist sites.

Overall, infrequent mixed severity fire regimes occurring at greater than 100 years characterize this system (Landfire 2007). A landscape variable sized patches results from that fire regime . Stand-replacement fires occur with mean return intervals of about 200-500 years, consequently where old-growth exist it is mostly "young old-growth" 200-500 years in age. Natural-origin stands less than 200 years old are also common. Fire frequency tends to decrease with increasing elevation and continentality but still remains within this typical range. Avalanches and wind events are also common disturbances in this type . Landfire (2007) modeled this as a fire regime III system with 60% in late-seral structure (50% closed), 25% mid-seral (20% closed), and 15% early seral in pre-settlement condition.

In a landscape analysis of the central Cascades in Washington , Thomson, Weller and Severtsen (2003) concluded that the pre-settlement mean forest patch sizes are 1-5 square miles (average of 4.3 square miles for the 25-square mile analysis windows and 6.9 square miles for the 100-square mile windows). Mixed-severity fires that are often stand-replacing events occur on the scale of 1000's of acres (Landfire 2007). Pre-settlement landscape patch structure as estimated by Landfire (2007) consisted of 15% early seral stage (cohort establishment of Franklin et al. 2002) dominated by shrubs and tree seedlings. That stage typically develops into closed canopy forest stands with poor understory development (biomass accumulation/ competitive exclusion of Franklin et al. 2002). Those patches occupied an estimated 20% of the landscape, typically with Pseudotsuga menziesii sometimes with Abies amabilis or Abies procera as the dominant trees. Trees are less than 20 inches diameter-at-breast height. Another 5% of the landscape consists of young, open canopy Pseudotsuga menziesii maybe with Pinus monticola stands developed from mix-severity fire. An estimate 10% of the forests is in the similar structural condition of larger trees following mix-severity fires but with Abies amabilis. An estimated 50% of forest patches would be closed canopy mature to old-growth stands with high vertical structural diversity (Maturation to Pioneer loss stage of Franklin et al. 2002).

Rank

S Rank: S5 **S Rank Date:** 16-Oct-2014 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons: This is a widespread type with little litter anthropogenic disturbance.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System (Sayre et al. 2009) mapped 7,875 km2.

Element State Rank Report - Draft

Scientific Name: ***North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest*** **Elcode:** CES204.098

Common Name: North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-fir Forest **Subnational ID:** 18427

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Based on NatureServe's Ecological System map, it looks like over 75% of the system is mapped is on USFS or NPS land. About 65% of mapped area is more than 800ft. from a road and assumed to be unlogged.

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category: 5 - Biological resource use Level of Threat: D = Low

Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: D = Low

Comments: assume on PVT timber or DNR logged/planted

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe.2009.US National Map Conterminous United States (Version 3.0; Updated March 2014) (Compressed file, 3.9GB). http://www.natureserve.org/conservation-tools/terrestrial-ecological-systems-united-states

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Hardpan Vernal Pool*** **Elcode:** CES204.859

Common Name: North Pacific Hardpan Vernal Pool **Subnational ID:** 18294

Descriptors

Element Description: Shallow ephemeral water bodies found in depressions (up to several hectares in size) in bedrock among grasslands and open woodlands in the San Juan Islands.Small patch system which occurs throughout intermountain valleys of California, Oregon and the Gulf and San Juan islands of Washington and British Columbia. The sporadic distribution of this system limits visibility of mapped occurrences, thus the map also displays the county in which the system is known to occur.

These pools are created in small depressions in bedrock. Have an indurated clay or cemented (Si or Fe) hardpan that retains water inputs throughout some portion of the spring, but typically the depression dries down entirely into early summer months. These vernal pools tend to be acidic. This system typically occurs with a hummocky micro-relief.

Characteristic plant species including Downingia elegans, Isoetes orcuttii, Pilularia americana, Triteleia hyacinthina, Eleocharis spp., Eryngium petiolatum, Plagiobothrys figuratus, Plagiobothrys scouleri, Grindelia nana, Veronica peregrina, Deschampsia danthonioides, and Callitriche spp.

Rank

S Rank: S2S3 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: An S2S3 rank was assigned because this system has very limited extent and distribution and most occurrences are very small. Because information about current conditions and relative distribution on populated vs. unpopulated islands is sparse, the author is of the opinion that the overall extent, distribution and area of occupancy metrics should be prioritized. Thus, the S2S3 rank was assigned.

Range

Range Extent: C = 250-1000 square km (about 100-400 square miles)

Comments: This system consists of shallow, ephemeral wetlands located in bedrock depressions in the San Juan Islands. Extent was measured to be near 1,000 km2, but the measurement included intervening open water between islands. Thus, the "C=250-1000km2" rating was selected.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) did not map this system. The National Wetland Inventory (NWI) map was clipped to those occurring in the San Juan Islands and then filtered to palustrine emergent wetlands with temporariliy or seasonlly flooded hydrology. The result showed that 1,800 acres (~7 km2) of such wetlands occur on the San Juan Islands and areas near Fidalgo Head near Anacortes. Given that these vernal pools can be very small (5-10m2), NWI are undoubtedly missing many vernal pools. Despite this, the NWI estimate of ~7km2 is still likely a large overestimate. The "C=0.5-1km2" was chosen but based on typical very small size of individual pools.

Population and EOs

Number of EOs: B = 6 - 20

Comments: There are no element occurrences in Washington Natural Heritage Program's database. The author has observed a few of these pools on Young's Hill within San Juan National Historical Park and based on distribution there, the "B=6-20" rating was selected. As with the Columbia Plateau Vernal Pool, teh method for defining an occurrnece of this system is complex becuase numerous pools can occur within meters of each other yet are hydrologically distinct.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** E = Good (21-40%)

Comments: Very little is known about these vernal pools. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 19% of potential vernal pools (see comments for area of occupancy metrics) had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 19% is assumed to be a good estimate of the proportion of this Ecological System with good/excellent integrity, at least for pools on the larger islands with development and past and ongoing grazing. What isn't known is how many of these pools occur on the small islands with no permanent human occupancy as it is assumed that those islands have likely escaped significant past human impacts such as grazing of livestock. Those islands could support vernal pools with good ecological integrity. Given the latter, the "E=21-40%" rating was selected.

Number Protected EOs:

Comments:

Threats

Scientific Name: ***North Pacific Hardpan Vernal Pool*** **Elcode:** CES204.859

Common Name: North Pacific Hardpan Vernal Pool **Subnational ID:** 18294

Threats: C = Medium

Comments: Given the location of this system on bedrock, it is exposed to less threats that many other wetland types. Grazing is likely the primariy threat, and the degree to which this is still impacting hardpan vernal pools today is unknown. In places like Young Hill (English Camp on San Juan Island), past grazing surely impacted these pools. Nonnative species are also a threat in some pools. That said, very little is known about this system. Focused inventory and assesment work is needed to provide additional details.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: C = Medium
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: C = Medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: C = Medium
Comments:

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: Very little is known about these vernal pools but based on habitat locality on bedrock and /or areas of very shallow soils, it is unlikely that there has been significant, direct loss of this system. However, some land uses such as livestock grazing may have resulted in changes to ecological integrity over the years. More survey work is needed to shed light on current conditions and distribution of vernal pools (what proportion are located on heavily populated islands?).

Long-term Trend: F = Decline of 10-30%

Comments: Very little is known about these vernal pools but based on habitat locality on bedrock and /or areas of very shallow soils, it is unlikely that there has been significant, direct loss of this system. However, some land uses such as livestock grazing may have resulted in changes to ecological integrity over the years. More survey work is needed to shed light on current conditions and distribution of vernal pools (what proportion are located on heavily populated islands?). The "F=Decline of 10-30%" was selected based on the assumption that livestock grazing was more prevalent during early settlement.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 05-Mar-2015

Scientific Name: ***North Pacific Hardpan Vernal Pool*** **Elcode:** CES204.859

Common Name: North Pacific Hardpan Vernal Pool **Subnational ID:** 18294

Internal Notes:

Scientific Name: ***North Pacific Hardwood-Conifer Swamp*** **Elcode:** CES204.090

Common Name: North Pacific Hardwood-Conifer Swamp **Subnational ID:** 18429

Descriptors

Element Description: The North Pacific Hardwood-Conifer swamp ecological system is dominated by coniferous or hardwood trees in poorly drained environments with slowly moving or stagnant surface water. These swamps mostly are small-patch in size and occur sporadically in glacial depressions, in river valleys, around the edges of lakes and marshes, or on slopes with seeps. They are primarily found on flat to gently sloping lowlands up to 457 m (1500 feet) elevation but also occur in montane environments up to the lower limits of continuous forest (below the subalpine parkland). These sites are indicative of poorly drained, mucky areas. Groundwater or streams and creeks which do not experience significant overbank flooding are major hydrological drivers. Surface water may be slowly moving through the site or occur as stagnant pools. Accumulation of organic matter (woody peat or muck) can be important in some occurrences. Soils can be woody peat but are more typically muck or mineral soils often with a thin veneer of organic surface layers. Windthrow creates canopy gaps and pit-mound topography which increases microsite diversity. Downed trees, root wads, and mounds provide suitable substrates for tree and shrub species that are not able to establish on saturated soils. Hollows created by windthrow are often dominated by species tolerant of saturated soil conditions. Canopy gaps create a diversity of light conditions in the swamp. Beaver activity might also occur in these swamps.

These swamps are dominated by any one or a number of conifer and hardwood species (Tsuga heterophylla, Picea sitchensis, Tsuga mertensiana, Chamaecyparis nootkatensis, Pinus contorta var. contorta, Alnus rubra, Fraxinus latifolia, Betula papyrifera) that are capable of growing on saturated or seasonally flooded soils. Younger stands often have a significant component of Alnus rubra. Other trees which may be present include Rhamnus purshiana, Pyrus fusca, Abies amabilis, and Populus balsamifera ssp. trichocarpa. Old-growth Thuja plicata trees often have broken-tops and develop candelabriform limbs. Tsuga heterophylla is usually found on higher microsites such as buttress roots, stumps, and nurse logs. The overstory can be less than 50% cover while the shrub understory can be over 50% and dense. Many shrubs are often found growing on elevated microsites, especially on downed trees and mound topography created from windthrow. On extremely wet sites, shrubs are often confined to higher microsites such as root wads, rotten logs, and root buttresses. Shrub species include Oplopanax horridus, Salix lucida ssp. lasiandra, S. sitchensis, Acer circinatum, Vaccinium ovalifolium, Rubus spectabilis, Cornus sericea, Rubus parviflorus, Ribes bracteosum, Physocarpus capitatus, Gaultheria shallon, Spiraea douglasii, and Symphoricarpos albus. Herbaceous species, Lysichiton americanus and Carex obnupta often dominate water-filled depressions sometimes created by windthrow Athyrium filix-femina, Blechnum spicant, Adiantum pedatum, Petasites frigidus, Dryopteris expansa, Stachys ciliata, Tolmiea menziesii, Viola glabella, Tiarella trifoliata, Polystichum munitum, Maianthemum dilatatum, Galium triflorum, Montia sibirica, and Urtica dioica are other common herbaceous species found in these swamps.

Historic and contemporary use practices have impacted hydrologic, geomorphic, and biotic structure and function of hardwood-conifer swamps in Washington. Adjacent and upstream land uses also have the potential to contribute excess nutrients, alter hydrology, and provide a vector for non-native species into this ecological system. Intense logging disturbance often results in establishment of Alnus rubra that's converted many conifer-dominated stands to hardwood dominance. Rubus spectabilis responds similarly to alder and tends to dominate the understory after logging. Logging activities tend to reduce the amount of large woody debris and remove future sources of that debris. Logging also increases insolation of the soil surface resulting in higher temperatures, lower humidity, and more sunlight reaching the understory all of which can affect hydrological and nutrient processes and species composition . Timber harvest can also alter hydrology, most often resulting in post-harvest increases in peak flows. Logging can also result in mass wasting and related disturbances (sedimentation, debris torrents) in steep topography increase in frequency with road building and timber harvest. Increases in nutrients and pollutants are other common anthropogenic impacts. Reed canarygrass (Phalaris arundinacea) is an abundant non-native species in low-elevation, disturbed settings dominated by shrubs or deciduous trees. Many other exotic species also occur. This system has also decreased in extent due to agricultural development, roads, dams and other flood-control activities.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Although there may not have been a significant loss of extent (although many occurrences have likely been converted to a different wetland type as a result of logging), most occurrences of this system have been degraded from logging and roads.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Scientific Name: ***North Pacific Hardwood-Conifer Swamp*** **Elcode:** CES204.090

Common Name: North Pacific Hardwood-Conifer Swamp **Subnational ID:** 18429

Comments: This forested swamp systems is found in western Washington where it occurs in depressions , flats, and areas of groundwater discharge. It is found at all elevations but most common in the lowlands. Very large patches of this type occur on the western Olympic peninsula on the coastal plain.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 59,218 acres (~240 km2). The National Wetland Inventory (NWI) mapped an estimated 13,805 acres (~56 km2) of palustrine forested wetlands within western Washington. However, this value also includes four other Ecological Systems (North Pacific Lowland Riparian Forest and Shrubland, North Pacific Montane Riparian Woodland, North Pacific Intertidal Freshwater Wetland, and North Pacific Coastal Interdunal Wetland). Both maps were subjectively investigated by the author using GIS and compared to field-based observations. NWI maps under map the extent of forested swamps on the outer coast while the Ecological System maps appears to grossly undermap in the Puget lowlands. Field experience suggest the "H=100-500km2" is the best estimate of current occupancy.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 78 element occurrenes in WNHP database. There are undoubtedly more occurrenes on the landscape.

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** C = Small (5-10%)

Comments: Of the 78 element occurrences in WNHP database, 25 have good or excellent ecological integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 78% of all palustrine forested wetlands in western Washington had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 78% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity (in addition to the fact that the NWI estimate includes four other ecological systems). Based on personal observations, logging has impact most occurrences. Roads have also impacted hydrolgical integrity in many occurrences. Thus, the metric rating "C=small (5-10%)" was chosen.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: Most sites have been logged and thus old growth structural characteristics have been impacted. The abundance of hardwood species has also likely increased due to logging impacts.

Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	B = High
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	B = High
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	D = Low
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	D = Low
Comments:			

Scientific Name: ***North Pacific Hardwood-Conifer Swamp*** **Elcode:** CES204.090

Common Name: North Pacific Hardwood-Conifer Swamp **Subnational ID:** 18429

Threat Category: 9 - Pollution Level of Threat: C = Medium

Comments:

Threat Category: 9.3 - Agricultural & forestry effluents Level of Threat: C = Medium

Comments:

Trends

Short-term Trend: E **=** Decline of 30-50%

Comments: In the past 50 years, much decline is likely associated with changes in ecological integrity from logging and road impacts.

Long-term Trend: C = Decline of 70-80%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. However, Landfire's map lumped North Pacific Shrub Swamps with Norht Pacific Hardwood-Conifer Swamp into a single entityg called "North Pacific Swamps" thus it is difficult to know speficially how each system change. However, when compared as a single group, "Swamps" in western Washington showed a 15% decline in extent relative to estimated historical acreage (153,456 current acres vs. 180,463 historical acres). Based on field observations the author's opinion is that most loss has likely been associated with forested swamps given that can they have timber value. Logging has had a significant impact on most occurrences. Development and agriculture may have resulted in direct loss of extent. More commonly, impacts have been conversion from forested swamp to shrub swamps or herbaceous wetlands from logging (which can raise water tables and exclude reforestation) and degradation of forest struture (selective logging removes old, big trees and logging and associated physical site disturbance can increase the abundance of hardwood trees such as Alnus rubra and Acer macrophyllum).

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Joe Rocchio **Version Date:** 19-Feb-2015

Internal Notes:

Scientific Name: ***North Pacific Herbaceous Bald and Bluff*** **Elcode:** CES204.089

Common Name: North Pacific Herbaceous Bald and Bluff **Subnational ID:** 18430

Descriptors

Element Description: The North Pacific Herbaceous Bald and Bluff ecological system is a grassland / herbaceous-dominated, small patch system on steep, hilly terrain in the lowlands to mid-montane elevations extending from eastern Vancouver Island to the southern Willamette Valley. Due to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. The climate is relatively dry to wet (20 to 100 inches annual precipitation), always with a distinct dry summer season when these sites usually become droughty enough to limit tree growth and establishment. Most sites receive little snowfall, although sites in the Abies amabilis zone can have significant winter snowpack. Snowpacks would be expected to melt off sooner on these sunny aspect sites than surrounding areas. Seeps are frequent features that result in vernally moist to wet areas. Rock outcrops are a typical small-scale feature within balds and are considered part of this system (Chappell 2006). Landslides are a significant disturbance on coastal bluffs without persistent salt spray and high winds, especially on bluffs composed of glacial deposits. Landslides can both destroy these herbaceous communities and create new habitat for them by creating new barren surfaces that are colonized by herbaceous species.

Balds with many favorable microsites can have a "savanna" type structure with a sparse tree layer of Pseudotsuga menziesii or, less commonly at lower elevations, Arbutus menziesii or Quercus garryana. Vegetation varies among and within individual balds with relative differences in soil moisture. Grasslands are the most prevalent vegetation cover, though forblands are also common especially in the mountains. Dwarf-shrublands commonly occur, especially in mountains or foothills, as very small patches, usually in a matrix of herbaceous vegetation. Dominant or codominant native grasses include Festuca roemeri, Danthonia californica, Achnatherum lemmonii, Festuca rubra (near saltwater), and Koeleria macrantha (Chappell 2006). Forb diversity can be high and can include species such as Camassia quamash, Camassia leichtlinii, Triteleia hyacinthina, Mimulus guttatus (seeps), Plectritis congesta, Lomatium martindalei, Allium cernuum, and Phlox diffusa (can be considered a dwarf-shrub). Important dwarf-shrubs are Arctostaphylos uva-ursi, Arctostaphylos nevadensis, and Juniperus communis. Small patches and strips dominated by the shrub Arctostaphylos columbiana are a common feature associated with some herbaceous balds. Significant portions of balds, especially on rock outcrops, are dominated by bryophytes (mosses) and to a lesser degree lichens. Fires, both lightning-ignited and those ignited by people, occasionally burn these sites. Lower elevation sites probably burned more frequently and in some cases intentionally. Due to shallow soils, steep slopes, sunny aspect, and/or upper slope position, these sites are dry and marginal for tree establishment and growth except in favorable microsites. Disturbance patches within that are part of the variation the matrix forest may appear similar to balds but have a preponderance of forest species, such as, Gaultheria shallon and Mahonia nervosa.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Balds are uncommon and widely distributed in western Washington. Most are small patches in forest susceptible to tree invasion. Exotic grasses and shrubs can be problematic particularly more developed or timber managed landscapes. Most herbaceous plant association composing this ecological system are S1 and S2 ranks and the shrub associations are S3 to S4. The typical small size and and low elevation occurrence are susceptible to loss. Both raise uncertainity.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: Mid-montane to foothills including San Juans, surrounding the Puget Lowland to Columbia River (Chappell 2006 W06CHA01WAUS)

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 60 sqkm in Washington. Inspection of mapping reveals a likely mis-mapping and undermapping in the West Cascades but is unlikely to change the occupancy rank assigned.

Population and EOs

Number of EOs: C = 21 - 80

Comments: 37 ecologcial system occurrrences in WaNHP data

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:**

Comments: 21 A or B Wa NHP occurrences

Number Protected EOs:

Scientific Name: ***North Pacific Herbaceous Bald and Bluff*** **Elcode:** CES204.089

Common Name: North Pacific Herbaceous Bald and Bluff **Subnational ID:** 18430

Comments:

Threats

Threats: C = Medium

Comments: Fire suppression, weed invasion tree/shrub iinvasion (Chappell 2006). In the short-term, edge-mediated tree invasion threatens only very small balds (Chappell 2006) which are most balds.

Threat Category: 5 - Biological resource use Level of Threat: Unknown

Comments: Timber harvest activities can have direct or indirect effects.

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: Negligible

Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: D = Low

Comments: High numbers or frequency of visits can have negative consequences in terms of reduction of vegetation cover, trail proliferation, increase of non-native species, and in extreme cases, creation of bare ground and surface erosion (Chappell 2006)

Threat Category: 6.1 - Recreational activities Level of Threat: D = Low

Comments:

Threat Category: 7 - Natural system modifications Level of Threat: D = Low

Comments: Evidence suggest that balds burned more frequently than forests in pre-Western settlement times. The San Juan Islands pre-settlement fires were much more frequent than currently and many dry-site open areas have shrunk considerably in size in the last 100 years (ChappellL 2006). Montane balds show less evidence of being maintained or enlarged by historic burning.

Threat Category: 7.1 - Fire & fire suppression Level of Threat: D = Low

Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium

Comments: Bald are susceptibile to non-native species invasions (Chappell 2006). Many balds have Pseudotsuga saplings or small trees growing along shaded edges. In the short-term, edge-mediated tree invasion threatens only very small balds (those narrower than a tree height in width) (Chappell 2006).

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low

Comments:

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: C = Medium

Comments: Trees tend to invade some balds in the absence of fire. The potential for tree invasion leading to conversion to forest on what is left of herbaceous balds appears to be much less than on Puget Prairies (Chappell 2006). Trough prairies

Trends

Short-term Trend: E = Decline of 30-50%

Comments: Increased human activity throughout much of range has lead to some loss and degradtion Evidence suggest that balds burned more frequently than forests in pre-Western settlement times. Montane balds show less evidence of being maintained or enlarged by historic burning.

Long-term Trend: F = Decline of 10-30%

Comments: Evidence suggest that balds burned more frequently than forests in pre-Western settlement times. The San Juan Islands pre-settlement fires were much more frequent than currently and many dry-site open areas have shrunk considerably in size in the last 100 years (Chappell 2006). Montane balds show less evidence of being maintained or enlarged by historic burning.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Scientific Name: ***North Pacific Herbaceous Bald and Bluff*** **Elcode:** CES204.089

Common Name: North Pacific Herbaceous Bald and Bluff **Subnational ID:** 18430

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Chappell, C.B. 2006. Upland plant associations of the Puget Trough ecoregion, Washington. Natural Heritage Rep. 2006-01. Washington Department of Natural Resources, Natural Heritage Program, Olympia , Wash. [http://www1.dnr.wa.gov/nhp/refdesk/communities/pdf/intro.pdf].

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 31-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Hypermaritime Shrub and Herbaceous Headland*** **Elcode:** CES204.088

Common Name: North Pacific Hypermaritime Shrub and Herbaceous Headland **Subnational ID:** 18431

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The herbaceous parts of this system is rare and are highly invasible by shrubs.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 11 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: I suspect most shrub versions are in good or excellect. Grassland (2 eos B and C) occurrences are small and rare.

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown
Comments: storms increase bluff erosion

Threat Category: 11.4 - Storms & flooding Level of Threat: Unknown
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***North Pacific Hypermaritime Shrub and Herbaceous Headland*** **Elcode:** CES204.088

Common Name: North Pacific Hypermaritime Shrub and Herbaceous Headland **Subnational ID:** 18431

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 31-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Hypermaritime Sitka Spruce Forest*** **Elcode:** CES204.841

Common Name: North Pacific Hypermaritime Sitka Spruce Forest **Subnational ID:** 18287

Descriptors

Element Description: The North Pacific Hypermaritime Sitka Spruce Forest system is a matrix to large patch type restricted to the hypermaritime (hypermaritime continentality sensu Klinka et al. 1989) climatic areas near the Pacific Coast, along a fog belt from Point Arena, California, north to the Kenai Peninsula, Alaska. The system is part of the coastal temperate rain forests of North America which contain the largest, most commercially valuable, and fastest-growing trees, the oldest and most fought-over forests (McKinnon 2003). Some of the system's associated forests are among the most productive in the world (Van Pelt 2007). The Washington Sitka spruce forests are found in the outermost coastal fringe where salt spray is prominent and on riparian terraces and valley bottoms near the coast where there is major fog accumulation. The system is found mostly below 300 m (985 ft) elevation and within 25 km (15 miles) of the outer coast when not restricted to valley bottoms. The associated hypermaritime climate has cool summers, abundant fog, and very wet winters without a major snowpack. Summer fogs are important ecological drivers as they ameliorate the effects of reduced summer precipitation. Annual precipitation averages 150 inches, with the majority falling as rain, which can be heavy. Soils are often leached and nutrient-poor with much of the soil nutrients in the surface organic matter layers (McKinnon 2003).

Stands are typically dominated or codominated by Picea sitchensis (over 10% cover) and often have a mixture of other conifers, such as Tsuga heterophylla (typically codominant or most abundant tree), Thuja plicata, or Chamaecyparis nootkatensis. Pseudotsuga menziesii is part of this system south into Oregon but rare in Washington except in the extreme southwest. The understory is rich with shade-tolerant species including evergreen shrubs Gaultheria shallon, and Vaccinium ovatum, forbs Maianthemum dilatatum and Oxalis oregana, and ferns Polystichum munitum, Dryopteris spp., and Blechnum spicant. A high diversity of mosses (commonly Hylocomium splendens and Rhytidiadelphus loreus) and lichens are abundant on logs, snags, trees, or the ground surface. Rubus spectabilis and Acer circinatum are common and persistent shrubs following disturbance. Plant species and community change is similar among old growth and earlier stand developmental stages although some species are more common on old growth.

Pre-settlement forests were mostly old-growth (a British Columbia project found 98% of hypermaritime forest stand age classes were greater than 141 years, McKinnon 2003) with abundant large woody debris. Picea sitchensis is seral to Tsuga heterophylla and is retained this system by canopy openings. The primary disturbance regime is mostly small-scale windthrow and other gap processes such as persistent salt-spray, slope movements and pathogens (Taylor 1990). There are occasional (average 20 years Henderson et al. 1989; 100-200 years Landfire 2007) widespread intense windstorms and very few fires. Wind disturbance in contrast to fire tends to topple taller trees and leave small trees, while the tallest trees are often the most wind-firm by surviving normal wind events and are left in major events (Van Pelt 2007). Taylor (1990) report canopy gaps aged between 11 and 105 years, occupy 14 to 30% of in Picea sitchensis- Tsuga heterophylla hypermaritime forests in northern Oregon. Natural blowdown patches in Alaska hypermaritime forests are small (less than 50 acres) and scattered (Nowacki and Kramer 1998). Patches are concentrated on ridgetops and upper slopes. Forest turnover is estimated to be between 206 and 422 years (Taylor 1990). Nowacki and Kramer (1998) cite that the 50 percent of the hypermaritime forest landscape on an Alaska Island was a mix of small - and large-scale disturbances. Harcombe and others (2005) concluded that Sitka spruce forests are composed of large multi-aged disturbance patches often reflecting topography. In some topographic locations, forests may be retained truncated developmental stages due to frequency of wind events, that is, never develop beyond stem exclusion stage.Daniels and Gray (2006) summarize that mean fire return intervals are typically over 1000 years in the hypermaritime forests in British Columbia. Fire is more important in southern coastal forest (Harcombe et al. 2005). In general, the flammability ratings of the wet coastal temperate rain forest are low. Coarse woody debris accounts for the majority of persistent surface fuels that stays moist under moss and herbs and in the shade of multiple layers of trees and shrubs. Biomass is relatively stable with similar total amounts in old-growth and second-growth stands (Harcombe et al. 2005). Schreiner and others (1996) show that elk herbivory is an important part of the relationship between patch type and tree fall in the pattern of old growth Picea sitchensis forest on the Olympic Pennisula.

Rank

S Rank: S1S2 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Uncommon to rare in an undisturbed condition. Many of known stands are small remnants. This reflect past management removal of trees, often burning or heavy site disturbance before planting off-site Douglas-fir, short rotations. Most protected areas along the Pacific Coast were logged in past.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Scientific Name: ***North Pacific Hypermaritime Sitka Spruce Forest*** **Elcode:** CES204.841

Common Name: North Pacific Hypermaritime Sitka Spruce Forest **Subnational ID:** 18287

Comments: Based on extent of Jan Henderson's Sitka spruce zone and extent of system as mapped by NatureServe (Sayre et al. 2009)

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map estimate of 2038 sqkm looks right. Although much is on industrial forest land that I must assume is mostly planted and site disturbed. The National Park coastal strip was at least high graded.

Population and EOs

Number of EOs: B = 6 - 20

Comments: 20 locations with 37 plant association occurrences in WANHP database.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: 12 locations (60% of total) with 17 plant association occurrences in WaNHP data. The amount of mapped area beyond 800 ft of road is used as measure of areas that have likely not been logged. Only 22% of mapped areas (Sayre et al. 2009) are beyond 800 ft of a road. 90% or more of mapped area appears to be on land mostly managed for timber, plantations common. Personnel experience suggest that undisturbed examples of this type are very hard to find.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: Not sure if logging threats are increasing on remaining areas. Possible climate change effects.

Threat Category: 5 - Biological resource use Level of Threat: B = High

Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High

Comments:

Trends

Short-term Trend: C = Decline of 70-80%

Comments: Logging accelerated on Olympic peninusla in 1970's.

Long-term Trend: C = Decline of 70-80%

Comments: Selective logging of Sitka spruce in 1920-30s and clearcut logging in 1960s.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Scientific Name: ***North Pacific Hypermaritime Sitka Spruce Forest*** **Elcode:** CES204.841

Common Name: North Pacific Hypermaritime Sitka Spruce Forest **Subnational ID:** 18287

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest*** **Elcode:** CES204.842

Common Name: North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest **Subnational ID:** 18289

Descriptors

Element Description: The North Pacific Hypermaritime Western Redcedar-Western Hemlock Forest system is a matrix to large patch type restricted to the hypermaritime (hypermaritime continentality sensu Klinka et al. 1989) climatic areas near the Pacific Coast centered in the northern coast of British Columbia into the southern half of southeastern Alaska and south into Washington. This is usually inland of the coastal fog zone and down slope of the rain-on-snow zone. The system occurs on low, gentle relief appearing mostly below 600 m (1970 ft) elevation and usually within 25 km (15 miles) of the outer coast. The associated hypermaritime climate has cool summers, fog, and very wet winters without a major snowpack. Annual precipitation is 100 to 150 inches, with the majority falling as rain, which can be heavy. Soils are often leached and nutrient-poor with much of the soil nutrients in the surface organic matter layers (MacKinnon 2003). Soils typically have a distinct humus layer overlying mineral horizons or bedrock and are often poorly drained. These forests are best developed in a mosaic with forested wetlands, bogs, and Picea sitchensis forests associated with valley bottoms on steep, more productive soils.
The forests are often open and scrubby but can be closed. Thuja plicata is always present and typically is dominant or codominant often with Tsuga heterophylla as codominant. Pinus contorta or Abies amabilis can be part of the canopy. In Washington, nearly pure stands of Tsuga heterophylla are common and seem to be associated with microsites most exposed to intense windstorms. Pseudotsuga menziesii is rare in Washington. Picea sitchensis can be present (less than 10% cover) put never common. The understory is rich with shade-tolerant species including shrubs Gaultheria shallon, and Vaccinium ovalifolium, forbs Maianthemum dilatatum and Oxalis oregana, and ferns Polystichum munitum, Dryopteris spp., and Blechnum spicant which can be abundant. A high diversity of mosses (commonly Hylocomium splendens and Rhytidiadelphus loreus) and lichens are abundant on logs, snags, trees, or the ground surface. Rubus spectabilis and Acer circinatum are common and persistent shrubs following disturbance. Plant species and community change is similar among old growth and earlier stand developmental stages although some species are more common on old growth.
Pre-settlement forests were mostly old-growth (a British Columbia project found 98% of hypermaritime forest stand age classes were greater than 141 years, MacKinnon 2003) with abundant large woody debris. Van Pelt (2007) maps the presettlement distribution of 1000 year and older Thuja plicata forest in Washington reflecting the extent of this system near the outer coast. These forests very rarely burn and are more influenced by gap disturbance processes and intense windstorms than by fire. Intense windstorms are occasional (average 20 years Henderson et al. 1989; 100-200 years Landfire 2007) and widespread. Wind disturbance in contrast to fire tends to topple taller trees and leave small trees, while the tallest trees are often the most wind-firm by surviving normal wind events and are left in major events (Van Pelt 2007). Thuja plicata often are over 1000 years old and with candelabra tops reflecting past wind breakage and other top kill events (Van Pelt 2007). Wind effects are in the range of 1-1000 of hectares (2.5-2500 acres); most are 10-100 ha (25-250 ac) (Landfire 2007). Natural blowdown patches in Alaska hypermaritime forests are small (less than 50 acres) and scattered (Nowacki and Kramer 1998). Patches are concentrated on ridgetops and upper slopes and some locations development beyond the stem exclusion stage is rare due to repeated blowdown. Tsuga heterophylla is the usual dominant in these blown down forests. Nowacki and Kramer (1998) cite that the 50 percent of the hypermaritime forest landscape on an Alaska Island was a mix of small- and large-scale disturbances. Mean fire return intervals are typically over 1000 years in the hypermaritime forests in British Columbia and Landfire (2007) state that is no evidence of fire in these forests. In general, the flammability ratings of the wet coastal temperate rain forest are low. Coarse woody debris accounts for the majority of persistent surface fuels that stays moist under moss and herbs and in the shade of multiple layers of trees and shrubs.

Rank

S Rank: S1S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Uncommon to rare in an undisturbed condition. Many of known stands are small remnants. High-graded stands with minimal other disturbance will take centuries for large trees to recover. Uncommon to rare in an undisturbed condition. Many known stands are small remnants.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Extent based on NatureServe's Ecological Systems map (Sayre et al. 2009).

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 1035sqkm. Likely a reasonable estimate but many areas logged are mapped as this type.

Scientific Name: ***North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest*** **Elcode:** CES204.842

Common Name: North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest **Subnational ID:** 18289

Population and EOs

Number of EOs: B = 6 - 20

Comments: 11 sites with 24 WANHP plant association element occurrences.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** B = Very small (<5%)

Comments: 7 of 11 sites in WANHP database are A or B ranked occurrences. The amount of mapped area beyond 800 ft of road is used as measure of areas that have likely not been logged. Only 16% of mapped areas (Sayre et al. 2009) are beyond 800 ft of a road suggesting most has been logged. Comer and Hak (2009)'s Landscape Condition Model indicates that 0% of area has >80% LCM index score, suggesting no areas are in good/excellent condition. DNR old growth model indicates about 3% of Olympic Experimental State Forest is old growth sitka spruce/western hemlock. Only small patches of A and B condition rank exist.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Most known element occurrrences have some form of protection.

Threat Category: 5 - Biological resource use Level of Threat: C = Medium

Comments: removal of LWD and large trees, thinning, short rotations, site disturbance

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: C = Medium

Comments: removal of LWD and large trees, thinning, short rotations, site disturbance

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: D = Low

Comments: planting Douglas-fir

Trends

Short-term Trend: C = Decline of 70-80%

Comments: Logging was accelerated on Olympic peninusla in 1970's.

Long-term Trend: D = Decline of 50-70%

Comments: There may have been a 54% decrease over 200 years estimated from NatureServe's Ecological Systems map (Sayre et al. 2009) compared to LANDFIRE Biophysical Unit map. The LANDFIRE map of the system barely overlaps the NatureServe map, as such this calculation under estimates loss.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

Henderson, Jan. 1986. Key to forested plant associations of the Olympic National Forest. .

Scientific Name:	***North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest***	**Elcode:**	CES204.842
Common Name:	North Pacific Hypermaritime Western Red-cedar-Western Hemlock Forest	**Subnational ID:**	18289

MacKinnon, A. 2003. West coast, temperate, old-growth forests. The Forestry Chronicle 79(3): 475-484.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Nowacki, G. J.; Kramer, M. G. 1998. The effects of wind disturbance on temperate rain forest structure and dynamics of southeast Alaska. Gen. Tech. Rep. PNW-GTR-421. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 25 p

Van Pelt, R. 2007. Identifying Mature and Old Forests in Western Washington. Wa. Dept Natural Resources, Olympia Wa. 104p.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Intertidal Freshwater Wetland*** **Elcode:** CES204.875

Common Name: North Pacific Intertidal Freshwater Wetland **Subnational ID:** 18300

Descriptors

Element Description: Substrates vary along the tidally-influenced but non-marine portions of rivers. This environment results when a heavier saltwater "wedge," pushes under freshwater. Freshwater then backs-up in rivers and sloughs spilling over on to adjacent floodplains. Overflow water is typically less than 0.5 parts per thousand salts (Kunze 1994). Related topography is created by river flooding events of sediments and large woody debris deposition and daily scouring and reworking by tidal action. Vegetation structure and composition varies and depend on substrate characteristics , elevation, and tidal flooding regime of particular sites. The vegetation is complex and includes tree-, shrub- and herbaceous-dominated patches. Little detailed vegetation data collection has occurred in this type. Existing studies indicate dominant species include Picea sitchensis, Alnus rubra trees, Cornus sericea, Rubus spectabilis, Salix sitchensis shrubs and herbaceous plants such as Carex lyngbyei, Myriophyllum hippuroides, Typha angustifolia, Athyrium filix-femina, and Carex obnupta.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of tidal areas in Washington . Hydrological alterations, especially those which alter tidal exchange, would have a negative effect on ecological processes and species composition. Natural sedimentation from the watershed changes elevation and the influence of tidally flooded areas. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Channel flow and tidal inundation are disrupted by construction of jetties, dikes, and dams. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of wetland habitat. Where the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader. Timber harvesting changes stand structure , wildlife habitat, site topography. Human land uses both within the wetland as well as in adjacent upland areas have reduced connectivity between wetland patches and upland areas. Land uses in contributing the watershed have the potential to contribute excess nutrients into to the system which could lead to the establishment of non-native species and/or dominance of native increasing species. The invasive weeds, for example Phalaris arundinacea, Polygonum sachalinense, and Rubus armenicus are problems in these freshwater wetlands. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Although most wetlands receive regulatory protection at the national, state, and county level, many have been and continued to be filled, drained, grazed, and farmed extensively (Chappell 2000). Additionally, these regulations only pertain to the filling of these wetlands and do not regulate alterations in ecological conditions of these sites.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This sytems has a narrow ecological niche and has experienced significant loss and/or conversion from historical conditions due to various stressors. Although there are significant areas of this type left, most occurrences have been impacted to some degree, especially by nonnative species such as Phalaris arundianceae.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: This structurally variable, tidally-influenced freshwater wetland system occurs primarily along the tribuataries and the mainstem of the lower Columbia and Chehalis rivers. The system is also found around the mouths of larger rivers that discharge into the Puget Sound (e.g., Nisqually River). Extent was coarsely measured at ~ 3,000 km2, thus the "D=1000-5000 km2" rating was selected.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 25,194 acres (~102 km2) of this system occurs in Washington. Based on field experience, the Ecological Systems map estimate was spot-checked using aerial photos and was concluded to be an underestimate of this sytem. The Ecological Systems maps seems to have only included tidall-influenced emergent or shrubland sites. Most tidally-influenced spruce swamps were mapped as riparian or hardwood-conifer swamps. National Wetland Inventory (NWI) maps did not allow for a straightforward estimate. Marcoe and Pilson (2011) esimated that historically the lower Columbia River estuary supported 39,440 acres (~160 km2) of forested and scrub-shrub tidally influenced wetlands and another 35,466 acres of tidally influenced herbaceous wetlands. The forested and scrub-shrub tidally influenced wetlands are most likely part of this system whereas tidally influenced herbaceous wetlands could also be classified as Temperate Pacific Salt and Brackish Marsh ecological system. Thus, somewhere between 39,440 to 55,000 acres (~160-223 km2) of this ecological system historically occurred in the lower Columbia River (Marcoe and Pilson 2011). Fresh et al. (2011) estimated freshwater tidal swamps covered > 190m2 of Puget Sound's largest river deltas. Based on these variable estimates the "H=100-500km2" was selected as the best estimate of area occupied throughout the range of this sytem in Washington .

Scientific Name: ***North Pacific Intertidal Freshwater Wetland*** **Elcode:** CES204.875

Common Name: North Pacific Intertidal Freshwater Wetland **Subnational ID:** 18300

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are 33 element occurrences in the Washington Natural Heritage Program's database. More occurrences occur on the landscape. The "C=21-80" was selected as the best estimate of number of occurrences.

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** C = Small (5-10%)

Comments: Of the 33 element occurrences, 29 have excellent to good ecological integrity. However, a low percentage of the total area of this sytem is believe to have excellent/good integrity due to nonnative species (e.g., Phalaris arundianceae, Lythrum salicaria, etc.), hydrological alterations from roads and other structures, logging, and associated stressors from agriculture and development.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Dams along the Columbia River, nonnative species (Phalaris arundianceae, Lythrum salicaria), logging, roads, agriculture and development are current threats.

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments:

Threat Category: 5 - Biological resource use Level of Threat: B = High
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High
Comments: many sites have been impacted by past logging

Threat Category: 7 - Natural system modifications Level of Threat: B = High
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: B = High
Comments: dams along Columbia River

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments: Phalaris arundinacea is abundant

Trends

Short-term Trend: D = Decline of 50-70%

Comments: Marcoe and Pilson (2011) estimated a 75% loss of forested intertidal swamps, 46$ loss of scrub-shrub intertidal swamps, and 68% loss of herbeceous intertidal wetlands (the latter includes Temperate Pacific Salt and Brackish Marsh) in the lower Columbia River. Based on field observations similarily significant losses may have occurred in the lower Chehalis river. It is not know what degree of loss may have occurred elsewhere within the range of the system. Degradation of most remaining occurrences due to infestation of nonnative species, hydrological alterations, roads, agriculture, and development has also occurred.

Long-term Trend: D = Decline of 50-70%

Comments: Marcoe and Pilson (2011) estimated a 75% loss of forested intertidal swamps, 46% loss of scrub-shrub intertidal swamps, and 68% loss of herbeceous intertidal wetlands (the latter includes Temperate Pacific Salt and Brackish Marsh) in the lower Columbia River. Based on field observations similarily significant losses may have occurred in the lower Chehalis river. It is not know what degree of loss may have occurred elsewhere within the range of the system. Degradation of most remaining occurrences due to infestation of nonnative species, hydrological alterations, roads, agriculture, and development has also occurred. Fresh et al. (2011) reports an estimated loss of 90% of freshwater tidal wetlands (approximatley 93% loss of tidal swamps) in the Puget Sound.

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***North Pacific Intertidal Freshwater Wetland*** **Elcode:** CES204.875

Common Name: North Pacific Intertidal Freshwater Wetland **Subnational ID:** 18300

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Fresh, K.L., M.N. Dethier, C.A. Simenstad, M. Logsdon, H. Shipman, C.D. Tanner, T.M. Leschine, T.F. Mumford, G. Gelfenbaum, R. Shuman, and J.A. Newton. 2011. Implications of Observed Anthropogenic Changes to the Nearshore Ecosystems in Puget Sound. Prepared in Support of Puget Sound Nearshore Ecosystem Restoration Project. Technical Report 2011-03

Kunze, L. M. 1994. Preliminary classification of native, low elevation, freshwater wetland vegetation in western Washington. Washington State Department of Natural Resources, Natural Heritage Program. 120 pp.

Marcoe, K. and S. Pilson. 2011. Habitat Change in the Lower Columbia River and Estuary, 1870-2011. Lower Columbia River Estuary Partnership. Portland, Or. Online: http://www.estuarypartnership.org/historical-habitat-change-lower-columbia-river-1870-2010

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 04-Mar-2015

Internal Notes:

Scientific Name: ***North Pacific Lowland Riparian Forest and Shrubland*** **Elcode:** CES204.869

Common Name: North Pacific Lowland Riparian Forest and Shrubland **Subnational ID:** 18298

Descriptors

Element Description: This riparian ecological system occurs throughout the Pacific Northwest and in Washington is most abundant throughout low elevations west of the Cascades and is also found along the eastern base of the Cascades south of Lake Chelan. These forests and tall shrublands are linear in character, occurring on low-elevation, alluvial floodplains that are confined by valleys and inlets or lower terraces of rivers and streams. Riparian forests are the most structurally and floristically diverse type of vegetation in the Pacific coastal region (Naiman and Bilby 1998). This ecological system is spatially heterogeneous with a multitude of vegetation patches occurring within the riparian zone. Complex geomorphic and biotic components and processes maintain the long-term integrity of this system. Riverine flooding and the succession that occurs after major flooding events are the major natural processes that drive this system. The system does not develop under stagnant hydrological regimes (i.e. is not a swamp). Frequent flooding erodes existing streambanks, deposits sediment and nutrient on existing communities, and creates new substrates for primary succession. Beaver activity is an important driver of hydrological change and subsequent development of a diversity of habitat patches. The contribution of large woody debris (LWD) from riparian or adjacent upland trees is important to maintaining the hydrological and sediment regimes. LWD has a significant impact on the evolution of channel morphology and also contributes to the spatial distribution and diversity of habitat patches within this system. Annual flooding is a key ecological processes which results in a diversity of patch types such as woodlands, shrublands, wet meadows, and marshes. These various plant communities are adapted to specific flooding regimes or seral stages. Very early successional stages can be sparsely vegetated or dominated by herbaceous vegetation. Willows such as Salix sitchensis may also dominate early- to mid-seral types. Dominant species of mid- to late-seral patches are typically deciduous trees (i.e., Populus balsamifera ssp. trichocarpa and Alnus rubra) but conifers can be dominant as well. Conifers such as Abies grandis, Pseudotsuga menziesii, Picea sitchensis, and Thuja plicata tend to increase with succession in the absence of major disturbance. Conifer-dominated plant communities are now very rare and not well described are important. Major broadleaf dominant species are Acer macrophyllum, Alnus rubra, Populus balsamifera ssp. trichocarpa, Salix sitchensis, Salix lucida ssp. lasiandra, Cornus sericea, and Fraxinus latifolia.

Historic and contemporary use practices have impacted hydrologic, geomorphic, and biotic structure and function of riparian areas in Washington. Human land uses both within the riparian area as well as in adjacent and upland areas have fragmented many riparian reaches which has reduced connectivity between riparian patches and riparian and upland areas. Adjacent and upstream land uses also have the potential to contribute excess nutrients into riparian areas. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrologic and sediment regimes. Alterations to both processes can affect the establishment of new and maintenance of existing riparian vegetation. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. Logging activities tend to reduce the amounts of large woody debris in streams and remove future sources of that debris. Timber harvest can also alter hydrology, most often resulting in post-harvest increases in peak flows. Mass wasting and related disturbances (stream sedimentation, debris torrents) in steep topography increase in frequency with road building and timber harvest. Roads and other water diversion/retention structures change watershed hydrology with wide-ranging and diverse effects, including major vegetation changes. The most significant of these are the major flood controlling dams, which have greatly altered the frequency and intensity of bottomland flooding. Increases in nutrients and pollutants are other common anthropogenic impacts Phalaris arundinacea is an abundant non-native species in low-elevation, disturbed settings dominated by shrubs or deciduous trees. Many other exotic species also occur. This system has also decreased in extent due to agricultural development, roads, dams and other flood-control activities.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Over half of this ecological system is estimated to have been lost. In addition, many, if not the majority, of extant occurrences have been degraded from a variety of stressors.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: These riparian forests and shrublands are found along stream and river corridors in the lowlands of western Washington.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***North Pacific Lowland Riparian Forest and Shrubland*** **Elcode:** CES204.869

Common Name: North Pacific Lowland Riparian Forest and Shrubland **Subnational ID:** 18298

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 515,891 acres (~2,088 km2) while National Wetland Inventory (NWI) mapped an estimated 34,061 acres (~138 km2) of palustrine forested and scrub-shrub wetlands within western Washington. However, this value also includes five other Ecological Systems (North Pacific Hardwood-Conifer Swamp, North Pacific Montane Riparian Woodland, North Pacific Intertidal Freshwater Wetland, North Pacific Shrub Swamp and North Pacific Coastal Interdunal Wetland). Both maps were subjectively investigated by the author using GIS and compared to field-based observations. Generally, NWI maps under map the extent of riparian while the Ecological System maps appears to overmap in some areas. In general, though, field experience suggests the actuall area of occupancy is likely closer to the Ecological Systems map estimate. Thus, "G=500-2000km2" was chosen.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 53 element occurrences in the WNHP database. There are undoubtedly more on the landscape. Given the linear and connective nature of this ecological system, it is difficult to discern discrete occurences. That said, based on field experience, "D=81-300" was chosen as the best estimate of the number of discrete occurrences.

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: Of the 53 element occurrences in the WNHP database, only 13 have excellent to good ecological integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 81% of all palustrine forested and scrub-shrub wetlands in western Washington had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 81% is assumed to be an overestimate of the area with good/excellent integrity (in addition to the fact that the NWI estimate includes four other ecological systems). Based on personal observations, agriculture, development, roads, logging, and nonnative species have impacted the majority of occurrences. Thus, the metric rating "D=moderate (11-20%)" was chosen.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: A large number of different stressors are impacting this system.

Threat Category:	1 - Residential & commercial development	Level of Threat:	C = Medium
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	D = Low
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			

Scientific Name: ***North Pacific Lowland Riparian Forest and Shrubland*** **Elcode:** CES204.869

Common Name: North Pacific Lowland Riparian Forest and Shrubland **Subnational ID:** 18298

Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			
Threat Category:	9 - Pollution	Level of Threat:	D = Low
Comments:			
Threat Category:	9.1 - Domestic & urban waste water	Level of Threat:	D = Low
Comments:			
Threat Category:	9.3 - Agricultural & forestry effluents	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: E **=** Decline of 30-50%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. That analysis showed that 55% of this Ecological System has been lost. It is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. Thus, the loss was equally splti between short- and long-term trends. In addition, logging, roads, development, agriculture, and grazing have resulted degradation of many extant occurrences. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames.

Long-term Trend: E = Decline of 30-50%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. That analysis showed that 55% of this Ecological System has been lost. It is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. Thus, the loss was equally splti between short- and long-term trends. In addition, logging, roads, development, agriculture, and grazing have resulted degradation of many extant occurrences. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Scientific Name: ***North Pacific Lowland Riparian Forest and Shrubland*** **Elcode:** CES204.869

Common Name: North Pacific Lowland Riparian Forest and Shrubland **Subnational ID:** 18298

Version

Version Author: Joe Rocchio **Version Date:** 20-Feb-2015

Internal Notes:

Scientific Name: ***North Pacific Maritime Coastal Sand Dune and Strand*** **Elcode:** CES200.881

Common Name: North Pacific Maritime Coastal Sand Dune and Strand **Subnational ID:** 18303

Descriptors

Element Description: Coastal dunes include beach strand (not the beach itself but sparsely or densely vegetated areas behind the beach), foredunes, sand spits, and active to stabile backdunes and sandsheets. Coastal dunes often front portions of inlets and tidal marshes. These communities are dependent upon long shore drift and wind. Most of these are spits or berms behind sandy beaches. In their natural state these are dominated by short to medium-tall grasses, sedges, or forbs, often with abundant bare sandy or gravelly surface exposed.
Coastal dune vegetation typically includes herbaceous, succulent, shrubs and tree species with varying degrees of tolerance for salt spray, wind and sand abrasion, and substrate stability. Dune succession is highly variable, so species composition can vary significantly among occurrences and add significantly to the overall species richness of an locale (Peinado and other 2007). Beach strands and low dunes may have Ambrosia chamissonis, Abronia latifolia, Cakile maritime and C. edentula. Dunes can be dominated by grasses, Leymus arenarius (= Elymus arenarius), Festuca rubra, Leymus mollis, or various forbs adapted to salty dry conditions. Gaultheria shallon and Vaccinium ovatum are major shrub species. Forested portions of dunes are included within this system and are characterized in Washington by Pinus contorta var. contorta early in succession, Picea sitchensis somewhat later in the sere, and in some seres Tsuga heterophylla. Characteristic Pacific Northwest coastal dune species include Abronia latifolia, Abronia umbellata ssp. breviflora, Ambrosia chamissonis, Calystegia soldanella, Camissonia cheiranthifolia, Leymus mollis, Lathyrus japonicas, Polygonum paronychia, and Tanacetum camphoratum (Zarnetske and other 2007). The mosaic of sparse to dense vegetation development in dune systems is driven by sand deposition, erosion, and lateral movement (Weidemann 1984). Disturbance processes include dune blowouts caused by wind and occasional wave overwash during storm tidal surges.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Uncommon; Dune stabilization and development; introduced grasses and shrubs that stabilize and change dune processes. Bluff and shoreline barriors (bulkheads) change sedimentation from feeder bluffs that alter spit and berm development.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Approximated point-to-point DNR ShoreZone inventory for dunegrass (http://www.dnr.wa.gov/researchscience/topics/aquatichabitats/pages/aqr_nrsh_inventory_projects.aspx) distribution to arrive at 4000 sqkm estimate.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 72 sqkm in SW Washington. DNR ShoreZone inventory for dunegrass (http://www.dnr.wa.gov/researchscience/topics/aquatichabitats/pages/aqr_nrsh_inventory_projects.aspx) estimated 90-180 sqkm. This overestimates because dunesgrass is in linear distance, I assumed average with 100-200 meters.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** C = Small (5-10%)

Comments: About 42% of area mapped in NatureServe's Ecological System map (Sayre et al. 2009) occur beyond 800ft of road, which is assumed to mean those areas are likely in good ecological condition. Large dunes areas in SW WA are dominated by exotic grass (Ammophila spp.) (Seabloom and Wiedemann 1994). Areas in Puget and Salish Sea spits are in ok condition.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Scientific Name: ***North Pacific Maritime Coastal Sand Dune and Strand*** **Elcode:** CES200.881

Common Name: North Pacific Maritime Coastal Sand Dune and Strand **Subnational ID:** 18303

Comments: Dune stabilization and development; introduced grasses and shrubs that stabilize and change dune processes. Bluff and shoreline barriors (bulkheads) change sedimentation from feeder bluffs that alter spit and berm development.Dune stabilization and development; introduced grasses and shrubs that stabilize and change dune processes. Bluff and shoreline barriors (bulkheads) change sedimentation from feeder bluffs that alter spit and berm development.

Threat Category: 1 - Residential & commercial development Level of Threat: CD = Medium - low
Comments: BPJ could do some GIS intersection

Threat Category: 1.1 - Housing & urban areas Level of Threat: CD = Medium - low
Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low
Comments: Dams on Columbia limit sand deposition for SW Wa dunes

Threat Category: 7.2 - Dams & water management/use Level of Threat: CD = Medium - low
Comments: Dams on Columbia limit sand deposition for SW Wa dunes; buldheads and other bluff and shoreline stabilization robs spits of sediment and changes natural process.

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: AB = Very high - high
Comments: Dune stabilization by exotics Amophila spp, Cytisis, Ulex plus native trees and shrubs.

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: AB = Very high - high
Comments: Dune stabilization by exotics Amophila spp, Cytisis, Ulex plus native trees and shrubs.

Trends

Short-term Trend: D **=** Decline of 50-70%

Comments:

Long-term Trend: C = Decline of 70-80%

Comments: Seabloom and Wiedemann (1994) site several references that Ammophila, since ist introduction in 1900, has become naturalized along the entire North American Pacific coast. In Washington all the large dunes are dominated by Ammophilla.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Seabloom, E.W. and Wiedemann, A.M. 1994. Distribution and effects of Ammophila breviligulata Fern. (American beachgrass) on the foredunes of the Washington coast. Journal of Coastal Research, 10(1), 178-188.

Wiedemann, A.M. 1984. The ecology of Pacific Northwest coastal sand dunes: a community profile. USDI Fish and Wildlife Service, Washington, D.C.

Scientific Name: ***North Pacific Maritime Coastal Sand Dune and Strand*** **Elcode:** CES200.881

Common Name: North Pacific Maritime Coastal Sand Dune and Strand **Subnational ID:** 18303

Zarnetske, P. L., E. W. Seabloom, and S. D. Hacker. 2010. Non-target effects of invasive species management: beachgrass, birds, and bulldozers in coastal dunes. Ecosphere 1(5):13.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest*** **Elcode:** CES204.001

Common Name: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest **Subnational ID:** 18432

Descriptors

Element Description: This and the North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock forest ecological system combine to form the matrix vegetation in the lower montane, foothills and lowlands of western British Columbia, western Washington and much of western Oregon except in rainshadows. In Washington, the North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest (hereafter referred to as Dry-Mesic) appears as the forest matrix in a landscape mosaic with the North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest system (hereafter referred to as Mesic-Wet) that occurs in mesic-wet environments.
The Dry-Mesic system occurs as lowland forests on dry to mesic sites. These forests are best represented on lower mountain slopes with high precipitation, long frost-free periods, and low to moderate fire frequencies. The associated climate is relatively mild and moist to wet. Mean annual precipitation is mostly 90-254 cm (35-100 inches) falling mostly as winter rain. Elevation ranges from sea level to 610 m (2000 feet). Snowfall is rare in lower elevations but occurs more regularly with increasing elevation but rarely establishes a snow pack. Topography ranges from relatively flat glacial till plains to steep mountainous terrain. Dry-Mesic fores are on soils are generally well-drained and are mesic to dry for much of the year.
The Dry-Mesic system is characterized by giant Pseudotsuga menziesii forests with Tsuga heterophylla or Thuja plicata co-dominant or occasional in the understory. Other tree species such as Abies grandis, Acer macrophyllum, Thuja plicata, Acer macrophyllum, Abies grandis, and Pinus monticola appear less abundantly but sometimes can be significant canopy components. Tsuga heterophylla is generally the dominant regenerating tree species and is typically lacking from young stands, especially in the Puget Lowlands. Late seral stands typically have an abundance of large coniferous trees, a multi-layered canopy structure, biological legacies of large snags, and many large logs on the ground. Early seral stands typically have smaller trees, single-storied canopies, may be dominated by conifers, broadleaf trees, or both and most cases have biological legacies of previous stands. The understory may contain Gaultheria shallon, Mahonia nervosa, Rhododendron macrophyllum, Acer circinatum, Achlys triphylla, Vaccinium ovatum, and Linnaea borealis. Polystichum munitum may also be present but less than 30-40% total cover. Mosses are often a major ground cover. Lichens are abundant in the canopy of old stands.

Fire is the major natural disturbance, thus these systems are less common to absent on the windward side of the Olympic Mountains and Willapa Hills, where fire is rare. Fire intervals vary from < 100 years in driest climatic areas to several hundred years in wetter climates. Stand replacing fire occasionally occur but areas supporting the Dry-Mesic system are more commonly moderate-severity fires. Bark beetles and fungi are significant causes of mortality that typically operate on a small scale the Dry-Mesic system. Landslides occur in some areas. Generally characterized as large, stand-replacing fires, historical (pre-1880), fires were high-severity or, less commonly, moderate-severity, with natural return intervals of a few hundred to several hundred years. More frequent moderate-severity fires would generally not burn these moister microsites. Landfire (2007) modeled the Dry-Mesic as a fire regime III system with 75% in late-seral structure (60% closed), 20% mid-seral (15% closed) and 5% early seral in pre-settlement condition. Approximately three-quarters of fire in Dry-Mesic forest systems are mixed severity with a fire interval of 100 to 150 years. The remaining fires are high severity every 300-500 years. Landfire (2007) modeled the Dry-Mesic as a fire regime V system with 75% in late-seral structure (70% closed), 20% mid-seral (15% closed) and 5% early seral in pre-settlement condition.
In a landscape analysis of the central Cascades in Washington, Thomson, Weller and Severtsen (2003) concluded that the pre-settlement mean forest patch sizes are 1-5 square miles (average of 4.3 square miles for the 25-square mile analysis windows and 6.9 square miles for the 100-square mile windows). Agee (1998) reckoned that over 385 sq. miles (10,000 ha) was the historic fire size in these systems. Pre-settlement patch structure as estimated by Landfire (2007) consisted of 5% of the landscape in early seral stage (cohort establishment of Franklin et al. (2002) dominated by shrubs or rarely herbaceous plants. That stage typically develops into closed canopy forest stands with poor understory development (biomass accumulation/ competitive exclusion of Franklin et al. 2002). Those patches occupied an estimated 15% of the landscape, typically with Pseudotsuga menziesii sometimes with Tsuga heterophylla as the dominant trees. Trees are less than 20 inches diameter-at-breast height, 12-inches on average. Another 5% of the landscape consists of young, open canopy forest stands that have experienced or developed from mix-severity fire (usually conifer-dominated). An estimate 15% of the Dry-Mesic forests is in the similar structural condition that developed following mix-severity fire but with less Tsuga heterophylla or other shade-tolerant species in the upper canopy. An estimated 60% of Dry-Mesic forest patches would be closed canopy mature to old-growth stands with high vertical structural diversity (Maturation to Pioneer loss stage of Franklin et al. 2002).

Rank

S Rank: S2S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: WGA information

Element State Rank Report - Draft

Scientific Name: ***North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest*** **Elcode:** CES204.001

Common Name: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest **Subnational ID:** 18432

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: Occurs in the Puget lowlands and foothills of West Cascades and Olympic Mts.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 5943 sqkm occurs in Washington. This type appears to be overmapped in Willapa Hills and if harvested and planted stands are excluded then less is corrrectly mapped.

Population and EOs

Number of EOs: D = 81 - 300

Comments: 59 association element occurrences are in WANHP's databse. These occurs at 42 locations. USFS and USNPS lands not surveyed and if such an inventory occurred, and outcome of doubling or tripling number of occurrnces would not seem outrageous.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** DE = Moderate to good (11-40%)

Comments: A to B ranked occurrences are at 16 locations. Much of the occurrences on federal lands are A to B condition and bigger. 30% of mapped area (Sayre et al. 2009) is over 800ft of roads suggesting that may not have been logged An estimated 1/3 of mapped area is on USFS & NPS managed lands.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: If around two/thirds of locations are on non-federal ownership, then igh seems right since this is where most of the human actiity is concentrated in western WA.

Threat Category: 1 - Residential & commercial development Level of Threat: D = Low
Comments: most of the harvesting and conversion of this type has occcured.

Threat Category: 1.1 - Housing & urban areas Level of Threat: D = Low
Comments:

Threat Category: 11.1 - Habitat shifting & alteration Level of Threat: C = Medium
Comments: my opinion Josh H has new model applicaitons

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.1 - Annual & perennial non-timber crops Level of Threat: Negligible
Comments: brush picking

Threat Category: 2.2 - Wood & pulp plantations Level of Threat: D = Low
Comments:

Threat Category: 5 - Biological resource use Level of Threat: C = Medium
Comments: maybe underestimating mostly planted and treated

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: C = Medium
Comments: maybe underestimating mostly planted and treated

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments: this considers plants, role of invasive/exotic insects and fungus non-estimated

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: need to check on introduced insects

Trends

Short-term Trend: E = Decline of 30-50%

Comments: Large loss of old growth/high quality stands. Climate change may introduce new impacts.

Scientific Name: ***North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest*** **Elcode:** CES204.001

Common Name: North Pacific Maritime Dry-Mesic Douglas-fir-Western Hemlock Forest **Subnational ID:** 18432

Long-term Trend: E = Decline of 30-50%

Comments: Comparing the Ecological System map (Sayre et al. 2009) with LANDFIREs' Biophysical Settings map showed a 84% decrease over 200 years.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington, DC. 493 pp.

Chappell, C., R. Crawford, J. Kagan, and P. J. Doran. 1997. A vegetation, land use, and habitat classification system for the terrestrial and aquatic ecosystems of Oregon and Washington. Unpublished report prepared for Wildlife habitat and species associations within Oregon and Washington landscapes: Building a common understanding for management. Prepared by Washington and Oregon Natural Heritage Programs, Olympia WA, and Portland, OR. 177 pp.

Franklin, J.F., T.A. Spies, R. Van Pelt, A.B. Carey, D.A. Thornburgh, D.R. Berg, D.B. Lindenmayer, M.E. Harmon, W.S. Keeton, D.C. Shaw, K. Bible and J. Chen. 2002. Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir as an example. Forest Ecology and Management 155: 399–423.

Thomson, J.L., C. Weller, and B. Severtsen. 2003. Cascades Crest Forests: Forest Loss, Habitat Fragmentation and Wildness. The Wilderness Society. 46p

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Maritime Eelgrass Bed*** **Elcode:** CES200.882

Common Name: North Pacific Maritime Eelgrass Bed **Subnational ID:** 18304

Descriptors

Element Description: [the following is from DNR 2005] This sytems includes periodically or permanently submerged marine shorelines areas capable of supporting vascular vegetation, Zostera marina, as well as obligate and nonobligate but associated epiphytic, water column, benthic, and rhizomatous communities. Z. marina requires sandy to muddy substrates and adequate light to allow for photosynthesis and is found in a variety of geographic and geomorphic settings. It tends to be found along relatively protected shorelines and within shallow embayments where water movement is sufficient to keep concentrations of nutrients in the water column relatively low but where wave action is such that movement and erosion of substrates and dislodging of shoots is minimal and sediment nutrient concentrations are moderate. Light must generally exceed 11% of surface radiation and though it can tolerate water temperatures from 0°C to 40.5°C, and salinity from 0 – 35 ppt, optimum ranges for maximum photosynthesis/respiration rates and seed germination are narrower and vary locally.

The combined physical requirements of Zostera marina usually result in meadows being distributed between approximately 0 m MLLW and -15 m MLLW where water clarity is high. Lower depth limits are controlled by light and upper limits by dessication, thermal stress, and disturbance (including wave action, erosion of or burial by sediments, ice scour). Exact depth ranges vary depending on local natural and anthropogenic drivers. At upper depth limits, other seagrass species may be present. In the Pacific Northwest, Z. japonica and occasionally Ruppia maritima may be found. In more southern areas (California and Baja California), Ruppia maritima is more common and recent findings of Z. japonica in Humboldt Bay indicate that Z. japonica may be expanding its range in the United States. In the Gulf of California, Halodule wrightii may be found. Because Z. japonica is not native to this region and may displace Z. marina in shallower areas, its presence should be noted and is considered in determining the rank of an occurrence.

At broader geographic scales, processes that set the range of important determining factors include climate (precipitation, insolation, air and water temperatures, currents/upwelling/littoral cells), weather (timing of thermal stress and tides, timing and severity of storms, ice), tidal range (affects light and flushing), types and magnitudes of freshwater inputs (affects mean and variance in salinity), and marine and freshwater sources of sediments, suspended particulates, and dissolved nutrients. Latitudinal and regional clines in these factors create related clines in morphology, genetic diversity, rates of sexual reproduction, and associated epiphytic and benthic biota.

Local geomorphic attributes and processes determining environmental factors include substrate, aspect, beach slope, fetch, tidal range or prism, sources of sediments, suspended particulates, and dissolved nutrients, and frequency of disturbances and mechanical damage caused by freezing, dessication, ice, burial, and erosion. Local processes also affect biological factors such as herbivory, disease, epiphytism, and competition for light (with seaweeds and phytoplankton).

Environmental gradients created by latitudinal, regional, subregional, and local conditions may create the need for subregional and even local ranking criteria and thresholds.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The rank seems reasonable given what is known about the extent, trends, and current conditions of this sytem. However, there is uncertainity about the metrics pertaining to current ecological integrity, severity of threats, and long-term trends.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Based on nearshore depth, there is an estimate area of potential eelgrass habitat of 244,852 acres (~990 km2) in Puget sound alone. Other places found but need estimates for Willapa, minor amt. on outer coast; unsure about Grays Harbor. A measure of geographic extent was determined to be too noisy given the very narrow range in which eelgrass occurs. However, the range extent was measured at ~6,000km2. The more conservative esimate was chosen here.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates acres 30,436 (~123 km2) mapped in WA. Washington Dept. of Natural Resources's Submerged Vegetation Monitoring program estimtates that there are 55,000 acres (~223 km2) in Puget Sound and Straight of Juan de Fuca and between 8,448 to 13,1762 (~34-56km2) acres in Willapa Bay (DNR 2015). There are likely additional areas in Grays Harbor and possibly along the outer coast.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are between 80-126 element occurrneces, depending on whether a 200m vs. 500m separation distance rule is used (DNR 2005).

Scientific Name: ***North Pacific Maritime Eelgrass Bed*** **Elcode:** CES200.882

Common Name: North Pacific Maritime Eelgrass Bed **Subnational ID:** 18304

Population Size: =

Comments:

Number of Viable EOs: U = Unknown **% of Range with Good Viability:**

Comments: Difficult to determine this. Available data is a measure of abundance, not quality. In other places in the world, the amount of development in coastal watersheds has a clear relationship with viability of this sytem. However, Puget Sound is a unique ecosystem relative to these other examples due to the nutrient rich upwelling which occurs here. Thus, there are naturally high levels of nitrogen in the Puget Sound which, in other regions, is often attributed to anthropogenic stressors. Thus, making causal infererences in the Puget Sound between human stressors and viability is difficult to tease out from natural conditions.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: Calculated rank = B; There is reasonble certainty about the presence/scope of the stressor listed but less certaintiy about the severity of their impacts. This is because the Puget Sound is a unique ecosystem relative to other ares within the global extent of eelgrasss (see comment about the "good viability/ecological integrity" metric.)

Threat Category: 1 - Residential & commercial development Level of Threat: Unknown

Comments: overlay population density with eelgrass beds to see; how much percent has a certain amt. of development; no clear relationship; circumstantial evidence; anywhere else in world this would be primary threat; but unique ecosystem of Puget sound complicates this relationship; studies from DOE that have assessed DO and temp; models that look at nutrient loads based on different sources; hood canal has low DO which has lots of fish kills; low flushing rate; Fred Short says N is here; DOE says N is natural and has high background loads; eelgrass grows in nearshore so they could be susceptible to localized anthropogenic sources of N (from outfalls---lots in Hood Canal that aren't regulated; so even low population density could have impact locally); what is long-term baseline data---not there

Threat Category: 1.3 - Tourism & recreation areas Level of Threat: D = Low

Comments: docks can shade out eelgrass

Threat Category: 11 - Climate change & severe weather Level of Threat: C = Medium

Comments:

Threat Category: 11.1 - Habitat shifting & alteration Level of Threat: C = Medium

Comments: sea level could restrict movement of seagrass; deeper part of bed would suffer the worst; no room for range extension primarily because of shoreline modification (sea wall which is large percentage in Puget Sound); but land still rising--what is net effect?

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low

Comments:

Threat Category: 2.2 - Wood & pulp plantations Level of Threat: D = Low

Comments: wood chips from log booming; creates adverse condition in sediment

Threat Category: 2.4 - Marine & freshwater aquaculture Level of Threat: D = Low

Comments: aquaculture can conflict with eelgrass beds; eelgrass (z. japonica) can grow in shellfish beds; z. japonica is nonnative but one of few eelgrass species in world that is spreading. In Willapa Bay, shellfish industry is spraying z. japonica---probably affecting z. marina but difficult to know how herbcide disperses; slight is conservative--may be negligible; any data to estimate?

Threat Category: 3 - Energy production & mining Level of Threat: Negligible

Comments:

Threat Category: 3.2 - Mining & quarrying Level of Threat: Negligible

Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low

Comments: this is related to shoreline modification; somewhat overlaps in development threats

Threat Category: 4.1 - Roads & railroads Level of Threat: Unknown

Comments: lots of railroads near water in Puget sound

Threat Category: 4.3 - Shipping lanes Level of Threat: D = Low

Comments: if harbors are dredged, then that can cause a temporarly suspension of sediment which can shade out eelgrass; dredgine can also have direct impact by removal of eelgrass

Scientific Name: ***North Pacific Maritime Eelgrass Bed*** **Elcode:** CES200.882

Common Name: North Pacific Maritime Eelgrass Bed **Subnational ID:** 18304

Threat Category: 6 - Human intrusions & disturbance Level of Threat: C = Medium
Comments:

Threat Category: 6.1 - Recreational activities Level of Threat: C = Medium
Comments: recreation boating; prop scarring

Threat Category: 7 - Natural system modifications Level of Threat: Negligible
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: Negligible
Comments: dams on rivers has huge impact on kelp; not much info on seagrass; possibly local impact on seagrss when dams are removed (short-term effect); maybe long-term affect due to increase of freshwater coming through and changing residence time of water on flats (increased inundation once dam removal); existing dams may have decreased extent of inundation and change sediment input (grain size distribution)---both could have impact (increase or decrease) on eelgrass; sedimentation---eelgrass doesn't do well when buried; but eelgrass likes fine-sediment to thrive---need a certain amount of fine-sediment coming into system.

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: Negligible
Comments: Zoster japonica is spreading but doesn't grow in same habitat (based on depth); so little overlap with Z. marina

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: D = Low
Comments: Labyrinthula (slime mold is a vector for eelgrass wasting disease; causes decline photosynthetic capabilities of eelgrass); Labyrinthula occurs naturally; in San Juan Islands; multiple site with evidence. Impact can vary from extreme to slight

Threat Category: 9 - Pollution Level of Threat: Unknown
Comments:

Threat Category: 9.1 - Domestic & urban waste water Level of Threat: Unknown
Comments:

Threat Category: 9.3 - Agricultural & forestry effluents Level of Threat: Unknown
Comments: N inputs from alder; so more alder could be increasing N loads (due to fact alnus rubra fixes N)

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: Washington Dept. of Natural Resources's Submerged Vegetation Monitoring program conducted a rigorous monitoring program and found that eelgrass area in the Puget Sound was relatively stable between 2000-2013 (DNR 2015). Of the 347 samples sites, 25 decreased and 17 increased in area. There are an abundance of threats and stressors present within the extent of where this system occurs. Shoreline modifications are assumed to have a direct impact on eelgrass but changes due to nutrient enrichment is less certain. In other parts of the world where eelgrass is found, there is a pretty strong relationship between coastal watershed development and eelgrass integrity. Howver, because of the upwelling of nutrient rich oceanic water in the Puget Sound and the high tidal range, the natural levels of nutrient is higher than the current influx from adjacent, developed lands. Thus, eelgrass in the Puget Sound has evolved in an nutrient rich environment making correlations between eelgrass trends and human stressor difficult .

Long-term Trend: F = Decline of 10-30%

Comments: There is little baseline data from which to base estimates (Mumford 2007). However, Thom and Hallum (1991) estimated there was a 30% and 15% loss of area of eelgrass in Bellingham Bay and the Snohomish River delta, respectively. They also noted that eelgrass cover may have increased five-fold in Padialla Bay and that there is anecdotal evidence that suggest eelgrass may have decreased in distribution in selected ares of the south Puget Sound. There are an abundance of threats and stressors present within the extent of where this system occurs. Shoreline modifications are assumed to have a direct impact on eelgrass but changes due to nutrient enrichment is less certain. In other parts of the world where eelgrass is found, there is a pretty strong relationship between coastal watershed development and eelgrass integrity. Howver, because of the upwelling of nutrient rich oceanic water in the Puget Sound and the high tidal range, the natural levels of nutrient is higher than the current influx from adjacent, developed lands. Thus, eelgrass in the Puget Sound has evolved in an nutrient rich environment making correlations between eelgrass trends and human stressor difficult. The rating here is based on the variable estimates of direct loss of eelgrass beds and potential changes to integrity from stressors.

Scientific Name: ***North Pacific Maritime Eelgrass Bed*** **Elcode:** CES200.882

Common Name: North Pacific Maritime Eelgrass Bed **Subnational ID:** 18304

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Mumford, T.F. 2007. Kelp and Eelgrass in Puget Sound. Prepared in support of the Puget Sound Nearshore Partnership. Technical Report 2007-05.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Thom, R.M. and L. Hallum. 1991. Long-term Changes in the Areal Extent of Tidal Marshes, Eelgrass Meadows and Kelp Forests of Puget Sound. University of Washington, School of Fisheries, Fisheries Reserach Institute, Wetland Ecosystem Team. Prepared for U.S. Environmental Protection Agency, Office of Puget Sound, Region 10. Seattle, WA

Washington Department of Natural Resources (DNR). 2005. Temperate, Northern Pacific Zostera marina Meadow. DRAFT Element Occurrence Specification. Washington Department of Natural Resources Aquatics Division. Olympia, WA

Washington Department of Natural Resources (DNR). 2015. Puget Sound Submerged Vegetation Monitoring Program: 2010-1013 Report. Washington Department of Natural Resources, Aquatic Resources Division, Nearshore Habitat Program. Olympia, WA

Version

Version Author: Bart Christiaen (primary) and Joe Rocchio **Version Date:** 12-Mar-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Maritime Mesic Subalpine Parkland*** **Elcode:** CES204.837

Common Name: North Pacific Maritime Mesic Subalpine Parkland **Subnational ID:** 18285

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 1747 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments:

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: Climate change could be a major threat impact over next 20 yrs. Additional research is needed.Major threat I see is climate change and tree invasion. However, the system may just change elevation range and tree island to parkland ratio.

Threat Category: 1 - Residential & commercial development Level of Threat: Negligible
Comments:

Threat Category: 1.3 - Tourism & recreation areas Level of Threat: Negligible
Comments: guess, much on NPS, trails and huts etc

Threat Category: 11 - Climate change & severe weather Level of Threat: C = Medium
Comments:

Threat Category: 11.1 - Habitat shifting & alteration Level of Threat: C = Medium
Comments: need to check models sources for 20yr tree invasion

Threat Category: 6 - Human intrusions & disturbance Level of Threat: Negligible
Comments:

Threat Category: 6.1 - Recreational activities Level of Threat: Negligible
Comments: guess. most is in NPS.

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Scientific Name: ***North Pacific Maritime Mesic Subalpine Parkland*** **Elcode:** CES204.837

Common Name: North Pacific Maritime Mesic Subalpine Parkland **Subnational ID:** 18285

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest*** **Elcode:** CES204.002

Common Name: North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest **Subnational ID:** 18433

Descriptors

Element Description: The Mesic-Wet forest system is a significant component of the lowland and low montane forests of western Washington, except on extremely dry sites and in the hypermaritime zone near the outer coast. These forests are best represented on lower mountain slopes with high precipitation, long frost-free periods, and low to moderate fire frequencies. The associated climate is relatively mild and moist to wet. Mean annual precipitation is mostly 90-254 cm (35-100 inches) falling mostly as winter rain. Elevation ranges from sea level to 610 m (2000 feet). Snowfall is rare in lower elevations but occurs more regularly with increasing elevation but rarely establishes a snow pack. Topography ranges from relatively flat glacial till plains to steep mountainous terrain. Mesic- Wet forest soils are moist to somewhat wet (but not saturated) for much of the year and are well-drained to somewhat poorly drained.

Mesic- Wet forest overstory canopy is dominated by Pseudotsuga menziesii, Tsuga heterophylla, and/or Thuja plicata. Abies grandis often can be codominant. Acer macrophyllum and Alnus rubra (the latter primarily where there has been historic logging disturbance) are commonly found as canopy or subcanopy codominants, especially at lower elevations. In a natural landscape, small patches can be dominated by these same broadleaf trees for several decades after a severe fire. Late seral stands typically have an abundance of large coniferous trees, a multi-layered canopy structure, large snags, and many large logs on the ground. Early seral stands typically have smaller trees, single-storied canopies, and may be dominated by conifers, broadleaf trees, or both. Young stands may lack Tsuga heterophylla or Thuja plicata, especially in the Puget Lowland. Tsuga heterophylla is generally the dominant regenerating tree species. Polystichum munitum (over 30-40% cover), Oxalis oregana, Rubus spectabilis, and Oplopanax horridus typify the poor to well-developed understory layers. Gaultheria shallon, Mahonia nervosa, Rhododendron macrophyllum, and Vaccinium ovatum are often present but are generally not as abundant as the aforementioned indicators. Acer circinatum is a very common codominant as a tall shrub. Mosses are often a major ground cover. Lichens are abundant in the canopy of old stands.

Fire is the major natural disturbance, thus these systems are less common to absent on the windward side of the Olympic Mountains and Willapa Hills, where fire is rare. Fire intervals vary from < 100 years in driest climatic areas to several hundred years in wetter climates. Landslides occur in some areas. Generally characterized as large, stand-replacing fires, historical (pre-1880), fires were high-severity or, less commonly, moderate-severity, with natural return intervals of a few hundred to several hundred years. More frequent moderate-severity fires would generally not burn these moister microsites. Landfire (2007) modeled the Mesic-Wet system, wind may be an equally important natural disturbance as fire. Typical Mesic-Wet system soils supporting a Polystichum understory would be deep, fine- to moderately coarse-textured, and for sites with an Oplopanax understory, soils typically have an impermeable layer at a moderate depth. Both types of soils are well-watered from upslope or hyperheic sources and seeps. Mesic- Wet forests are nearly all high severity fires with a fire interval of 400 to 800 years (Landfire 2007).
 In a landscape analysis of the central Cascades in Washington , Thomson, Weller and Severtsen (2003) concluded that the pre-settlement mean forest patch sizes are 1-5 square miles (average of 4.3 square miles for the 25-square mile analysis windows and 6.9 square miles for the 100-square mile windows). Agee (1998) reckoned that over 385 sq. miles (10,000 ha) was the historic fire size in these systems. Pre-settlement patch structure as estimated by Landfire (2007) consisted of 5% of the landscape in early seral stage (cohort establishment of Franklin et al. (2002) dominated by shrubs or rarely herbaceous plants. That stage typically develops into closed canopy forest stands with poor understory development (biomass accumulation/ competitive exclusion of Franklin et al. 2002). Those patches occupied an estimated 15% of the landscape, typically with Pseudotsuga menziesii sometimes with Tsuga heterophylla as the dominant trees, although Acer macrophyllum or Alnus rubra can dominate patches in Mesic- Wet forest systems. Trees are less than 20 inches diameter-at-breast height, 12-inches on average. Another 5% of the landscape consists of young, open canopy forest stands that have experienced or developed from mix-severity fire (usually conifer-dominated) or in more mesic to wet areas, windthrows, root-rot or die back by Alnus rubra after 80 or so years. Another 5% of Mesic- Wet forest system areas are display open canopy, mature to old-growth structure (largest trees over 20 inches dbh) following windthrow or root-rot opening of the canopy. An estimated 70% of Mesic- Wet forest patches would be closed canopy mature to old-growth stands with high vertical structural diversity (Maturation to Pioneer loss stage of Franklin et al. 2002).

Rank

S Rank: S3S4 **S Rank Date:** 16-Oct-2014 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Scientific Name: ***North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest*** **Elcode:** CES204.002

Common Name: North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest **Subnational ID:** 18433

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: used Comer and Hak (NatureServe 2009 M09NAT01HQUS) map 13662 sqkm

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: as a measure of logged 22% of mapped area over 800ft of road. Looks like less 25% of area on USFS and NPS.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: I might weigh logging too much since most is alrady converted

Threat Category: 1 - Residential & commercial development Level of Threat: D = Low
Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: C = Medium
Comments:

Threat Category: 11 - Climate change & severe weather Level of Threat: D = Low
Comments:

Threat Category: 11.1 - Habitat shifting & alteration Level of Threat: D = Low
Comments: probably shift to Dry Mesic type, check with Josh H

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.2 - Wood & pulp plantations Level of Threat: D = Low
Comments:

Threat Category: 5 - Biological resource use Level of Threat: B = High
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High
Comments: consider planting, treating conversion

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: need to check on extoic pests

Trends

Short-term Trend: =

Comments:

Long-term Trend: F = Decline of 10-30%

Comments: 26% decrease over 200 years estimated from US Systems map compared to LANDFIRE BpS map for Dry-mesic DF-WH. Wet-Mesic would be in a similar range of decrease.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Scientific Name: ***North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest*** **Elcode:** CES204.002

Common Name: North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest **Subnational ID:** 18433

Needs

Research Needs:
Inventory Needs:
Protection Needs:
Management Needs:

References

Citation

Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington, DC. 493 pp.

Chappell, C., R. Crawford, J. Kagan, and P. J. Doran. 1997. A vegetation, land use, and habitat classification system for the terrestrial and aquatic ecosystems of Oregon and Washington. Unpublished report prepared for Wildlife habitat and species associations within Oregon and Washington landscapes: Building a common understanding for management. Prepared by Washington and Oregon Natural Heritage Programs, Olympia WA, and Portland, OR. 177 pp.

Franklin, J.F., T.A. Spies, R. Van Pelt, A.B. Carey, D.A. Thornburgh, D.R. Berg, D.B. Lindenmayer, M.E. Harmon, W.S. Keeton, D.C. Shaw, K. Bible and J. Chen. 2002. Disturbances and structural development of natural forest ecosystems with silvicultural implications, using Douglas-fir as an example. Forest Ecology and Management 155: 399–423.

Thomson, J.L., C. Weller, and B. Severtsen. 2003. Cascades Crest Forests: Forest Loss, Habitat Fragmentation and Wildness. The Wilderness Society. 46p

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014
Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Mesic Western Hemlock-Silver Fir Forest*** **Elcode:** CES204.097

Common Name: North Pacific Mesic Western Hemlock-Silver Fir Forest **Subnational ID:** 18434

Descriptors

Element Description:

Rank

S Rank: S5 **S Rank Date:** 16-Oct-2014 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 1511sqkm in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: About 74% of area mapped (Sayre et al. 2009) is more than 800ft from a road and assumed to be unlogged. Over 90% of are mapped occurs within USFS lands, NPS lands, and DNR Natural Resource Conservation Areas.

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category: 5 - Biological resource use Level of Threat: D = Low

Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: C = Medium

Comments: plant with native trees few other treatments,

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Scientific Name: ***North Pacific Mesic Western Hemlock-Silver Fir Forest*** **Elcode:** CES204.097

Common Name: North Pacific Mesic Western Hemlock-Silver Fir Forest **Subnational ID:** 18434

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Montane Massive Bedrock, Cliff and Talus*** **Elcode:** CES204.093

Common Name: North Pacific Montane Massive Bedrock, Cliff and Talus **Subnational ID:** 18435

Descriptors

Element Description:

Rank

S Rank: S4S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons: No reat real threats.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map estimates 560 sqkm as occurring within Washington. A quick scan of imagery suggests that alpine and avalanche chutes were sometimes mapped as this system and the map also missed areas of rock outcrops.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: no known of any extent

Threat Category: Level of Threat:

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Scientific Name: ***North Pacific Montane Massive Bedrock, Cliff and Talus*** **Elcode:** CES204.093

Common Name: North Pacific Montane Massive Bedrock, Cliff and Talus **Subnational ID:** 18435

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***North Pacific Montane Riparian Woodland and Shrubland*** **Elcode:** CES204.866

Common Name: North Pacific Montane Riparian Woodland and Shrubland **Subnational ID:** 18297

Descriptors

Element Description: The North Pacific Montane Riparian Woodland and Shrubland ecological system occurs throughout the coastal mountains of the Pacific Northwest and in Washington is most abundant as woodland and shrubland on steep streams and narrow floodplains between the Tsuga heterophylla zone and the alpine environments in the Cascades and Olympics. It is the primary riparian system in the Abies amabilis and Tsuga mertensiana zones on both sides of the Cascade crest. Winters are moderate with 3-10+ foot snowpack, infrequent drought and summer precipitation that can exceed 6 inches. This system commonly occurs in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Occurrences are less frequently found in moderate-wide valley bottoms on floodplains along meandering rivers, and on pond or lake margins. It is also associated with drainages, stream terraces, semi-riparian flats and spring or seep fed slopes.

This system occurs on steep stream banks with narrow floodplains where the shrubby or deciduous vegetation is significantly different than surrounding conifer forests . These riparian woodlands are mostly found in V-shaped, steep valleys with many large boulders and coarse soils. The forest vegetation in these environments is often very similar to the adjacent uplands (Baker 1987, Kovalchik and Clausnitzer 2004, LANDFIRE 2007). Narrow and steep (i.e. confined) occurrences have minimal to no floodplain development whereas less steep and wider valley bottoms (i.e., unconfined) occurrences are often associated with substantial floodplain development (Gregory et al. 1991). Floodplains associated with the latter are comprised of a complexity of geomorphic surfaces which support a diverse array of vegetation communities and are able to store and release water slowly throughout the growing season (Hubert 2004). Confined streams typically have shallow soils with minimal alluvium and transport water downstream rapidly through step-pool channels armored by boulders, bedrock, and large woody debris (LANDFIRE 2007; Hubert 2004).

Beaver can be important hydrogeomorphic driver of montane riparian systems, especially along unconfined reaches. The presence of beaver creates a heterogeneous complex of wet meadows, marshes and riparian shrublands and increases species richness on the landscape. Naiman et al. (1986) note that beaver-influenced streams are very different from those not impacted by beaver activity by having numerous zones of open water and vegetation, large accumulations of detritus and nutrients, more wetland areas, having more anaerobic biogeochemical cycles, and in general are more resistance to disturbance.

Confined occurrences of this system (mostly along Rosgen A and B channels) are conifer woodlands dominated by Abies amabilis, Abies lasiocarpa, Tsuga mertensiana or Pinus contorta var. murrayana. Lower elevation occurrences with less confined channels may contain deciduous trees, such as, Populus balsamifera ssp. trichocarpa, Alnus incana ssp. tenuifolia (= Alnus tenuifolia) and Alnus rubra. Major shrub species include Alnus viridis ssp. sinuata, Acer circinatum, Salix sitchensis, Oplopanax horridus, Rubus spectabilis, and Ribes bracteosum and herbaceous Senecio triangularis, Saxifraga arguta, and Petasites frigidus plants. Vaccinium alaskense and Vaccinium ovalifolium can be frequent above bankfull riparian zones (Diaz and Mellen 1996).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of riparian areas in Washington. Human land uses both within the riparian area as well as in adjacent and upland areas have fragmented many riparian reaches which has reduced connectivity between riparian patches and riparian and upland areas. Adjacent and upstream land uses also have the potential to contribute excess nutrients into riparian areas. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrologic and sediment regimes. Alterations to both processes can affect the establishment of new, and maintenance of existing, riparian vegetation. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. Logging activities tend to reduce the amounts of large woody debris in streams and remove future sources of that debris. Timber harvest can also alter hydrology, most often resulting in post-harvest increases in peak flows. Mass wasting and related disturbances (stream sedimentation, debris torrents) in steep topography increase in frequency with road building and timber harvest. Roads and other water diversion/retention structures change watershed hydrology with wide-ranging and diverse effects, including major vegetation changes.

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The system remains relatively common the landscape but has likely experience some degradation. Although the calculated estimate of historical loss was extremely high, field observations suggest this is in error.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Scientific Name: ***North Pacific Montane Riparian Woodland and Shrubland*** **Elcode:** CES204.866

Common Name: North Pacific Montane Riparian Woodland and Shrubland **Subnational ID:** 18297

Comments: These woodlands are found along riparian landforms in the montane and subalpine areas of the Cascades and Olympic Mountains. Measured extent was ~35,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 88,930 acres (~360 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to montane regions within western Washington. Next, total acreage of palustrine forested wetlands (most of which would be included in this system; the remaining would be included within North Pacific Hardwood-Conifer Swamp) in that area were summed. The results showed that 61,213 acres (~245 km2) of such wetlands occur within the extent of this system. Both estimates were within the "H=100-500km2" rating.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are just a few element occurrences in the Washigton Natural Heritage Program database. However, there are many occurrences on the landscape. Most high-elevation streams in the Cascades and Olympics support this Ecological System.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** E = Good (21-40%)

Comments: Much of this system occurs on public lands and most occurences are in assumed to be in good condition. Logging has probably impacted structure of many stands and roads may have impact some occurrences.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Roads and logging are primary threats.

Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. That analysis showed that 89% of this Ecological System has been lost. This seems like a very high overestimate. Whatever the amount of loss that hass occurred, is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. Thus, the loss was equally split between short- and long-term trends. In addition, logging, roads have likely degraded many extant occurrences. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames.

Scientific Name: ***North Pacific Montane Riparian Woodland and Shrubland*** **Elcode:** CES204.866

Common Name: North Pacific Montane Riparian Woodland and Shrubland **Subnational ID:** 18297

Long-term Trend: F = Decline of 10-30%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. That analysis showed that 89% of this Ecological System has been lost. This seems like a very high overestimate. Whatever the amount of loss that hass occurred, is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. Thus, the loss was equally split between short- and long-term trends. In addition, logging, roads have likely degraded many extant occurrences. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***North Pacific Montane Shrubland*** **Elcode:** CES204.087

Common Name: North Pacific Montane Shrubland **Subnational ID:** 18436

Descriptors

Element Description: The North Pacific Montane Shrubland ecological system occurs on upland sites within the zone of continuous forest (not associated with avalanche chutes and sheets) at montane into subalpine elevations below subalpine parklands. They occur in the Cascades and Olympic Mountains Washington and into adjacent western Oregon and north into British Columbia. These shrublands or shrubfields are a typically seral to coniferous forest and their persistence depends on periodic fires or other periodic disturbance that limits tree growth. It is less common to absent on the windward sides of the coastal mountains where fires are rare due to very wet climates. The shrub species in this system provide important browse and cover species for wildlife as well as berries for people.
This system consists of long-lived, typically deciduous, broadleaf, seral shrublands that persist for several decades or more after major wildfires, or smaller patches of shrubs that periodically burn on dry sites that are marginal for tree growth. The system can occur in small to large patches on ridgetops and upper to lower mountain slopes, especially on sunny southern aspects. Elevation ranges from about 152 m (500 feet) elevation up to the lower limits of subalpine parkland.
Composed mostly of deciduous broadleaf shrubs, the North Pacific Montane Shrubland sometimes contains a mix of shrub-statured trees or sparse cover of conifer trees. Species composition is highly variable; however, some of the most common species include Acer circinatum, Acer glabrum, Holodiscus discolor, Sorbus spp., Rubus parviflorus and Vaccinium membranaceum. This system can also be dominated by evergreen shrubs Arctostaphylos nevadensis, and Ceanothus velutinus. Herbaceous cover is often low as well as litter accumulation. The evergreen, woody-based “forb” Xerophyllum tenax can be dominant in some areas often with Vaccinium membranaceum. Important forbs include Chamerion angustifolium, Heracleum maximum and Pteridium aquilinum.

They appear as large and small patches surrounded by conifer trees but lack significant tall tree cover within them. Shrublands vary in height from less than 3 feet (1m) in higher, drier environments to over 10 ft (3m) in mild moist areas and often are vigorous sprouting species. The shrubfields occur on all aspects and soils although they are more prevalent on south and west-facing slopes that have periodically burned. They are generally associated with well-drained sites. Soils tend to be moist to wet and can be too rocky to support forest cover. North Pacific Shrubland is maintained by recurring disturbances, including fire and downslope movement of soil, water, snow and rock. Vaccinium membranaceum is an important member of this mixed shrubland vegetation being the focus of native people burning. Fire was used by native people to expand or rejuvenate shrubfields for berries and/or beargrass (Richards and Alexander 2006, Boyd 1999, Fisher 1996) so shrubfields are sometimes anthopogenic in extent.

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: No inventory of ecological condition of shrubfields other than factors influencing berry production and little is known about other mid-montane shrublands. Decline is mostly cited in more anthopogenic huckleberry fields due to forest invasion. I may have under-estimated how much percentage of good or excellent condition exists.

Range

Range Extent: H = >2,500,000 square km (greater than 1,000,000 square miles)

Comments: This system has spotty distribution within Olympic Mountains and Cascades Ranges within the montane western hemlock and silver fir zones.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimated 229 sqkm in Washington; however, the map missed smaller patches and overmapped forest cover on Gifford Pincho National Forest.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: About 68% of mapped areas (Sayre et al. 2009) occur beyond 800ft of roads and assumed to be less susceptible to anthropogenic disturbances.. Tree invasion is a significant stressor on sites.

Number Protected EOs:

Comments:

Threats

Scientific Name: ***North Pacific Montane Shrubland*** **Elcode:** CES204.087

Common Name: North Pacific Montane Shrubland **Subnational ID:** 18436

Threats: BC = High - medium

Comments: Tree invasion and commercial harvesting of huckleberries are threats .Tree invasion and commercial harvesting of huckleberries are threats.

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown
Comments:

Threat Category: 5 - Biological resource use Level of Threat: CD = Medium - low
Comments:

Threat Category: 5.2 - Gathering terrestrial plants Level of Threat: CD = Medium - low
Comments: huckleberry harvest beyond tradition in smaller area

Threat Category: 7 - Natural system modifications Level of Threat: BC = High - medium
Comments: trees invasion with suppression

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BC = High - medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: Unknown
Comments: noted in Parks et al

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: Unknown
Comments:

Trends

Short-term Trend: F = Decline of 10-30%

Comments: Huckleberry field declined in Skamania Co. Fisher estimated that 100 ac/yr would disappear by 2040. This estimates is assumed here to apply to all fire maintained shrublands.

Long-term Trend: AE = Decline of >30%

Comments: LANDFIRE state that shrubfields are stable. Several source say huckleberry fields declining (Fisher 1996).

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Boyd, R., ed. 1999. Indians. Fire, and the Land in the Pacific Northwest. Corvallis: Oregon State University Press.

Fisher, Andrew H. 1996. The 1932 Handshake Agreement: Cultural persistence andAccommodation in the Pacific Northwest. Arizona State University

Richards, R.T. and S.J. Alexander. 2006. A social history of wild huckleberry harvesting in the Pacific Northwest. Gen. Tech PNW-GTR-657. Portland Oregon. USDA FS PNW Research Station 113p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***North Pacific Mountain Hemlock Forest*** **Elcode:** CES204.838

Common Name: North Pacific Mountain Hemlock Forest **Subnational ID:** 18286

Descriptors

Element Description:

Rank

S Rank: S4S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: If not for predicted climate change effects and restricted range of the system it would be S 5.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 3560 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: 95% of mapped area (Sayre et al. 2009) occurs over 800ft of road which is assumed to mean that most has not been logged. Almost all is on NPS USFS and NRCA lands.

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: I'm uncertain of climate impact in next 50ys. Very little impacts otherwise.

Threat Category: 11 - Climate change & severe weather Level of Threat: C = Medium

Comments:

Threat Category: 11.3 - Temperature extremes Level of Threat: C = Medium

Comments: depends on model

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Scientific Name: ***North Pacific Mountain Hemlock Forest*** **Elcode:** CES204.838

Common Name: North Pacific Mountain Hemlock Forest **Subnational ID:** 18286

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Oak Woodland*** **Elcode:** CES204.852

Common Name: North Pacific Oak Woodland **Subnational ID:** 18316

Descriptors

Element Description: The North Pacific Oak Woodland ecological system is limited to the southern portions of the North Pacific region. It occurs primarily in the Puget Trough and Willamette Valley but trickles down into the Klamath ecoregion and into California. This system is associated with dry, predominantly low-elevation sites and/or sites that experienced frequent presettlement fires. Oak types associated with wetlands and riparian areas are not included here. They are associated with the North Pacific Lowland Riparian Forest and Shrubland ecological system.

In the Willamette Valley, soils are mesic yet well-drained, and the type is clearly large patch in nature. In the Puget Lowland and Georgia Basin, this system is primarily found on dry sites, typically either shallow bedrock soils or deep gravelly glacial outwash soils. In Washington, this oak woodland is most abundant on gravelly outwash plains in Thurston and Pierce counties but is found on dry sites that experienced frequent presettlement fires in other part of the Puget Trough . It occurs on various soils in the interior valleys of the Klamath Mountains, and on shallow soils of "bald hill" toward the coast. Even where more environmentally limited, the system is strongly associated with a pre-European settlement, low-severity fire regime. Succession in the absence of fire tends to favor increased shrub dominance in the understory, increased tree density, and increased importance of conifers, with the end result being conversion to a conifer forest. Dissemination of acorns by squirrels and chipmunks is thought to be the most important long-distance dispersal mechanism.

The vegetation ranges from savanna and woodland to forest dominated by deciduous broadleaf trees, mostly Quercus garryana. Codominance by the evergreen conifer Pseudotsuga menziesii is common, and Pinus ponderosa is important in some stands. In Washington, Pinus ponderosa is rare but important in some Pierce County stands. In the south, common associates also include Quercus kelloggii and Arbutus menziesii. Acer macrophyllum, Cornus nuttallii, and Fraxinus latifolia are common associates in moister sites while Arbutus menziesii, Pinus ponderosa, and occasionally P. contorta are common in more xeric sites. Understory species are diverse and today include many non-native and increaser species. Native shrubs such as Symphoricarpos albus, Holodiscus discolor, Rosa spp., Mahonia aquifolium, Amelanchier alnifolia, Oemleria cerasiformis, and the nonnative shrub Cytisus scoparius are common. Under natural fire regimes, some sites (moist or otherwise protected sites) have naturally high relative cover of shrubs (up to 60%) while other sites typically have less than 10% cover of shrubs (fire regime I Landfire 2007). Native grass species such as Festuca roemeri, Carex inops ssp. inops, Bromus carinatus, Danthonia californica, and Elymus glaucus and nonnative species such as Arrhenatherum elatius, Dactylis glomerata, Holcus lanata, and Poa pratensis, are common components to oak woodlands. Native forbs such as Camassia quamash, Vicia americana, Galium aparine, Fragaria vesca, Lomatium utriculatum and nonnative forbs such as Hypericum perforatum, Hypochaeris radicata, and Plantago lanceolata are also conspicuous components to these oak woodlands. Oak woodlands also support distinctive epiphytic species as compared to other habitats throughout its range. In the Willamette Valley, over 100 species of epiphytic and terrestrial lichen and bryophytes have been documented in Oregon white oak forests (Pike 1973).

Rank

S Rank: S1 **S Rank Date:** 17-Oct-2014 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Most of the damage has been done over the past 100 years I think its increased in rarity due to change from historic condition and distribution. Individual sites may have increased in oak stem density due to fire suppression. Presumably there has been no increases in extent. Exotic grasses and shrubs have altered composition rangewide, conifers have invaded and supressed oaks. Urbanization has occurred in and around occurrences.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 62 sqkm as occurring in Washington. Also used Chappell and others (2001) map.

Population and EOs

Number of EOs: B = 6 - 20

Comments: 20 association WANHP element occurrences at 14 sites

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** C = Small (5-10%)

Scientific Name: ***North Pacific Oak Woodland*** **Elcode:** CES204.852

Common Name: North Pacific Oak Woodland **Subnational ID:** 18316

Comments: No A rank, 5 B element occurrence ranks at for sites. 9% of mapped area (Sayre et al. 2009) occurs over 800ft of road suggesting those areas are in better condition.. WANHP data does not include D or worse stands in database.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Most impacts are from past disturbance but their effects are still present.

Threat Category: 1 - Residential & commercial development Level of Threat: CD = Medium - low
Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: CD = Medium - low
Comments: the remaining oak maybe less threatened because of ownership and site

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments: mostly on-going current use

Threat Category: 5 - Biological resource use Level of Threat: CD = Medium - low
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: D = Low
Comments: thinking conifer harvest that influecnces understory and regen patterns

Threat Category: 7 - Natural system modifications Level of Threat: BD = High - low
Comments:

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BD = High - low
Comments: changes in tree and shrub cover over 20 yrs unsure of impacts

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BC = High - medium
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: BC = High - medium
Comments: may over estimate scope its mostly more open associations

Trends

Short-term Trend: U = Unknown

Comments:

Long-term Trend: B = Decline of 80-90%

Comments: in condition and conversion

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Scientific Name: ***North Pacific Oak Woodland*** **Elcode:** CES204.852

Common Name: North Pacific Oak Woodland **Subnational ID:** 18316

Chappell, C. B., M. S. Mohn Gee, B. Stephens, R. Crawford, and S. Farone. 2001. Distribution and decline of native grasslands and oak woodlands in the Puget Lowland and Willamette Valley ecoregions, Washington. Pages 124-139 in Reichard, S. H., P.W. Dunwiddie, J. G. Gamon, A.R. Kruckeberg, and D.L. Salstrom, eds. Conservation of Washington's rare plants and ecosystems. Washington Native Plant Society, Seattle, Wash. 223 pp.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

NatureServe.2009.US National Map Conterminous United States (Version 3.0; Updated March 2014) (Compressed file, 3.9GB). http://www.natureserve.org/conservation-tools/terrestrial-ecological-systems-united-states

Pike, L.H. 1973. Lichens and bryophytes of a Willamette Valley oak forest. Northwest Science, Vol. 47(3), pp. 149-158

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Scientific Name: ***North Pacific Serpentine Barren*** **Elcode:** CES204.095

Common Name: North Pacific Serpentine Barren **Subnational ID:** 18437

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons: Uncommon habitat but with few threats.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 24.5 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	Negligible
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	Negligible
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	Negligible
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	Negligible
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	Unknown
Comments:			
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	Unknown
Comments:			

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Scientific Name: ***North Pacific Serpentine Barren*** **Elcode:** CES204.095

Common Name: North Pacific Serpentine Barren **Subnational ID:** 18437

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***North Pacific Shrub Swamp*** **Elcode:** CES204.865

Common Name: North Pacific Shrub Swamp **Subnational ID:** 18296

Descriptors

Element Description: The North Pacific Shrub Swamp ecological system occurs as a large patch throughout the Maritime Pacific Northwest, from Cook Inlet and Prince William Sound, Alaska, to the southern coast of Oregon. It includes deciduous broadleaf tall shrublands located in depressions, around lakes or ponds, or river terraces where water tables fluctuate seasonally, in areas that receive nutrient-rich waters. Soils are muck or mineral soils. Surface water may be slowly moving through the site or as stagnant pools. Groundwater or streams and creeks which do not experience significant overbank flooding are major hydrological drivers. Beaver activity might also occur in these swamps.

Alnus incana ssp. tenuifolia (= Alnus tenuifolia), Alnus viridis ssp. crispa (= Alnus crispa), Alnus viridis ssp. sinuata (= Alnus sinuata), Cornus sericea, Malus fusca, Myrica gale, Salix spp., and Spiraea douglasii are the major dominants. Indicator herbaceous plants include Carex deweyana, Carex obnupta, Lysichiton americanus, Oenanthe sarmentosa and Urtica dioica.

Shrub swamps may occur in mosaics with marshes or forested swamps, being on the average wetter than forested swamps and drier than marshes. However, it is also common for this system to dominate entire wetland systems. The North Pacific Hardwood-Conifer Swamp system is usually in slightly drier environments than this system. The North Pacific Lowland Riparian Forest and Shrubland and the North Pacific Montane Riparian Woodland and Shrubland are somewhat similar systems but differ in that they typically consist of a mix of trees and shrubs and occur as a linear fringe along stream or river channels where exposure to overbank flooding is an important ecological driver.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of hardwood-conifer swamps in Washington. Adjacent and upstream land uses also have the potential to contribute excess nutrients, alter hydrology, and provide a vector for non-native species into this ecological system. Logging activities tend to reduce the amounts of large woody debris and remove future sources of that debris, to increase insolation of the soil surface resulting in higher temperatures, lower humidity, and more sunlight reaching the understory all of which can affect hydrological and nutrient processes and species composition , to alter hydrology, most often resulting in post-harvest increases in peak flows, and to increase mass wasting and related disturbances (sedimentation, debris torrents) in steep topography increase in frequency with road building and timber harvest. Increases in nutrients and pollutants are other common anthropogenic impacts. Reed canarygrass (Phalaris arundinacea) is an abundant non-native species in low-elevation, disturbed settings dominated by shrubs or deciduous trees. Many other exotic species also occur. This system has also decreased in extent due to agricultural development, roads, dams and other flood-control activities.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system remains abundant on the landscape, and may have even increased in extent from historical acreage. However, logging, development, agriculture, hydrological changes, nutrient enrichment, and nonnative species have likely degraded many occurrences.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: These wet shrublands are found in depressions, along riparian areas, beaver ponds, shorelines, and groundwater discharge areas. They occur from the lowlands to the Cascade Crest in western Washington. Measured extent is approximately 65,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 121,235 acres (~491 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were filtered for palustrine scrub-shrub wetlands and showed that 95,630 acres (~387 km2) occur in western Washington. The NWI estimate likely includes shrublands other systems such as North Pacific Bog and Fen, North Pacific Intertidal Freshwater Wetland, North Pacific Coastal Interdunal Wetland, and North Pacific Lowland Riparian Forest and Shrubland. Regardless, both estimates fall within the "H=100-500 km2" rating.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 72 element occurrences in the Washington Natural Heritage Program's database. More occurrences are definitely on the landscape. The "D=81-300" rating was selected.

Population Size: =

Comments:

Scientific Name: ***North Pacific Shrub Swamp*** **Elcode:** CES204.865

Common Name: North Pacific Shrub Swamp **Subnational ID:** 18296

Number of Viable EOs: E = Many (41-125) **% of Range with Good Viability:** E = Good (21-40%)

Comments: Of the 72 element occurences, 49 have excellent or good ecological integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 88% of palustrine scrub-shrub wetlands had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 88% is assumed to be a significant overestimate of the area of this Ecological System with good/excellent integrity. Many occurrence in the Puget lowlands, where development and agriculture are common stressors, have been degraded due to changes in hydrology, nutrient loading, and nonnative species (Phalaris arundianceae). In addition, Spiraea douglasii, although a native shrub, tolerates these kinds of disturbances quite well and can outcomplete other native species by becoming extremely dense and tall when stressors are present. Ajdacent logging could also change hydrolgical, nutrient, and sediment cylcing. Based on all this information, the rating "E=21-40%" was chosen for 'percent area occupied' with good ecological integrity.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: A wide variety of stressors threaten extant occurrences including logging , development, agriculture, and nonnative species. These stressors can result inchanges in hydrology, sediment and nutrient regimes, and can homogenize vegetation composition and change vegetation structure.changes in hydrology/sediment/nutrients can homogenize composition and change vegetation structure

Threat Category:	1 - Residential & commercial development	Level of Threat:	D = Low
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	D = Low
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	D = Low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	D = Low
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	C = Medium
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	C = Medium
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	B = High
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	B = High
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.2 - Problematic native species/diseases	Level of Threat:	B = High
Comments: Spiraea douglasii will take over sites when hydrology, sediment, and nutrient regimes get shifted			
Threat Category:	9 - Pollution	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.1 - Domestic & urban waste water	Level of Threat:	D = Low
Comments:			

Scientific Name: ***North Pacific Shrub Swamp*** **Elcode:** CES204.865

Common Name: North Pacific Shrub Swamp **Subnational ID:** 18296

Threat Category: 9.3 - Agricultural & forestry effluents Level of Threat: C = Medium

Comments:

Trends

Short-term Trend: F = Decline of 10-30%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. However, Landfire's map lumped North Pacific Shrub Swamps with North Pacific Hardwood-Conifer Swamp into a single entityg called "North Pacific Swamps" thus it is difficult to know speficially how each system change. However, when compared as a single group, "Swamps" in western Washington showed a 15% decline in extent relative to estimated historical acreage (153,456 current acres vs. 180,463 historical acres). Based on field observations the author's opinion is that most loss has likely been associated with forested swamps given that can they have timber value. In addition, logging of swamps often raises water tables making tree regeneration difficult which often results in those areas being converted to shrub and/or herbaceous wetlands. It is even possible that shrub swamps have increased in extent due to conversion of logged swamps to shrubby wetlands. However, it is also likely that the same stressors that might have increase extent have also decreased ecological integrity of many occurrences. The ratings "F=10-30%" was selected to account for these varying effects and most of this decline is assumed to be change of ecological integrity. It is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. Thus, the loss was equally splti between short- and long-term trends. In addition, logging, roads, development, agriculture, and grazing have resulted degradation of many extant occurrences. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames.

Long-term Trend: F = Decline of 10-30%

Comments: To get an estimate of loss from historical extent, the total acreage mapped by NatureServe's Ecological System map (=current extent) was compared to the Landfire's Environmental Site Potential map (=historical extent). Both maps use Ecological Systems as the legend. However, Landfire's map lumped North Pacific Shrub Swamps with North Pacific Hardwood-Conifer Swamp into a single entityg called "North Pacific Swamps" thus it is difficult to know speficially how each system change. However, when compared as a single group, "Swamps" in western Washington showed a 15% decline in extent relative to estimated historical acreage (153,456 current acres vs. 180,463 historical acres). Based on field observations the author's opinion is that most loss has likely been associated with forested swamps given that can they have timber value. In addition, logging of swamps often raises water tables making tree regeneration difficult which often results in those areas being converted to shrub and/or herbaceous wetlands. It is even possible that shrub swamps have increased in extent due to conversion of logged swamps to shrubby wetlands. However, it is also likely that the same stressors that might have increase extent have also decreased ecological integrity of many occurrences. The ratings "F=10-30%" was selected to account for these varying effects and most of this decline is assumed to be change of ecological integrity. It is difficult to know how much of that loss has occurrend within the last 50 years vs. longer term. Thus, the loss was equally splti between short- and long-term trends. In addition, logging, roads, development, agriculture, and grazing have resulted degradation of many extant occurrences. The degree to which stressors are degrading occurrences is assumed to be relatively similar in both short- and long-term trends, although the sources of those stressors may be different in those different time-frames.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Scientific Name: ***North Pacific Shrub Swamp*** **Elcode:** CES204.865

Common Name: North Pacific Shrub Swamp **Subnational ID:** 18296

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***North Pacific Volcanic Rock and Cinder Land*** **Elcode:** CES204.092

Common Name: North Pacific Volcanic Rock and Cinder Land **Subnational ID:** 18438

Descriptors

Element Description:

Rank

S Rank: S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 83 sqkm occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments:

Threat Category: 1 - Residential & commercial development Level of Threat: Negligible

Comments:

Threat Category: 1.3 - Tourism & recreation areas Level of Threat: Negligible

Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: Negligible

Comments:

Threat Category: 6 - Human intrusions & disturbance Level of Threat: Negligible

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***North Pacific Volcanic Rock and Cinder Land*** **Elcode:** CES204.092

Common Name: North Pacific Volcanic Rock and Cinder Land **Subnational ID:** 18438

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Scientific Name: ***North Pacific Wooded Volcanic Flowage*** **Elcode:** CES204.883

Common Name: North Pacific Wooded Volcanic Flowage **Subnational ID:** 18439

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 16-Oct-2014 **G_RANK:** GNR **G Rank Date:** 30-Mar-2005

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments: Mostly in Mt Adams vicinity but associated with all volcanos

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System (Sayre et al. 2009) mapped 82 km2. This is assumed to be an underestimate.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: as measure of unlogged area, 84% of area 800ft from roads, almost all on USFS NPS

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: can't think of any, maybe grazing leases logging on edges??

Threat Category: Level of Threat:

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Scientific Name: ***North Pacific Wooded Volcanic Flowage*** **Elcode:** CES204.883

Common Name: North Pacific Wooded Volcanic Flowage **Subnational ID:** 18439

Version

Version Author: Rex Crawford **Version Date:** 16-Oct-2014

Internal Notes:

Scientific Name: ***Northern Columbia Plateau Basalt Pothole Ponds [Provisional]*** **Elcode:** CES304.058

Common Name: Northern Columbia Plateau Basalt Pothole Ponds [Provisional] **Subnational ID:** 18308

Descriptors

Element Description: Shallow freshwater water bodies found in small depressions gouged into basalt by Pleistocene floods. Found within Artemisia shrub-steppe and Pinus ponderosa savanna or woodland landscapes. The system is occupies the bottom of a basalt cliff (1-20+ m tall) lined circular or linear depression where seasonal water fluctuations maintain the vegetation community. Characteristic emergent species include Scirpus and/or Schoenoplectus, Typha, Juncus, Potamogeton, Polygonum, Nuphar, and Phalaris. This system may also include areas of relatively deep water with floating-leaved plants (species of Lemna, Potamogeton, and Brasenia). Woody plants, including Populus tremuloides, Salix exigua, Crataegus douglasii, or Rosa woodsii, occur adjacent to more northerly potholes.

Some pothole ponds are accessible to livestock and thus overgrazing is a potential threat. The non-native Phragmites has also established and invading in some of these ponds. Adjacent land uses such as agriculture and grazing could potential result in excess nutrients and sediment moving into these ponds.

Rank

S Rank: S1S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The S1S2 ranks was chosen to reflect some uncertainty about the overall ecological integrity of this system across the landscape. Most sites visited by the author have been impacted by grazing and/or nonnative species. However, very little focused inventory has occurred and it isn't clear what proportion of sites have been observed.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: This ecological system is limited to the channeled scablands within the Columbia Basin where they occur as small, scattered depressions gouged into the basalt by Pleistocene floods. The system is primarily found in Adams, Douglas,Grant, Lincoln,Okagnogan, and Spokane counties where it is found on impervious basalt outcrops exposed by the Missoula floods (Bjork and Dunwiddie 2004). Extent was measured to be ~15,000 km2.norther portion of Columbia Basin in scablands

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) did not map this system. NWI estimates were made by clipping basalt flows from WA DNR's 1:100K Surface Geology layer within the three channeled scabland tracts (Grand Coulee tract; Telford-Crab Creek tract; and Cheney-Palouse tract). Then, the number and acreage of NWI palustrine emergent wetlands with semi-permanent to permanently flooded status occuring on this basalt layers were calculated. The result was 11,993 acres (~49 km2) of wetlands with moderate probability of being this ecological system. However, this value likely includes other wetlands such as Inter-Mountain Basin Alkaline Closed Depression, Inter-Mountain Basin Playa, and North American Arid Freshwater Emergent Marsh). This value is surely an overestimate. Field observation suggest that this systems is quite rare on the landscape. The "F=5-20 km2" estimate was heavily influenced by field observations.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are no element occurrences in the Washington Natural Heritage Program database. The "C=21-80" rating is based on field observations by Natural Heritage ecologist.

Population Size: =

Comments:

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: Although no element occurrences have been documented, we assume there that potholes that are inaccessible to livestock (due to being too steep) are likely to be in good ecological condition. This assumption is reflected in the "C=few (4-12)" rating. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 62% of NWI polygons predicted to include this system had good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 62% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. Grazing has reduced quality of many sites and nonnative species such as Phalaris arundianceae dominate many sites. Based on all this information, the rating "E= 11-20%" was chosen for 'percent area occupied' with good ecological integrity as many sites are in a landscape which has or is currently grazed by livestock.

Scientific Name: ***Northern Columbia Plateau Basalt Pothole Ponds [Provisional]*** **Elcode:** CES304.058

Common Name: Northern Columbia Plateau Basalt Pothole Ponds [Provisional] **Subnational ID:** 18308

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: This system is almost exclusively impacted by grazing and invasion from nonnative species, espeically Phalaris arundianceae. Its location on rocky basalt outcrops within the channeled scabland landscape limits impacts from development, roads, and agriculture.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: B = High

Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: B = High

Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High

Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High

Comments:

Trends

Short-term Trend: E **=** Decline of 30-50%

Comments: There are no data sources with reliable estimates of loss of this ecological system but direct loss is assumed to be very little due to its location in deep, steep potholes within a scabland landscape. However, degradation of ecological integrity of a significant number of occurrences is assumed to have occurred from grazing and the spread of nonanative species, espeically Phalaris arundianceae.

Long-term Trend: E = Decline of 30-50%

Comments: There are no data sources with reliable estimates of loss of this ecological system but direct loss is assumed to be very little due to its location in deep, steep potholes within a scabland landscape. However, degradation of ecological integrity of a significant number of occurrences is assumed to have occurred from grazing and the spread of nonanative species, espeically Phalaris arundianceae.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Bjork, C. R., and P. W. Dunwiddie. 2004. Floristics and distribution of vernal pools on the Columbia Plateau of eastern Washington. Rhodora Vol. 106, No. 928. pp. 327-347

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Scientific Name: ***Northern Columbia Plateau Basalt Pothole Ponds [Provisional]*** **Elcode:** CES304.058

Common Name: Northern Columbia Plateau Basalt Pothole Ponds [Provisional] **Subnational ID:** 18308

Version

Version Author: Joe Rocchio **Version Date:** 03-Mar-2015

Internal Notes:

Scientific Name: ***Northern Rocky Mountain Avalanche Chute Shrubland*** **Elcode:** CES306.801

Common Name: Northern Rocky Mountain Avalanche Chute Shrubland **Subnational ID:** 18269

Descriptors

Element Description: This ecological system occurs in the mountains throughout the northern Rockies, from Wyoming north and west into British Columbia and Alberta. It is composed of a diverse mix of deciduous shrubs or trees, and conifers found on steep, frequently disturbed slopes in the mountains. Occurrences are found on the lower portions and runout zones of avalanche tracks, and slopes are generally steep, ranging from 15-60%. Aspects vary, but are more common where unstable or heavy snowpack conditions frequently occur. Sites are often mesic to wet because avalanche paths are often in stream gullies, and snow deposition can be heavy in the run-out zones. The vegetation consists of moderately dense, woody canopy characterized by dwarfed and damaged conifers and small, deciduous trees/shrubs. Characteristic species include Abies lasiocarpa, Acer glabrum, Alnus viridis ssp. sinuata or Alnus incana, Populus balsamifera ssp. trichocarpa, Populus tremuloides, or Cornus sericea. Other common woody plants include Paxistima myrsinites, Sorbus scopulina, and Sorbus sitchensis. The ground cover is moderately dense to dense forb-rich, with Senecio triangularis, Castilleja spp., Athyrium filix-femina, Thalictrum occidentale, Urtica dioica, Erythronium grandiflorum, Myosotis asiatica (= Myosotis alpestris), Veratrum viride, Heracleum maximum (= Heracleum lanatum), and Xerophyllum tenax. Mosses and ferns are often present

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Rare type. Observed avalanche tracks on imagery at isolated peaks in higher mountain ranges form Salmo-Priest Wilderness in Pend Oreille County south to Mt Spokane and east in Kettle Range. Climate model indicates reduced snow pack in Rockies by 2035.

Range

Range Extent: C = 250-1000 square km (about 100-400 square miles)

Comments: This system occurs in mountain of northeast Washington where considerable snow pack is accumulated.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System (Sayre et al. 2009) map did not include this system in WA. However, field observations indicate this system occurs the Salmo-Priest Wildernss and nine other isolated ranges in NE Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Best professional judgment was to estimate rating. There are assumed to be very little direct humans influences in range except Mount Spokane where avalanche tracks may be impacted by ski activities.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: Avalanches are mainly governed by temperature flucuations, heavy precipitations and wind regimes, they are likely to be strongly influenced by climatic flucuations (Eckert et al 2008). Change of snowpack amounts and timing will likely change associated biota.Avalanches are mainly governed by temperature flucuations, heavy precipitations and wind regimes, they are likely to be strongly influenced by climatic flucuations (Eckert et al 2008). Change of snowpack amounts and timing will likely change associated biota.

Threat Category: 11 - Climate change & severe weather Level of Threat: BC = High - medium

Comments: snow pack changs

Threat Category: 11.3 - Temperature extremes Level of Threat: AC = Very high - medium

Comments: avalanches are mainly governed by temperature flucuations, heavy precipitations and wind regimes, they are likely to be strongly influenced by climatic flucuations. Eckert et al 2008. BPJ - change of snowpack amounts and timing will likely change associated biota.

Scientific Name: ***Northern Rocky Mountain Avalanche Chute Shrubland*** **Elcode:** CES306.801

Common Name: Northern Rocky Mountain Avalanche Chute Shrubland **Subnational ID:** 18269

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments:

Long-term Trend: G = Relatively Stable (<=10% change)

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Eckert, N., E. Parent, M. Naaim, and D. Richard. 2008. Bayesian stochastic modelling for avalanche predetermination: from a general system framework to resturn period computations. Stochastic Environmental Research and Risk Assessment. Vol. 22, Issue 2, pp. 185-206

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Conifer Swamp*** **Elcode:** CES306.803

Common Name: Northern Rocky Mountain Conifer Swamp **Subnational ID:** 18249

Descriptors

Element Description: Conifer dominated swamps on poorly drained, seasonally or permanently saturated, soil occurring in eastern Washington above lower treeline. The system is found on benches, toeslopes or valley bottoms along mountain streams. Can occur on steeper slopes where soils are shallow over unfractured bedrock. Sites have poorly drained soils in an area with a mosaic of moving and stagnant water. Soils can be woody peat, muck or mineral but tend toward mineral. Plant associations which may be present include wetland phases of Thuja plicata, Tsuga heterophylla, and Picea engelmannii forests. These wetland types are generally distinguishable from other upland forests and woodlands by shallow water tables and mesic or hydric undergrowth vegetation; some of the most typical species include Athyrium filix-femina, Dryopteris spp., Lysichiton americanus, Equisetum arvense, Senecio triangularis, Mitella breweri, Mitella pentandra, Streptopus amplexifolius, Calamagrostis canadensis, or Carex disperma.

Roads and clearcut logging practices can increase the frequency of landslides and resultant debris flows/torrents, as well as sediment loads in streams and wetlands. This in turn alters hydrologic patterns and the composition and structure of montane riparian and wetland habitats. Logging typically reduces large woody debris and canopy structural complexity. Timber harvest on some sites can cause the water table to rise and subsequently prevent trees from establishing . Wind disturbance can be greatly increased by timber harvest in or adjacent to this system.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This ecological system has likely not been significantly reduced in extent due to occurring on USFS managed lands where most impacts are from roads, hydrological management, and livestock grazing.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: This system is found in the Okanogan Highlands, Northern Rockies, and Blue Mountains of eastern Washington.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 338 acres (~1.4 km2) in Washington. This may be an underestimate, although occurrences are always very small.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are 10 element occurrences in the Washigton Natural Heritage Program database. However, as demonstrated by various USFS classification efforts (e.g., Kovalchik and Clausnitzer 2004) there are many more occurrences on the landscape.

Population Size: =

Comments:

Number of Viable EOs: E = Many (41-125) **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Field observations suggest that many occurrences are remain with good ecological integrity. Most occurrences are on public lands. Some may have been degraded by past/ongoing logging.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Logging changes vegetation structure and oads may be impacting hydrology of some sites.

Threat Category: 1 - Residential & commercial development Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: D = Low
Comments:

Threat Category: 4.1 - Roads & railroads Level of Threat: D = Low
Comments:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Conifer Swamp*** **Elcode:** CES306.803

Common Name: Northern Rocky Mountain Conifer Swamp **Subnational ID:** 18249

Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: It is not known how much has historically been lost. Most of the sytem occurs on public lands so development is an unlikely source of loss. However, logging have impacted integrity of some sites. Most change likely degradation rather than loss due to logging and road impacts.

Long-term Trend: F = Decline of 10-30%

Comments: It is not known how much has historically been lost. Most of the sytem occurs on public lands so development is an unlikely source of loss. However, logging have impacted integrity of some sites. Most change likely degradation rather than loss due to logging and road impacts.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Kovalchik, B.L. and R.R. Clausnitzer. 2004. Classification and Management of Aquatic, Riparian, and Wetland Sites on the National Forests of Eastern Washington. Series Description. United States Dept. of Agriculture. Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-593

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest*** **Elcode:** CES306.805

Common Name: Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest **Subnational ID:** 18272

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system is widespread. However, logging (espeically high-grading), grazing and fire suppression has lowered overall ecological integrity of many occurrences.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 16,5024 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: 46% of mapped area (Sayre et al 2009) occur 800ft beyond roads, suggesting a little over half as been logged. Over less than half on USFS lands.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: These forests have many indirect and direct impacts that mostly reduce condition, such as grazing, fire suppresion, and invasive species.These forests have many indirect and direct impacts that mostly reduce condition, such as grazing, fire suppresion, and invasive species.

Threat Category: 11 - Climate change & severe weather Level of Threat: BC = High - medium
Comments: over next 20yrs increased fire and likely beetles, defoliators on fir.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: CD = Medium - low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: CD = Medium - low
Comments: most of this has livestock sometime or another

Threat Category: 5 - Biological resource use Level of Threat: BC = High - medium
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: BC = High - medium
Comments: seems to me the removal of large trees particularly ponderosa lowers quality, lats of natural regen and partial cuts

Threat Category: 7 - Natural system modifications Level of Threat: BC = High - medium
Comments:

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BC = High - medium
Comments: check with LANDFIRE departure lots of over stocked, suppressed stands

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: D = Low
Comments: dry end of system more so post fire increase grasses knapweeds

Scientific Name: ***Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest*** **Elcode:** CES306.805

Common Name: Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest **Subnational ID:** 18272

Trends

Short-term Trend: F = Decline of 10-30%

Comments: Recent fires.

Long-term Trend: E = Decline of 30-50%

Comments: Past highgrade logging, grazing, and fire suppression effects.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Foothill Conifer Wooded Steppe*** **Elcode:** CES306.958

Common Name: Northern Rocky Mountain Foothill Conifer Wooded Steppe **Subnational ID:** 19379

Descriptors

Element Description:

Rank

S Rank: S3S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Since the system is not mapped it may be more rare than presumed.

Range

Range Extent:

Comments: This system was not included in NatureServe's Ecological Systems map (Sayre et al. 2009). It occurs at lower treeline and stringers into the Columbia Basin.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Based on personal observations, the system occupies small to large patches. Some occurences of this type may be mapped (Sayre et al. 2009) as ponderosa pine savanna although the wooded steppe phsiognomy is frequently observable on imagery in adjacent non-forest.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: Based on personal observations, this sytems is generally in better condition better than ponderosa pine savanna. The better sites are probably shrubby types on steep, rocky slopes

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 5 - Biological resource use Level of Threat: CD = Medium - low
Comments:

Threat Category: 5.2 - Gathering terrestrial plants Level of Threat: CD = Medium - low
Comments: high grading for wood not forestry

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low
Comments: change in forest structure with suppression

Threat Category: 7.1 - Fire & fire suppression Level of Threat: CD = Medium - low
Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***Northern Rocky Mountain Foothill Conifer Wooded Steppe*** **Elcode:** CES306.958

Common Name: Northern Rocky Mountain Foothill Conifer Wooded Steppe **Subnational ID:** 19379

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland*** **Elcode:** CES306.804

Common Name: Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland **Subnational ID:** 18271

Descriptors

Element Description: The Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland system includes riparian woodland and shrubland consisting of deciduous, coniferous, and mixed conifer-deciduous trees and shrubs that occur on streambanks and river floodplains in the lower montane and foothill zones of the Northern Rocky Mountains. In Washington, this linear system occurs on streambanks and river floodplains of the lower montane and foothill zones in the northern Rocky Mountains, the Okanogan Highlands, the Blue Mountains, and sporadically on the slopes of the northeast Cascades. In the Okanogan, this is defined as all the cottonwood-dominated or codominated riparian systems below subalpine and above the Ponderosa pine zone. Complex geomorphic and biotic components and processes maintain the long-term integrity of this system (Gregory et al. (1991). Annual flooding is a key ecological process which results in a diversity of patch types such as woodlands, shrublands, wet meadows, and marshes. Beaver activity is an important driver of hydrological change. Woodlands are often dominated by Populus balsamifera ssp. trichocarpa which is the key indicator species. Several other tree species can be mixed in the canopy, including Populus tremuloides, Betula papyrifera, and Betula occidentalis. Shrub understory components include Cornus sericea, Acer glabrum, Alnus incana, Betula papyrifera, Oplopanax horridus and Symphoricarpos albus. Ferns and forbs of mesic sites are commonly present in many occurrences, including such species as Athyrium filix-femina, Gymnocarpium dryopteris, and Senecio triangularis.

The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands. Stand replacement fires are rare but may occur when replacement fires occur in adjacent uplands (Fire regime III; average fire frequency of 100 years; LANDFIRE 2007). More frequent surface fires (~ every 50 years) can affect shrub patches through a combination of replacement fire from uplands and occasional native burning (LANDFIRE 2007). Following stand replacement fires deciduous woody species (e.g., Populus tremuloides, Salix spp., etc.) can be top-killed but generally resprout within a short period. Post-fire establishment of conifers occurs from seed. Wet meadows seldom burn and when they do, they typically recover within a single growing season (LANDFIRE 2007).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of riparian areas in eastern Washington. Human land uses both within the riparian area as well as in adjacent and upland areas have fragmented many riparian reaches which has reduced connectivity between riparian patches and riparian and upland areas. Adjacent and upstream land uses also have the potential to contribute excess nutrients into riparian areas Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrology regime. Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. In general, excessive livestock or native ungulate use leads to less woody cover and an increase in sod-forming grasses particularly on fine-textured soils. Undesirable forb species, such as Urtica dioca and Equisetum spp., increase with livestock use. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. All of these stressors have resulted in many riparian areas being incised, supporting altered riparian plant communities, as well as numerous non-native species. This system has also decreased in extent due to agricultural development, roads, dams and other flood-control activities.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This Ecological System remains widespread on the landscape, however most occurrences have been degraded from a variety of stressors.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: Within Washington, this ecological system is found above lower treeline in the lower montane zones of East Cascades, Okanagon, Northern Rockies, and Blue Mountains.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland*** **Elcode:** CES306.804

Common Name: Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland **Subnational ID:** 18271

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 42,779 acres (~173 km2). The National Wetland Inventory (NWI) mapped an estimated 15,095 acres (~61 km2) of palustrine forested/scrub-shrub wetlands within the subalpine-montane zone of eastern Washington. However, this value also includes two other Ecological Systems (Rocky Mountain Subalpine-Montane Riparian Woodland and Northern Rocky Mountain Conifer Swamp). Both maps were subjectively investigated by the author using GIS. NWI maps definitely under map the extent of riparian woodlands and shrublands along riverine zones while the Ecological System map does a good job of capturing areas where NWI maps missed along riparian corridors. However, the Ecological System maps also overmaps in areas where this ecological system is unlikely to occur (e.g., outside of riparian zones). The "G=20-100km2" was chosen to represent this variability in the two maps.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are less than 10 element occurrences in WNHP database, primarily due to lack of focused inventory efforts. Kovalchik and Clausnitzer (2004) have between 50-100 vegetation plots of this Ecological System. Based on these sources and personal observations, the "D=81-300" rating was chosen.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 91% of all palustrine forested/scrub-shrub wetlands in the subalpine-montanze zone of eastern Washington had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 91% is assumed to be a gross overestimate of the area of this Ecological System with good/excellent integrity (in addition to the fact that the NWI estimate includes two other ecological systems). Based on personal observations, grazing, roads, logging, and nonnative species have had a large impact on the integrity of this ecological system. Most of this system occurs on public lands. Thus, the metric rating "E=good (21-40%)" was chosen.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Hydrological alterations from roads and other management, livestock grazing, logging, and nonnative species are primary threats.

Threat Category:	1 - Residential & commercial development	Level of Threat:	D = Low
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	D = Low
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	B = High
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	B = High
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			

Scientific Name: ***Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland*** **Elcode:** CES306.804

Common Name: Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland **Subnational ID:** 18271

Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			
Threat Category:	9 - Pollution	Level of Threat:	D = Low
Comments:			
Threat Category:	9.3 - Agricultural & forestry effluents	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: Based on personal observations, grazing, roads, logging, and nonnative species continue to impact many occurrences. Some loss may occur due to road construction.

Long-term Trend: E = Decline of 30-50%

Comments: There are no data sources with reliable estimates of loss of this ecological system. Comparing NatureServe's Ecological System map (=current extent) to Landfire's Environmental Site Potential map (=historical extent) was not useful because the latter grouped riparian systems in a different way that the Ecological System map . Thus, no meaningful numbers could be extracted from the analysis. Nonentheless, field experience indicates that conversion of many riparian areas to agriculture/hay fields is common. it is assumed that grazing and logging had a large impact on the integrity of extant occurrences.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Kovalchik, B.L. and R.R. Clausnitzer. 2004. Classification and Management of Aquatic, Riparian, and Wetland Sites on the National Forests of Eastern Washington. Series Description. United States Dept. of Agriculture. Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-593

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 19-Feb-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland*** **Elcode:** CES306.040

Common Name: Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland **Subnational ID:** 18440

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 31-Mar-2005

State Exemplary Site:

Rank Reasons: I might over estimate the overall condition, conversionin the lower elevations to farm, hay, pasture

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) 2077 sqkm may have overmapped Montane shrub steeppe as this.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: BPJ most I've seen are good

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: climate change will impact but not included in threatsclimate is an unknown like a concern to lead to change

Threat Category: 2 - Agriculture & aquaculture Level of Threat: CD = Medium - low
Comments: BPJ most are small patches, larger patches lower elevation mpre threats tolower condition

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: CD = Medium - low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: BD = High - low
Comments: deciduous shrubs and tree invasion without fire, exotics with severe fire

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: CD = Medium - low
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: CD = Medium - low
Comments: annua/biennials in xerics. Pasture grasses mesic

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: CD = Medium - low
Comments: shrub/tree invasionsee fire suppression

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Scientific Name: ***Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland*** **Elcode:** CES306.040

Common Name: Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland **Subnational ID:** 18440

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 27-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Mesic Montane Mixed Conifer Forest*** **Elcode:** CES306.802

Common Name: Northern Rocky Mountain Mesic Montane Mixed Conifer Forest **Subnational ID:** 18270

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 2073 sqkm as occuring in Washington. That map seems to overestimate the area of this type in the Blue Mountains.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: 49% of mapped are (Sayre et al. 2009) beyond 800 ft of road, suggesting about half has been logged in the past. Most of this type is on USFS lands.

Number Protected EOs:

Comments:

Threats

Threats: AC = Very high - medium

Comments: These forests are productive and are somewhat resilient. White pine, espeicially older individuals/stands have been lost. Logging has changed overall forest structure.These forests are productive and are somewhat resilient. White pine, espeicially older individuals/stands have been lost. Logging has changed overall forest structure.

Threat Category: 11 - Climate change & severe weather Level of Threat: BD = High - low
Comments:

Threat Category: 11.2 - Droughts Level of Threat: BD = High - low
Comments: over next 20 fire increase

Threat Category: 5 - Biological resource use Level of Threat: CD = Medium - low
Comments: around 70% is in USFS logging often relies on natural regen

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: CD = Medium - low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: BC = High - medium
Comments: this is cedar hemlock and the 100-200+yr return interval forest not clear of impacts need to check landfire

Threat Category: 7.1 - Fire & fire suppression Level of Threat: B = High
Comments: need to get a departure layer

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments: Insects damage in larch and white pine, defoliater on doug fir and fir

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Scientific Name: ***Northern Rocky Mountain Mesic Montane Mixed Conifer Forest*** **Elcode:** CES306.802

Common Name: Northern Rocky Mountain Mesic Montane Mixed Conifer Forest **Subnational ID:** 18270

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Montane-Foothill Deciduous Shrubland*** **Elcode:** CES306.994

Common Name: Northern Rocky Mountain Montane-Foothill Deciduous Shrubland **Subnational ID:** 18250

Descriptors

Element Description:

Rank

S Rank: S4? **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments: This sytem has a small footprint in foothills around the Columbia Basin.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map estimated 842 sqkm in Washington. This maybe an underestimate but even so the total is still likely in the lower end of the rating for this metric.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** DE = Moderate to good (11-40%)

Comments: Based on best professional judgment. Very little of this sytem is in good condition within the steppe zones but condition generally increases into the foothill/forest zone.

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: Threats seem to depend on which type of shrubfield and where it occurs. Some will increase extent.Threats seem to depend on which type of shrubfield and where it occurs. Some will increase extent.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments: steep slopes limit ad mid elev

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments: where fenced can be serious

Threat Category: 7 - Natural system modifications Level of Threat: CD = Medium - low
Comments: fire supprssion increase shrubs in some areas, tree invasion in others

Threat Category: 7.1 - Fire & fire suppression Level of Threat: CD = Medium - low
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: CD = Medium - low
Comments: most invasives increase with live stock use although POAPRA increases

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: CD = Medium - low
Comments: Prunus cerasifera can be serious, maybe blackberry

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: CD = Medium - low
Comments: tree invasion

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***Northern Rocky Mountain Montane-Foothill Deciduous Shrubland*** **Elcode:** CES306.994

Common Name: Northern Rocky Mountain Montane-Foothill Deciduous Shrubland **Subnational ID:** 18250

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Ponderosa Pine Woodland and Savanna*** **Elcode:** CES306.030

Common Name: Northern Rocky Mountain Ponderosa Pine Woodland and Savanna **Subnational ID:** 18446

Descriptors

Element Description: Precipitation varies from 36-76 cm (~14-30 in.) with most occurring as snowfall. These woodlands occur on warm, dry, exposed sites on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops are most common. They are generally found on glacial till, glacio-fluvial sand and gravel, dunes, basaltic rubble, colluvium, to deep loess or volcanic ash-derived soils, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acidic pH, an abundance of mineral material, rockiness, and periods of drought during the growing season.

These woodlands and savannas are, or at least historically were, fire-maintained and occurring at the lower treeline/ecotone between grasslands or shrublands at lower elevations and more mesic coniferous forests at higher elevations. Canopy coverage typically ranges from 10-60%. Summer drought and frequent, low-severity fires create woodlands composed of widely spaced, large trees with small scattered clumps of dense, even-aged stands which regenerated in forest gaps or were protected from fire due to higher soil moisture or topographic protection. Closed canopy or dense stands were also part of the historical range of stand variability but was a minor component of that landscape. However, such structure is increasing in abundance due to fire suppression. Older stands typically include multiple size and age cohorts and are maintained by frequent surface and mixed-severity fires. Native Americans and lightning were sources of ignition during presettlement era. Historically, many of these woodlands and savannas lacked the shrub component as a result of low severity but high frequency fires (2 - to 10-year fire-return intervals). Some sites, because of low productivity, naturally lacked a dense shrub understory. Mixed-severity fires had a return interval of 25-75 years while stand-replacing fire occurred at an interval of >100 year. The latter two intervals only occur on 20-25% of stands within the landscape while surface fires were the dominant fire regime on over 75% of stands (LANDFIRE Northern Rocky Mountain Ponderosa Pine . BPS:0111650 Models; www.landfire.gov). Western pine beetle is another significant disturbance and especially affects larger trees. Mistletoe can cause tree mortality in young and small trees. Fires and insect outbreaks resulted in a landscape consisting of a mosaic of open forests of large trees (most abundant patch), small denser patches of trees, and openings.

Fire suppression has created conditions that increase the likelihood of all these disturbances. Most areas that may have been savanna in the past are now more nearly closed-canopy woodlands/forests. Pinus ponderosa var. ponderosa is the predominant conifer; Pseudotsuga menziesii (primarily var. glauca) may be present in the tree canopy but is usually absent. Populus tremuloides may be present, but is generally <25% of tree canopy. The understory can be shrubby, with Artemisia tridentata, Arctostaphylos uva-ursi, Ceanothus velutinus, Physocarpus malvaceus, Purshia tridentata, Symphoricarpos albus, Prunus virginiana, Amelanchier alnifolia, and Rosa spp. being common. Understory vegetation in the true savanna occurrences is predominantly fire-resistant grasses and forbs that resprout following surface fires and shrubs, understory trees and downed logs are uncommon in these areas. Open stands support grasses such as Pseudoroegneria spicata, Hesperostipa spp., Achnatherum spp., Festuca idahoensis, or Festuca campestris. The more mesic portions of this system may include Calamagrostis rubescens or Carex geyeri, species more typical of Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:** 16-Nov-2004

State Exemplary Site:

Rank Reasons: very few sites not impacted in some way. Could make a case for S2 on extent alone.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) over map (4981sqkm) I think oak-pine was often mapped as this in Klickitat and Yakima Counties and wooded steppe into the shrubsteppe zones . Most is invasion forest into steppe or shrubsteppe

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** C = Small (5-10%)

Scientific Name: ***Northern Rocky Mountain Ponderosa Pine Woodland and Savanna*** **Elcode:** CES306.030

Common Name: Northern Rocky Mountain Ponderosa Pine Woodland and Savanna **Subnational ID:** 18446

Comments: 58 association occurrences 12 sites, as an indicator of unlogged 38% mapped area beyond 800ft of road. Greater impact to undergrowth and increased tree density. Savannas are rare

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: change in structure due to fire suppression, high grading and weed invasionchange in structure due to fire suppression, high grading and weed invasion

Threat Category: 1 - Residential & commercial development Level of Threat: Negligible
Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: Negligible
Comments: around spokane

Threat Category: 11 - Climate change & severe weather Level of Threat: C = Medium
Comments: guessing increased droughts fire

Threat Category: 2 - Agriculture & aquaculture Level of Threat: B = High
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: B = High
Comments: impacts structure and to understory composition

Threat Category: 5 - Biological resource use Level of Threat: B = High
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High
Comments: removal of large wood, increased density

Threat Category: 7 - Natural system modifications Level of Threat: B = High
Comments: increased density of smaller trees

Threat Category: 7.1 - Fire & fire suppression Level of Threat: B = High
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments: dry sites tend to increase in annual grasses, knapweeds. Moister site orachgrasses

Trends

Short-term Trend: **=**

Comments:

Long-term Trend: D = Decline of 50-70%

Comments: Haugo etal 2010 discuss factors that changed this system. Has likely increased in size, condition low

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Scientific Name: ***Northern Rocky Mountain Ponderosa Pine Woodland and Savanna*** **Elcode:** CES306.030

Common Name: Northern Rocky Mountain Ponderosa Pine Woodland and Savanna **Subnational ID:** 18446

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Subalpine Deciduous Shrubland*** **Elcode:** CES306.961

Common Name: Northern Rocky Mountain Subalpine Deciduous Shrubland **Subnational ID:** 19382

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This sytem is not common but the threats are few. I think more resilient than the S3 rank implies.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimated 57 sqkm in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Used best professional judgment to rank metric. Livestock impacts could be more widespread and degrading than consdered here.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: Tree invasion and commercial harvesting huckleberriess

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown
Comments:

Threat Category: 5 - Biological resource use Level of Threat: D = Low
Comments: huckleberry harvest beyond tradition in smaller area

Threat Category: 5.2 - Gathering terrestrial plants Level of Threat: D = Low
Comments: huckleberry harvest beyond tradition in smaller area

Threat Category: 7 - Natural system modifications Level of Threat: BC = High - medium
Comments: trees invasion with suppression

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BC = High - medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: Unknown
Comments: noted in Parks et al

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: Unknown
Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: F = Decline of 10-30%

Comments: BPJ native people fires reduce size

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***Northern Rocky Mountain Subalpine Deciduous Shrubland*** **Elcode:** CES306.961

Common Name: Northern Rocky Mountain Subalpine Deciduous Shrubland **Subnational ID:** 19382

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Subalpine Woodland and Parkland*** **Elcode:** CES306.807

Common Name: Northern Rocky Mountain Subalpine Woodland and Parkland **Subnational ID:** 18253

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: There is some uncertainity about the degree of impacts as threats are mostly on USFS land and above most land uses. Other than recreation, livestock grazing may be the most common stressor.

Range

Range Extent:

Comments: Within Washington this sytem occurs in the East Cascades, northeastern portion of Olympic Mountains, and Kettle Range.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 2900 sqkm.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: Esimated that 97% of mapped area is unlogged by calculating the proportion of unlogged stands by calculating area mapped beyond 800ft (assumption being that logging didn't not occur beyond this distance). Livestock grazing and blister rust may reduce the proportion of this area in excellent to good condition.

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: Blister rust is a threat to the whitebark pine component of this system. Subalpine larch and spruce-fir are likely without much threat, other than livestock grazing. However, more data are needed.Blister rust is a threat to the whitebark pine component of this system. Subalpine larch and spruce-fir are likely without much threat, other than livestock grazing. However, more data are needed.

Threat Category: 11 - Climate change & severe weather Level of Threat: CD = Medium - low
Comments: maybe increased tree invasion

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments: no experience here I know grazing is allowed iin Pasayten wilderness

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium
Comments: blister rust

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: C = Medium
Comments: blister rust on whitebark pine

Trends

Short-term Trend: E = Decline of 30-50%

Comments: from 2012 WGA Grank

Long-term Trend: F = Decline of 10-30%

Comments: From NatureServe's estimate for the Western Governor's Association ranking project (2012).

Other Factors

Intrinsic Vulnerability: =

Comments:

Scientific Name: ***Northern Rocky Mountain Subalpine Woodland and Parkland*** **Elcode:** CES306.807

Common Name: Northern Rocky Mountain Subalpine Woodland and Parkland **Subnational ID:** 18253

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Northern Rocky Mountain Subalpine-Upper Montane Grassland*** **Elcode:** CES306.806

Common Name: Northern Rocky Mountain Subalpine-Upper Montane Grassland **Subnational ID:** 18252

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimated 30 sqkm in Wasington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: Estimate based on liimted personal experience; past sheep and cattle heavy grazing is typical for this type in Blue Mountain and elsewhere in Northern Rockies.

Number Protected EOs:

Comments:

Threats

Threats: BC = High - medium

Comments: Potential impacts from climate change is unknown but likely a concern.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: BD = High - low
Comments: some documentatio in Blue mts

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: BD = High - low
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: BD = High - low
Comments:

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BD = High - low
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BD = High - low
Comments: in Blue mts; noted in MT

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: BD = High - low
Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Scientific Name: ***Northern Rocky Mountain Subalpine-Upper Montane Grassland*** **Elcode:** CES306.806

Common Name: Northern Rocky Mountain Subalpine-Upper Montane Grassland **Subnational ID:** 18252

Needs

Research Needs:
Inventory Needs:
Protection Needs:
Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 31-Oct-2014

Internal Notes:

Scientific Name: ***Northern Rocky Mountain Western Larch Savanna*** **Elcode:** CES306.837

Common Name: Northern Rocky Mountain Western Larch Savanna **Subnational ID:** 18441

Descriptors

Element Description: Larix occidentalis dominates although stands may be co-dominated by Pseudotsuga menziesii or Pinus contorta. The shade-tolerant, more fire sensitive trees Abies lasiocarpa, Picea engelmannii, or Abies grandis are slow to establish on these sites, grow slowly and, given the fire-return intervals, rarely gain canopy dominance but can be common in the sub-canopy. Undergrowth is dominated by low-growing Arctostaphylos uva-ursi, Calamagrostis rubescens, Linnaea borealis, Spiraea betulifolia, Vaccinium caespitosum, or Xerophyllum tenax. Less frequent fire allows mixed-dominant stands to develop often with shrubby undergrowth of Acer glabrum, Ceanothus velutinus, Shepherdia canadensis, Physocarpus malvaceus, Rubus parviflorus, or Vaccinium membranaceum. Larix occidentalis is a long-lived species (400-900 years old; Van Pelt 2008), and thus stands fitting this concept are themselves long-persisting. However, the Larix-dominated stands probably rarely exceed 250 years due to various mortality factors and competition by shade-tolerant species.

Many Larix occidentalis stands and mixed conifer stands with Larix are early to mid-seral components of the mixed to high severity fire systems - East Cascades Mesic Montane Mixed Conifer Forest, Northern Rocky Mountain Mesic Montane Mixed Conifer Forest and Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest systems. Those stands initiate following crown fires in areas with stand-replacing fire frequencies greater than 150 years. This contrasts with the high-frequency, mixed to low-severity fires that maintain the characteristic open-canopied savanna or woodland of the Northern Rocky Mountain Western Larch Savanna system. Canopy coverage typically ranges from 10-60%. These sites may be maintained in a mid-seral, single-layer status for hundreds of years by low or mixed intensity, high frequency fires. Landfire Biophysical Setting Model 1010452 (2007) describes this system as variant of the Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest system with a mixed severity fire regime (III), mean fire return interval of approximately 40 years, rare replacement fires, and occasional small, patchy surface fires. Older stands typically include multiple size and age cohorts and are maintained by frequent surface and mixed-severity fires. Closed canopy or dense stands were also minor part of the historical range of stand variability. However, such vertical structure is increasing in abundance due to fire suppression. Fire suppression has created conditions that increase the likelihood of stand replacement fire as well mistletoe infestations of Larix stands. Landfire (2007) estimated 30% of the system was open late-seral, 20% closed late-seral, 40% open and closed mid-seral and 10% early seral. Since European settlement, fire suppression, tree harvesting, introduced diseases, road building, development, and plantation establishments have all impacted natural disturbance regimes, forest structure, composition, landscape patch diversity, and tree regeneration. Timber harvesting has focused on the large, older trees in mid- and late-seral forests thereby eliminating many old forest attributes from stands. Fire suppression has resulted in increased tree regeneration and thus a denser understory composed of young trees. Fire suppression has also allowed less fire-resistant, shade-tolerant trees to become established in the understory (and sometimes dominate the canopy) of moist or protected sites creating more dense and multi-layered forests than what historically occurred on the landscape. Road development has fragmented many forests creating fire breaks. Under present conditions the fire regime tends to be more high severity and variable, with stand-replacing fires more common, and the forests are more homogeneous. The resultant stands at all seral stages tend to lack snags, have high tree density, and are composed of smaller and more shade-tolerant trees. The introduced forest pest, larch casebearer (Coleophora laricella) defoliates trees and with heavy infestation and eventually kill trees.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The open grown oldgrowth and woodland structure has been largely lost due to fire suppressiiion and logging of big trees. Only two areas are known that have the orignal structure within a mix of closed forest.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: assume the distribution of western larch in Wa estimates historic extent.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: Comer Hak (NatureServe 2009 M09NAT01HQUS) map probably over represented 90sqkm

Population and EOs

Number of EOs: A = 1 - 5

Scientific Name: ***Northern Rocky Mountain Western Larch Savanna*** **Elcode:** CES306.837

Common Name: Northern Rocky Mountain Western Larch Savanna **Subnational ID:** 18441

Comments: I know of two mostly large open at Judy's Park, Colockum and one on the Colville Res both are small in mosaic with closed stands. Not in WANHP database. Mixed larch stands relatively common that tend to be closed forest.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** B = Very small (<5%)

Comments: Loss of old growth single story forest structures (Hessburg and others 1999)

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: This is the more open grown larch stands that are converted to mixed conifer and/or degraded with cutting big trees. Introduced insects are reducing vigour of larch mostly in Okanogan Highlands.This is the more open grown larch stands that are converted to mixed conifer and/or degraded with cutting big trees. Introduced insects are reducing vigour of larch mostly in Okanogan Highlands.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments: grazing after logging even if large larch are left

Threat Category: 5 - Biological resource use Level of Threat: BC = High - medium
Comments: removal of large trees can change system to a mixed conifer type

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: BC = High - medium
Comments: removal of large trees can change system to a mixed conifer type

Threat Category: 7 - Natural system modifications Level of Threat: B = High
Comments: ICBMP included the open larch as one of the stand conditions most changed to closed mixed conifer

Threat Category: 7.1 - Fire & fire suppression Level of Threat: B = High
Comments: ICBMP included the open larch as one of the stand conditions most changed to closed mixed conifer

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: C = Medium
Comments: The larch casebearer and the balsam woolly adelgid are two destructive insects introduced into the region in the1980's (Hesbrug, Mitchell and Filip 1997).

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: C = Medium
Comments: larch case bearer impacts need search

Trends

Short-term Trend: C **=** Decline of 70-80%

Comments: The amount of western larch cover type has decreased by 72 percent since the mid 1950's. Trees of Idaho http://www.idahoforests.org/weslarch.htm

Long-term Trend: B = Decline of 80-90%

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***Northern Rocky Mountain Western Larch Savanna*** **Elcode:** CES306.837

Common Name: Northern Rocky Mountain Western Larch Savanna **Subnational ID:** 18441

References

Citation

Van Pelt, R. 2008. Identifying Old trees and Forests in Eastern Washington. Wa. Dept Natural Resources, Olympia Wa. 169p.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Scientific Name: ***Rocky Mountain Alpine Bedrock and Scree*** **Elcode:** CES306.809

Common Name: Rocky Mountain Alpine Bedrock and Scree **Subnational ID:** 18273

Descriptors

Element Description:

Rank

S Rank: S4? **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: European study indicate rapid colonization of scree by plants may represent decline with climate change.

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 34 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:**

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: No known threats; uncertain if increase in area with glacier retreat will be offset with transition to vegetated surface?

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: BC = Moderately vulnerable to not intrinsically vulnerable.

Comments:

Environmental Specificity: B = Narrow. Specialist or community with key requirements common.

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Scientific Name: ***Rocky Mountain Alpine Bedrock and Scree*** **Elcode:** CES306.809

Common Name: Rocky Mountain Alpine Bedrock and Scree **Subnational ID:** 18273

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Alpine Dwarf-Shrubland*** **Elcode:** CES306.810

Common Name: Rocky Mountain Alpine Dwarf-Shrubland **Subnational ID:** 18256

Descriptors

Element Description:

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments: For purposes of ranking this sysytem was combined with CES306.811 Rocky Mountain Alpine Fell-field & CES306.816 Rocky Mountain Alpine Turf.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 250 sqkm in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Best professional judgment was for esimate. There are few threats except past grazing and climate change.

Number Protected EOs:

Comments:

Threats

Threats: CD = Medium - low

Comments: This combines three systems.

Threat Category: 11 - Climate change & severe weather Level of Threat: CD = Medium - low

Comments: BPJ need to look att models

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low

Comments: grazing in Paystaten Wilderness how much impact unkown

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low

Comments: grazing in Paystaten Wilderness how much impact unkown

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***Rocky Mountain Alpine Dwarf-Shrubland*** **Elcode:** CES306.810

Common Name: Rocky Mountain Alpine Dwarf-Shrubland **Subnational ID:** 18256

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 22-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Alpine Fell-Field*** **Elcode:** CES306.811

Common Name: Rocky Mountain Alpine Mosaic **Subnational ID:** 18274

Descriptors

Element Description:

Rank

S Rank: SNR **S Rank Date:** **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments:

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:**

Comments:

Number Protected EOs:

Comments:

Threats

Threats:

Comments:

Threat Category: Level of Threat:

Comments:

Trends

Short-term Trend: **=**

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: **Version Date:**

Scientific Name: ***Rocky Mountain Alpine Fell-Field*** **Elcode:** CES306.811

Common Name: Rocky Mountain Alpine Mosaic **Subnational ID:** 18274

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Alpine-Montane Wet Meadow*** **Elcode:** CES306.812

Common Name: Rocky Mountain Alpine-Montane Wet Meadow **Subnational ID:** 18275

Descriptors

Element Description: The Rocky Mountain Alpine-Montane Wet Meadow ecological system is a small patch system found throughout the high elevations of Rocky Mountains and Intermountain regions. Wet meadows are dominated by herbaceous species with very low velocity surface and subsurface water flows. They appear in elevations from montane to alpine (1000 to 3600 m). These types occur as large meadows in montane or subalpine valleys associated with groundwater discharge or seasonally high water tables such as narrow strips bordering ponds, lakes, and streams, and along toe slope seeps. They are typically found on flat areas or gentle slopes, but may also occur on sub-irrigated sites with slopes up to 10%. In alpine regions, sites typically are small depressions located below late-melting snow patches or on snowbeds tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding, however montane wet meadows may be seasonally flooded. Soils of this system are mineral and may have large amount of organic matter but less than 40 cm (16 in) thick. Soils show typical hydric soil characteristics, including high organic content and/or low chroma and redoximorphic features. This system often occurs as a mosaic of several plant associations, often dominated by graminoids. Wet site species such as Calamagrostis stricta, Caltha leptosepala, Cardamine cordifolia, Carex illota, C. microptera, C. nigricans, C. scopulorum, C. utriculata, C. vernacular, Deschampsia cespitosa, Eleocharis quinqueflora, Juncus drummondii, Phippsia algida, Rorippa alpina, Senecio triangularis, and Trifolium parryi are common. Often alpine dwarf-shrublands, especially those dominated by Salix spp., are immediately adjacent to the wet meadows. This system is characterized as montane to alpine wet meadows that are typically dominated by graminoids and occasionally forbs and soils do not have > 40 cm of organic matter.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: There has been degradation of many occurrences but likely not significant loss of extent. Many occurrences are likely to remain with good ecological integrity due to being at high elevations and thus not exposed to many stressors. Current threats are high.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: This ecological system is found in the East Cascades, eastern portion of the North Cascades, Okanogan Highlands, northern Rocky Mountiains, and Blue Mountains of eastern Washington. It occurs above lower tree line up to alpine areas. In the upper subalpine/alpine areas of the East Cascades this ecological system may merge with the Temperate Pacific Subalpine-Montane Wet Meadow. It generally occurs in depressions, along pond shorelines, areas with seasonal groundwater discharge and below melting snowbanks. The concept used by WNHP for this ecological system varies from NatureServe's original descritpion. NatureServe included many areas which would technically be considered fens. We include those sites in the Rocky Mountain Fen Ecological System and not here.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 31,183 acres (~126 km2) while National Wetland Inventory (NWI) maps estimated 16,557 acres (~67 km2). All palustrine emergent wetlands were used in the NWI analysis, which likely represents a slight overestimate of this Ecological System since systems like Rocky Mountain Fen (in part) are likely included in the palustrine emergent wetland category. Its not known exactly how much of the latter occurs, thus it is difficult to know for certain how much the NWI this estimate might be inflated. NatureServe's concept of this ecological systems includes many wetlands that would technically be considered "fen". Thus, the disparity between the two estimates could be particaly explained by a broader concept used by NatureServe. However, that wouldn't account for over an additional 60 km2 of areas. NWI is known to undermap many wetland types, however it is accepted here to be a more accurate estimate than the Ecological System map. Thus, the "G=20-100 km2" rating was chose. However, Sayre et al. (2009) estimate is almost five times as much as NWI. This is believed to be a gross overestimate; however, the "H=100-500 km2" rating was chosen to reflect the disparity between the two.

Population and EOs

Number of EOs: D = 81 - 300

Comments: Plant association EOs in eastern WA are few, primarily due to lack of focused inventory efforts. Kovalchik and Clausnitzer (2004) had over 70 vegetation plots in wet meadows. Undoubtedly more occur on the landscape.

Population Size: =

Comments:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Alpine-Montane Wet Meadow*** **Elcode:** CES306.812

Common Name: Rocky Mountain Alpine-Montane Wet Meadow **Subnational ID:** 18275

Number of Viable EOs: E = Many (41-125) **% of Range with Good Viability:** F = Excellent (>40%)

Comments: A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 90% of all palustrine emergent wetlands had a good to excellent integrity in montane regions of eastern Washington (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 90% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. However, the rating "F=>40%" was chosen. Field experience suggests that roads, forestry, grazing, and nonnative species have degraded many occurrences of this Ecological System, espeically in the Okanogan and northern Rockies. There are very few occurrences in WNHP's database. This is based on field observations by WNHP ecologists.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Grazing, roads, etc. threaten ecological integrity of extant occurrences.

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	B = High
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	B = High
Comments:	grazing by livestock is likely most common stressor		
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	6 - Human intrusions & disturbance	Level of Threat:	D = Low
Comments:			
Threat Category:	6.1 - Recreational activities	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	D = Low
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: Most change reflected here is degradation rather than direct loss. Roads and reservoices may have resulted in some complete loss of some occurrences but most change has likely been in the form of changes in ecological integrity. Grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations dont' address stressors that impact quality thus, it is likely long- and short-term trends are simlar. Although grazing management may be helping to lessen impacts from contemporary grazing practices.

Scientific Name: ***Rocky Mountain Alpine-Montane Wet Meadow*** **Elcode:** CES306.812

Common Name: Rocky Mountain Alpine-Montane Wet Meadow **Subnational ID:** 18275

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: There are no data sources with reliable estimates of loss of this ecological system (Landfire's Environmental Potential Map did not explicitly map this ecological system). Most change reflected here is degradation rather than direct loss. Roads and reservoices may have resulted in some complete loss of some occurrences but most change has likely been in the form of changes in ecological integrity. Grazing is widespread in many areas, both historically and on the contemporary landscape. Wetland regulations dont' address stressors that impact quality thus, it is likely long- and short-term trends are simlar.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments: Limited to seasonally wet areas; long enough to preclude upland vegetation but generally these areas dry out by summer's end.

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Kovalchik, B.L. and R.R. Clausnitzer. 2004. Classification and Management of Aquatic, Riparian, and Wetland Sites on the National Forests of Eastern Washington. Series Description. United States Dept. of Agriculture. Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-593

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 18-Feb-2015

Internal Notes:

Scientific Name: ***Rocky Mountain Aspen Forest and Woodland*** **Elcode:** CES306.813

Common Name: Rocky Mountain Aspen Forest and Woodland **Subnational ID:** 18276

Descriptors

Element Description: This system is characterized by dominance of Populus tremuloides in forests or woodlands with less than 25% total tree canopy cover by conifers. The tree canopy is typically closed and essentially all Populus tremuloides regeneration results from asexual vegetative production of sprouts from roots following disturbances (Hadfield and Magelssen 2004, 2006). Populus tremuloides is the sole dominant in many stands although scattered Abies grandis, Pinus ponderosa, Pinus contorta or Pseudotsuga menziesii trees are common in Washington stands (Hadfield and Magelssen 2004, 2006). Symphoricarpos oreophilus and S. albus are the most common dominant shrubs. Tall shrubs, such as Acer glabrum, Salix scouleriana and Amelanchier alnifolia may be abundant. In some stands, Calamagrostis rubescens may dominate the ground cover without shrubs. Other common grasses are Festuca idahoensis, Bromus carinatus, or Elymus glaucus. Characteristic tall forbs include Agastache spp., Aster spp., Senecio spp., Rudbeckia spp. Low forbs include Thalictrum spp., Galium spp., Osmorhiza spp., and Lupinus spp.

Occurrences of this system originate and are maintained by stand-replacing disturbances such as crown fire, insect outbreak, disease and windthrow within the matrix of conifer forests. Fire plays an important role in maintenance of this habitat. Populus tremuloides will colonize sites after fire or other stand disturbances through root sprouting. The stems of these thin-barked, clonal trees are easily killed by ground fires, but they can quickly and vigorously resprout in densities of up to 30,000 stems per hectare (CNHP 2005). With adequate disturbance a clone may live many centuries or millennia. The stems are relatively short-lived (100-150 years), and stands will succeed to longer-lived conifer forest if left undisturbed. Natural fire return interval may be as frequent as 7-10 years although Landfire Modeling (2007) cites 35-100 year frequency of mixed severity fires as fire regime III (Landfire modeling of this system in the central Rockies assumes fire regime I). Ungulate browsing plays a variable role in aspen habitat by slowing tree regeneration by eating Populus tremuloides sprouts on some sites. Wolf predation plays a role in reducing elk browse effects and thus structure of Populus tremuloides stands in Yellowstone (Halofsky et al 2008). Although Populus tremuloides produces abundant seeds, seedling survival is rare because the long moist conditions required to establish them are rare in these habitats (Romme et al. 1997). Grazing reduces the fine fuels thereby reducing the risk of fires spreading into the stands and killing aspen stems and small conifers (Hadfield and Magelssen 2004, 2006).

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Naturally uncommon in Washington and appears to declining due to fire suppression effects of conifer invasion and aging of clones. Elk and livestock have minimal impact of aspen although associated flora changes with invasion of kentucky bluegrass, knapweeds etc. USFS papers conclude that aspen is considerably less common today than historically largely because of existing land uses.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: Extent mapped by natureServe 2009

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 113 sqkm as occurring in Washignton. This appears to be an overestimate. Hadfield and others (2004, 2006) surveyed Wenatchee, Okanogan Colville NF with initially 408 stands. Of those 249 were upland types and and 50-60% of those were less than 2ac.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** E = Good (21-40%)

Comments: Few observations. There tends to be alot of Poa pratensis in stands. Hadfield and other (2004, 2006) found 50-60% of stands <2ac amd 50-60% were decadent.

Number Protected EOs:

Comments:

Threats

Threats: AB = Very high - high

Scientific Name: ***Rocky Mountain Aspen Forest and Woodland*** **Elcode:** CES306.813

Common Name: Rocky Mountain Aspen Forest and Woodland **Subnational ID:** 18276

Comments: Increasing wildfire could increase aspen. However, fire suppression and grazing effects continue to threatend regeneration of these stands. 50-60% of aspen are decadent and sucessoinal to conifers (Hadfield and other 2004, 2006).Increasing wildfire could increase aspen. However, fire suppression and grazing effects continue to threatend regeneration of these stands. 50-60% of aspen are decadent and sucessoinal to conifers (Hadfield and other 2004, 2006).

Threat Category: 2 - Agriculture & aquaculture Level of Threat: C = Medium
Comments: assume most stands with grazing both elk and cattle

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: C = Medium
Comments: associated with structural and compositional changes plus conifer invasion

Threat Category: 7 - Natural system modifications Level of Threat: B = High
Comments:

Threat Category: 7.1 - Fire & fire suppression Level of Threat: B = High
Comments: Hadfield papers suppression leads to reduced patch size and aspen regen

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: BD = High - low
Comments: unclear impacts likely alters herbaceous composition

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: BD = High - low
Comments:

Trends

Short-term Trend: D = Decline of 50-70%

Comments: Hadfield and other (2004, 2006) found 50-60% of stands were <2ac amd 50-60% were decadent.

Long-term Trend: E = Decline of 30-50%

Comments: Fire supression impacts, effects of change in native browsers and introduction of livestock have decreased ecological condition and altered dynamics of stands. This impacts have likely accelerated over past century.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Hadfield, J. and R. Magelssen. 2004. Assessment of the Condition of Aspen on the Okanogan and Wenatchee National Forests. USDA Okanogan and Wenatchee National Forests report. 26 p.

Hadfield, J. and R. Magelssen. 2006. Assessment of the Condition of Aspen on the Colville National Forest. USDA Colville National Forests report. 23 p.

Hadfield, J.S. 2003. Little Pend Oreille National Wildlife Refuge aspen condition assessment survey. U.S. D.A. Forest Ser., Forestry Sciences Lab, Wenatchee, WA. 11 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Cliff, Canyon and Massive Bedrock*** **Elcode:** CES306.815

Common Name: Rocky Mountain Cliff, Canyon and Massive Bedrock **Subnational ID:** 18277

Descriptors

Element Description:

Rank

S Rank: S4S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: not real threats

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 180 sqkm as occurring in Washington. A quick scan of imagrey suggest some areas of rock outcrops were missed. Mostly mapped in East Cascades but occurs in other mountains of eastern Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments:

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: Potentially some mining.

Threat Category: 3 - Energy production & mining Level of Threat: D = Low

Comments: Limestone mines

Threat Category: 3.2 - Mining & quarrying Level of Threat: D = Low

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Scientific Name: ***Rocky Mountain Cliff, Canyon and Massive Bedrock*** **Elcode:** CES306.815

Common Name: Rocky Mountain Cliff, Canyon and Massive Bedrock **Subnational ID:** 18277

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 03-Nov-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Dry Tundra*** **Elcode:** CES306.816

Common Name: Rocky Mountain Dry Tundra **Subnational ID:** 18257

Descriptors

Element Description:

Rank

S Rank: SNR **S Rank Date:** **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments:

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:**

Comments:

Number Protected EOs:

Comments:

Threats

Threats:

Comments:

Threat Category: Level of Threat:

Comments:

Trends

Short-term Trend: **=**

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: **Version Date:**

Scientific Name: ***Rocky Mountain Dry Tundra*** **Elcode:** CES306.816

Common Name: Rocky Mountain Dry Tundra **Subnational ID:** 18257

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Lodgepole Pine Forest*** **Elcode:** CES306.820

Common Name: Rocky Mountain Lodgepole Pine Forest **Subnational ID:** 18278

Descriptors

Element Description:

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: I think it might be more S3 than S4 because of beetles and forest health treatments.

Range

Range Extent:

Comments: low end of range

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map estimates 448 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: 79% of mapped area (Sayre et al. 2009) occurs beyond 800 ft of road, suggesting most has not been logged. Most on USFS lands and much of it in Wilderness Areas.

Number Protected EOs:

Comments:

Threats

Threats: AC = Very high - medium

Comments: Recent fires and subsequent regeneration to Pinus contorta stands may abatement some fire suppression issues.Recent fires and subsequent regeneration to Pinus contorta stands may abatement some fire suppression issues.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments: grazing during stand establishment

Threat Category: 5 - Biological resource use Level of Threat: CD = Medium - low
Comments: most on USFS land

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: CD = Medium - low
Comments: if planted can covert to mixedd conifer or spruce fir

Threat Category: 7 - Natural system modifications Level of Threat: BC = High - medium
Comments: fire suprression moved stand to heavy beetle damage and shade tolerant conifers

Threat Category: 7.1 - Fire & fire suppression Level of Threat: BC = High - medium
Comments: need to look at ICBMP other sources

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: CD = Medium - low
Comments:

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: CD = Medium - low
Comments: bark beetles

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments: Need to look at Interior Columbia Basin Ecosystem Management Project models.

Scientific Name: ***Rocky Mountain Lodgepole Pine Forest*** **Elcode:** CES306.820

Common Name: Rocky Mountain Lodgepole Pine Forest **Subnational ID:** 18278

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland*** **Elcode:** CES306.828

Common Name: Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland **Subnational ID:** 18279

Descriptors

Element Description:

Rank

S Rank: S3S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Need more certainity in wooly aphid effects rangewide and amount of logging.

Range

Range Extent:

Comments: Mostly found in the East Cascades, Blue Mountains, and Northern Rockies but also found in the northeaster portion of Olympic Mountains.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 3000 sqkm occurs in Washington. This seems to be an underestimate.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: 86% of mapped area (Sayre et al. 2009) is beyond 800ft of roads, suggesting most has not been logged. The Interior Columbia Basin Ecosystem Management Project reports indicate a major loss of late seral stands and an increase in mid and early seral stands relative to historic distributions.

Number Protected EOs:

Comments:

Threats

Threats: AC = Very high - medium

Comments: Spruce bark beetle are a potential threat.Specific threats are of low confidence.

Threat Category: Level of Threat:

Comments:

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

Scientific Name: ***Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland*** **Elcode:** CES306.828

Common Name: Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland **Subnational ID:** 18279

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 17-Oct-2014

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland*** **Elcode:** CES306.830

Common Name: Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland **Subnational ID:** 18281

Descriptors

Element Description:

Rank

S Rank: S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Need more certainity in wooly aphid effects and the amount of logging.

Range

Range Extent:

Comments: low end of range

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 2800 sqkm as occurring in Washington.

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: 88% of mapped area (Sayre et al. 2009) is over 800ft from roads which is assumed to mean most that 88% has not been logged.. Most is on USFS and NPS managed lands.

Number Protected EOs:

Comments:

Threats

Threats: D = Low

Comments: Minor logging, balsom woolly aphid kills fir; spruce bark beetle could be an impact.Climate change could effect system but not included here.

Threat Category: 11 - Climate change & severe weather Level of Threat: Unknown
Comments:

Threat Category: 5 - Biological resource use Level of Threat: D = Low
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: D = Low
Comments: quick imspectiono f mapped area and cuts

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: D = Low
Comments: balsam wooly aphid

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: Negligible
Comments: balsam wooly aphid

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Scientific Name: ***Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland*** **Elcode:** CES306.830

Common Name: Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland **Subnational ID:** 18281

Needs

Research Needs:
Inventory Needs:
Protection Needs:
Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 20-Oct-2014
Internal Notes:

Scientific Name: ***Rocky Mountain Subalpine-Montane Fen*** **Elcode:** CES306.831

Common Name: Rocky Mountain Subalpine-Montane Fen **Subnational ID:** 18282

Descriptors

Element Description: This system includes high-elevation wetlands with organic soils (> 40 cm organic matter). It is confined to specific environments where perennial groundwater discharge occurs such as low points in the landscape, slopes where groundwater intercepts the soil surface, or pond/lake magins. These fens are typically dominated by graminoids and shrubs. Surface topography is typically smooth to concave with slopes ranging from 0-10%. Persistent soil saturation leads to accumulation of organic material. Peat depth varies according to topographic position and nutrient status and ranges from less than 1 meter up to 4 meters. Groundwater inflows maintain a fairly constant water level year-round, with water at or near the surface most of the time. More than a few inches of standing water above the soil surface is typically not present and if so, only in scattered locations such as pools or in hollow between hummocks. Soil and water chemistry is determined by bedrock associated with the contributing water source. Some fen types have distinct soil and water chemistry which are strong ecological drivers in relation to fen development and structure. Mosses are an integral functional component to fens as they provide a critical role in the accumulation of peat, formation of hummocks, and nutrient cycling. Fen vegetation varies by fen type. Calcareous or extremely rich fens support a unique flora of calciophiles. Poor fens have a flora resembling those of bogs. Intermediately rich fens, the most common type in this system, are dominated by graminoids, especially clonal Carex spp. Graminoid cover may constitute 40-100% of the herbaceous layer. Forbs are typically sparse, with occasional dense patches in some areas and consists of perennial, terrestrial and aquatic species. Shrubs such as Betula nana, Salix spp. are commonly found in fens. Mosses are abundant and often form contiguous carpets. Occasional trees such as Pinus contorta and Picea engelmannii may be found (typically stunted).

Groundwater pumping, water diversions, ditches, peat mining, septic systems, dams, and roads all can have a negative impact on hydrology. Livestock management can compact peat, destroy hummocks, create pugging (creation of pedestals in the peat by hooves), and can create exposed patches of peat which could lead to a negative carbon budget and therefore a net loss of peat. Excessive trampling by recreation could have a similar effect. Timber management and associated roads in adjacent areas could alter hydrology and introduce excess nutrients and sediment. Increased nutrients can alter species composition by allowing invasive non-native species or aggressive native species to become dominant. Restoration of peat substrates is not achievable within a meaningful management time frame.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This ecological system has likely not been significantly reduced in extent due to occurring on USFS managed lands where most impacts are from roads, hydrological management, and livestock grazing.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: This systems occurs in subalpine to montane portions of East Cascades, Okanogan Highlands, Northern Rocky Mtns., and Blue Mtns. It is primarily found in depressions, at groundwater discharge sites, along pond/lake shores, and in high elevation valleys. NatureServe has defined this system more narrowly that we define for Washington (see Rocchio and Crawford 2008). NatureServe included primarily alkaline peatlands within this category and put many neutral to slightly acid sedge-dominated areas into the Rocky Mountain Alpine-Montane Wet Meadow Association.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 199 acres (~0.8 km2) while National Wetland Inventory (NWI) maps estimated 16,557 acres (~67 km2) of palustrine emergent but only a small percentage of this would be fen. Unfortunately, NWI code indicating organic soils was rarely used and was not useful for identifying fens. The is undoubtedly much more than 199 acres of Rocky Mountain Fen in Washington. The "E=2-5km2" rating was chosen and mostly based on field-based observations. This concept is very narrowly defined by NatureServe and many peatland ecologist believe this to be in error. The rating presented here is based on the concept described in Rocchio and Crawford (2008.)

Population and EOs

Number of EOs: D = 81 - 300

Comments: Kovalchik and Clausnitzer (2004) had ~175 vegetation plots from sites that appear to be fens; however, it is not known how many of these plots may be from the site. Very few element occurrences are currently documented in WNHP's database. Not very common in East Cascades or Okanogan Highlands. Becomes more common in NE Washington but still relatively uncommon.

Population Size: =

Scientific Name: ***Rocky Mountain Subalpine-Montane Fen*** **Elcode:** CES306.831

Common Name: Rocky Mountain Subalpine-Montane Fen **Subnational ID:** 18282

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Most occurrences are on USFS lands where stressors are primarily grazing. Because of unstable saturated soils, grazing by livestock is often limited to the edges of fens, leaving much of the interior of these sites free from this stressor. However, livestock do graze the interior of some of these sites. Roads may impact hydrology of some sites. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps). The classification of those polygons was the same as NWI maps, thus no synthesis was possible specifically for fens (Rocchio et al. 2014). Based on field experience of the author, it is assumed that >40% of this Ecological System has good/excellent integrity.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: Roads may impact hydrology. Livestock grazing is a common stressor.

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	D = Low
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	D = Low
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: Grazing, roads, nonnative species and hydrological alterations have contined to result in negative changes to ecological integrity. However, this is assumed to be relativley minimal.

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: Based on personal observations the distribution of Rocky Mountain Fen is primarily on USFS lands where most impacts are likely changes in ecological integrity rather than significant, direct loss of fen extent. Roads and water management has likely resulted in loss of some fen area but is assumed to be <10%. Grazing, roads, nonnative species and hydrological alterations have also resulted in negative changes to ecological integrity.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Scientific Name: ***Rocky Mountain Subalpine-Montane Fen*** **Elcode:** CES306.831

Common Name: Rocky Mountain Subalpine-Montane Fen **Subnational ID:** 18282

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J. and R.C. Crawford. 2008. Draft Field Guide to Washington's Ecological Systems. Draft report prepared by the Washington Natural Heritage Program, Washington Department of Natural Resources. Olympia, WA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 18-Feb-2015

Internal Notes:

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Subalpine-Montane Mesic Meadow*** **Elcode:** CES306.829

Common Name: Rocky Mountain Subalpine-Montane Mesic Meadow **Subnational ID:** 18280

Descriptors

Element Description:

Rank

S Rank: S3S5 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons:

Range

Range Extent:

Comments:

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 165 sqkm as occurring in Washingotn. 25 sqkm mapped below lower treeline is likely Northern Rocky Mountain Foothill and Valley Grassland .

Population and EOs

Number of EOs: =

Comments:

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** EF = Good to excellent (>20%)

Comments: No good source of current ecological condition; livestock - elk both use system.

Number Protected EOs:

Comments:

Threats

Threats: BD = High - low

Comments: Scope and extent of impact unclear.

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	BD = High - low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	BD = High - low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	CD = Medium - low
Comments:			
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	CD = Medium - low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	BD = High - low
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	BD = High - low
Comments:			

Trends

Short-term Trend: =

Comments:

Long-term Trend: =

Comments:

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Scientific Name: ***Rocky Mountain Subalpine-Montane Mesic Meadow*** **Elcode:** CES306.829

Common Name: Rocky Mountain Subalpine-Montane Mesic Meadow **Subnational ID:** 18280

Needs

Research Needs:
Inventory Needs:
Protection Needs:
Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 31-Oct-2014

Internal Notes:

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Shrubland*** **Elcode:** CES306.832

Common Name: Rocky Mountain Subalpine-Montane Riparian Shrubland **Subnational ID:** 18283

Descriptors

Element Description: The Rocky Mountain Subalpine-Montane Riparian Shrubland system is comprised of montane to subalpine riparian shrublands occurring as narrow bands or large expanses of shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels. Snowmelt moisture may create shallow water tables or seeps for a portion of the growing season. In Washington, stands typically occur at elevations between approximately 2,000 – 7,500 feet (Kovalchik and Clausnitzer 2004). This system most commonly occurs in drainages, stream terraces, semi-riparian flats and spring or seep fed slopes. Soils vary but are typically well-developed, fine-textured, poorly drained, and often have histic epipedons. Sites can be quite wet, with saturated soils and standing water occasionally present. Sites with true organic soils (i.e. > 40 cm of organic soil) would be classified as Rocky Mountain Subalpine-Montane Fen Ecological System.

Narrow and steep (i.e. confined) occurrences have minimal to no floodplain development whereas less steep and wider valley bottoms (i.e., unconfined) occurrences are often associated with substantial floodplain development (LANDFIRE 2005; Gregory et al. 1991). Floodplains associated with the latter are comprised of a complexity of geomorphic surfaces which support a diverse array of vegetation communities and are able to store and release water slowly throughout the growing season (Hubert 2004). Confined streams typically have shallow soils with minimal alluvium and transport water downstream rapidly through step-pool channels armored by boulders, bedrock, and large woody debris (LANDFIRE 2005; Hubert 2004).

Beaver are an important hydrogeomorphic driver of Rocky Mountain Subalpine-Montane Riparian Shrublands, especially along unconfined reaches. The presence of beaver creates a heterogeneous complex of wet meadows, marshes and riparian shrublands and increases species richness on the landscape. Naiman et al. (1986) note that beaver-influenced streams are very different from those not impacted by beaver activity by having numerous zones of open water and vegetation , large accumulations of detritus and nutrients, more wetland areas, having more anaerobic biogeochemical cycles, and in general are more resistance to disturbance.

 In Washington, Alnus sinuata and Cornus sericea are common dominant shrubs along confined (mostly along Rosgen A and B channels), steep and/or gravelly streams (Kovalchik and Clausnitzer 2004). Occasionally, trees such as Picea engelmannii, Abies lasiocarpa, Populus balsamifera ssp. trichocarpa, and Thuja plicata can occur in the shrublands. Along these steep reaches, the understory can be depauperate but species such as Hydrophyllum fendleri, Senecio triangularis, Athyrium filix-femina, and Gymnocarpium dryopteris are often present (Kovalchik and Clausnitzer 2004). A variety of willows (Salix sp.) and mountain alder (Alnus incana) are common dominant shrubs along unconfined, gently sloped streams with finer sediment. Tall willow species (e.g., Salix bebbiana, S. boothii, S. drummondiana, S. geyeriana, S. lasiandra, etc.) are dominant at low to moderate elevations while short willow species (e.g., S. cascadensis, S. commutata, S. planifolia, S. nivalis, S. farriae, etc.) are dominant in subalpine and alpine shrublands. Understory species are highly variable. Graminoids (Carex utriculata, C. scopulorum, C. spectabilis, C. disperma, Eleocharis spp., Calamagrostis canadensis, Glyceria elata) typically dominate the understory of willow types and composition varies according to elevation and site type (Kovalchik and Clausnitzer 2004). Equisetum ssp. and forbs can be abundant in some willow sites (Kovalchik and Clausnitzer 2004). Alnus incana shrublands often support other shrubs such as Cornus sericea, Symphoricarpos albus, Spiraea douglasii, and Rosa spp. (Kovalchik and Clausnitzer 2004). Cover of understory species generally has an inverse relationship with the cover of Alnus incana. Typical species include Carex utriculata, C. disperma, Calamagrostis canadensis, Glyceria elata, Equisetum spp. Athyrium filix-femina, Maianthemum stellatum, Viola spp., Senecio triangularis, Pyrola secunda, and a variety of other forbs (Kovalchik and Clausnitzer 2004).

The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands. Stand replacement fires are rare but may occur when replacement fires occur in adjacent uplands (Fire regime III; average fire frequency of 100 years; LANDFIRE 2005). More frequent surface fires (~ every 50 years) can affect shrub patches through a combination of replacement fire from uplands and occasional native burning (LANDFIRE 2005). Wet meadows seldom burn and when they do, they typically recover within a single growing season (LANDFIRE 2005).

Historic land contemporary and use practices have impacted hydrologic, geomorphic, and biotic structure and function of riparian areas in eastern Washington. Human land uses both within the riparian area as well as in adjacent and upland areas have fragmented many riparian reaches which has reduced connectivity between riparian patches and riparian and upland areas. This can adversely affect the movement of surface/groundwater, nutrients, and dispersal of plants and animals. Roads, bridges, and development can also fragment both riparian and upland areas. Intensive grazing and recreation can also create barriers to ecological processes.

Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrology as well as biotic integrity of riparian shrublands (Woods 2001; Kattelmann and Embury 1996; Poff et al. 1997; Baker 1987). All these stressors can induce downstream erosion and channelization, reduce changes in channel morphology, reduce base and/or peak flows, lower water tables in floodplains, and reduce sediment deposition in the floodplain (Poff et al. 1997).

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Shrubland*** **Elcode:** CES306.832

Common Name: Rocky Mountain Subalpine-Montane Riparian Shrubland **Subnational ID:** 18283

Vegetation responds to these changes by shifting from wetland and riparian dependent species to more mesic and xeric species typical of adjacent uplands (typical of herbaceous species) and/or encroaching into the stream channel. Floodplain width and the abundance and spatial distribution of various patch types also typically decline.

Livestock grazing is a significant threat in confined riparian shrublands. Excessive livestock or native ungulate use can impact riparian shrublands by altering nutrient concentrations and cycles, changing surface and subsurface water movement and infiltration, shifting species composition, and reducing regeneration of woody species (Kauffman and Krueger 1984; Elmore and Kauffman 1984; Weixelman et al. 1997; Flenniken et al. 2001; Kauffman et al. 2004).

Management effects on woody riparian vegetation can be obvious , e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Reed canarygrass (Phalaris arundinacea) can be a major invasive in these shrublands.

All of these stressors have resulted in many riparian areas being incised, supporting altered riparian plant communities, as well as numerous non-native species. This system has also decreased in extent due to agricultural development, roads, dams and other flood-control activities.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The system remains relatively common the landscape but has likely experience some degradation.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: These shrublands are found along riparian landforms in the subalpine and montane areas of East Cascades, Okanogan, northern Rockies, and Blue Mountainseastern Washington. Measured extent was ~38,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 11,070 acres (~45 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to montane regions within eastern Washington. Next, total acreage of palustrine scrub-shrub wetlands (most of which would be included in this system; the remaining would be included within Rocky Mountain Fen) in that area were summed. The results showed that 9,027 acres (~37 km2) of such wetlands occur within the extent of this system. The two maps are have similar estimates.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 12 element occurrences in the Washigton Natural Heritage Program database. However, as demonstrated by various USFS classification efforts (e.g., Kovalchik and Clausnitzer 2004) there are many more occurrences on the landscape.

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: Livestock grazing has and continues to impact most occurrences. Road and adjacent logging may also impact some occurrences. Nonnative species are an issue in some sites, especially where there is grazing.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: Livestock grazing has and continues to impact most occurrences. Road and adjacent logging may also impact some occurrences. Nonnative species are an issue in some sites, especially where there is grazing. Removal of woody vegetation for agriculture or hay pasture creation is problematic in the some of the large, broad valleys.

Threat Category: 2 - Agriculture & aquaculture Level of Threat: B = High

Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: B = High

Comments:

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Shrubland*** **Elcode:** CES306.832

Common Name: Rocky Mountain Subalpine-Montane Riparian Shrubland **Subnational ID:** 18283

Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	D = Low
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	C = Medium
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	C = Medium
Comments:			

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: It is not known how much has historically been lost. Most of the sytem occurs on public lands so development is an unlikely source of loss. However conversion to other wetland types may have occurred. For example, conversion of this sytem to herbaceous wetlands has occurred in some of the large, broad valleys where removal of woody vegetation for agriculture or hay pasture creation has occurred.

Long-term Trend: F = Decline of 10-30%

Comments: It is not known how much has historically been lost. Most of the sytem occurs on public lands so development is an unlikely source of loss. However conversion to other wetland types may have occurred. For example, conversion of this sytem to herbaceous wetlands has occurred in some of the large, broad valleys where removal of woody vegetation for agriculture or hay pasture creation has occurred.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Gregory, Stanley V., Swanson, Frederick J., McKee, Arthur W. and Cummins, Kenneth W. 1991. An Ecosystem Perspective of Riparian Zones: Focus on Links Between Land and Water. BioScience, Vol. 41. 540 - 551.

Kovalchik, B.L. and R.R. Clausnitzer. 2004. Classification and Management of Aquatic, Riparian, and Wetland Sites on the National Forests of Eastern Washington. Series Description. United States Dept. of Agriculture. Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-593

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Scientific Name:	***Rocky Mountain Subalpine-Montane Riparian Shrubland***	**Elcode:**	CES306.832
Common Name:	Rocky Mountain Subalpine-Montane Riparian Shrubland	**Subnational ID:**	18283

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Woodland*** **Elcode:** CES306.833

Common Name: Rocky Mountain Subalpine-Montane Riparian Woodland **Subnational ID:** 18284

Descriptors

Element Description: The Rocky Mountain Subalpine-Montane Riparian Woodland system is comprised of seasonally flooded forests and woodlands found at montane to subalpine elevations. Snowmelt moisture may create shallow water tables or seeps for a portion of the growing season. In Washington, stands typically occur at elevations between 2,000 – 7,000 feet (Kovalchik and Clausnitzer 2004). This system most commonly occurs in V-shaped, narrow valleys and canyons (where there is cold-air drainage). Less frequently, occurrences are found in moderate-wide valley bottoms on large floodplains along broad, meandering rivers, and on pond or lake margins.

These riparian woodlands are mostly found in V-shaped, steep valleys with many large boulders and coarse soils. The forest vegetation in these environments is often very similar to the adjacent uplands (Baker 1987, Kovalchik and Clausnitzer 2004). Disturbances may create gaps in the canopy and allows pioneer species, such as aspen, or shrubs to establish. Less steep and wider valleys can lead to shrubland or woodland development. Flooding inundates vegetation, can physically dislodge seedlings/saplings, and alter channel morphology through erosion and deposition of sediment. Infrequent, high-powered floods determine large geomorphic patterns that persist on the landscape for hundreds to thousands of years (Hubert 2004). Floods of intermediate frequency and power produce floodplain landforms which persist for tens to hundreds of years as well as reset succession to early seral vegetation types (LANDIRE 2005; Hubert 2004). High frequency low-powered floods which occur nearly annually determine short-term patterns such as seed germination and seedling survival (Hubert 2004).

Narrow and steep (i.e. confined) occurrences have minimal to no floodplain development whereas less steep and wider valley bottoms (i.e., unconfined) occurrences are often associated with substantial floodplain development (LANDFIRE 2005; Gregory et al. 1991). Floodplains associated with the latter are comprised of a complexity of geomorphic surfaces which support a diverse array of vegetation communities and are able to store and release water slowly throughout the growing season (Hubert 2004). Confined streams typically have shallow soils with minimal alluvium and transport water downstream rapidly through step-pool channels armored by boulders, bedrock, and large woody debris (LANDFIRE 2005; Hubert 2004).

Beaver, are of minimal significance in confined riparian woodlands as the steep nature of the latter system and often lack of deciduous trees typically precludes beaver activity. However, beaver activity but can have an impact on hydrology and vegetation in unconfined occurrences and especially in those areas dominated by aspen (Populus tremuloides).

Conifer and aspen woodlands dominate the canopy of this system. In Washington, confined occurrences (mostly along Rosgen A and B channels) are dominated by Abies lasiocarpa and/or Picea engelmannii (Kovalchik and Clausnitzer 2004). In older stands, Picea engelmannii may dominate the canopy while Abies lasiocarpa forms multi-aged canopies in the understory (Kovalchik and Clausnitzer 2004). Both Abies lasiocarpa and/or Picea engelmannii may be reproducing in the understory. Pinus contorta, Pseudotsuga menziesii, and Larix occidentalis are common early seral species. Common understory shrubs in confined woodlands include Alnus viridis ssp. sinuata, Lonicera involucrata, Oplopanax horridus, Rosa gymnocarpa, Rubus parviflorus, Cornus canadensis, Ledum glandulosum, Vaccinium scoparium, and V. cespitosum. Arnica latifolia, Clintonia uniflora, Galium trifidum, Polemonium pulcherrimum, Senecio triangularis, Maianthemum stellatum, Streptopus amplexifolius, Athyrium filix-femina, and Gymnocarpium dryopteris are common herbaceous species (Kovalchik and Clausnitzer 2004). Unconfined occurrences (mostly Rosgen C and E channels) are most often dominated by a canopy of Picea engelmannii while Populus tremuloides, Betula papyrifera, and occasionally Pinus contorta occur as early seral species. Common shrubs include Cornus sericea, Symphoricarpos albus, Cornus canadensis, Lonicera involucrata, Rubus parviflorus, Pachistima myrsinites, Salix ssp. Alnus incana, A. viridis ssp. sinuata, and Ribes lacustre. Herbaceous species often found in unconfined occurrences include Carex scopulorum var. prionophylla, C. disperma, Elymus glaucus, Aralia nudicaulis, Streptopus amplexifolius, Gymnocarpium dryopteris, and Equisetum ssp. Riparian woodlands dominated by Populus tremuloides are less common than coniferous dominated sites, however they can be found along riparian zones along low to moderate gradient channels (mostly Rosgen C and B channels) and ephemeral draws or depressions (Kovalchik and Clausnitzer 2004). Moderately large Populus tremuloides individuals are found in mature stands. Betula papyrifera and Pinus contorta are occasionally found in these stands. Regenerating Populus tremuloides and occasionally Betula papyrifera, Pseudotsuga menziesii, or Picea engelmannii can be found in the understory. Shrub diversity can be high and include Cornus sericea, Symphoricarpos albus, Alnus incana, Acer glabrum var. douglasii, Amelanchier alnifolia, Ribes lacustre, Rosa gymnocarpa, Rubus parviflorus, and Salix ssp. Herbaceous species are sparse in stands with high shrub cover. However, species such as Carex pellita, Calamagrostis canadensis, Deschampsia cespitosa, Angelica arguta, Fragaria virginiana var. platypetala, Petasites sagittatus, Maianthemum stellatum, and Equisetum arvense are often found in these woodlands (Kovalchik and Clausnitzer 2004). Some stands in northeastern Washington are dominated by Thuja plicata and/or

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Woodland*** **Elcode:** CES306.833

Common Name: Rocky Mountain Subalpine-Montane Riparian Woodland **Subnational ID:** 18284

Tsuga heterophylla and represent an inland version of the North Pacific Lowland Riparian Forest and Shrubland system. Either the EIA associated with the latter or this system should be applicable to these riparian forests . Thuja plicata and Tsuga heterophylla also occur along with Oplopanax horridus and Lysichiton americanus on saturated soils in depressions or seeps. Such sites would be classified as the Northern Rocky Mountain Conifer Swamp.

The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands. Stand replacement fires are rare but may occur when replacement fires occur in adjacent uplands (Fire regime III; average fire frequency of 100 years; LANDFIRE 2005). More frequent surface fires (~ every 50 years) can affect shrub patches through a combination of replacement fire from uplands and occasional native burning (LANDFIRE 2005). Following stand replacement fires deciduous woody species (e.g., Populus tremuloides, Salix spp., etc.) can be top-killed but generally resprout within a short period. Post-fire establishment of conifers occurs from seed. Wet meadows seldom burn and when they do, they typically recover within a single growing season (LANDFIRE 2005).

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of riparian areas in eastern Washington. Human land uses both within the riparian area as well as in adjacent and upland areas have fragmented many riparian reaches which has reduced connectivity between riparian patches and riparian and upland areas. This can adversely affect the movement of surface/groundwater, nutrients, and dispersal of plants and animals. Roads, bridges, and development can also fragment both riparian and upland areas. Intensive grazing and recreation can also create barriers to ecological processes.

Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can have a substantial impact on the hydrology as well as biotic integrity of riparian woodlands (Woods 2001; Kattelmann and Embury 1996; Poff et al. 1997; Baker 1987). All these stressors can induce downstream erosion and channelization, reduce changes in channel morphology, reduce base and/or peak flows, lower water tables in floodplains, and reduce sediment deposition in the floodplain (Poff et al. 1997). Vegetation responds to these changes by shifting from wetland and riparian dependent species to more mesic and xeric species typical of adjacent uplands (typical of herbaceous species) and/or encroaching into the stream channel. Although already narrow, floodplain width and the abundance and spatial distribution of various patch types also typically decline.

Livestock grazing is not a significant threat in confined riparian woodlands. However, in unconfined reaches, excessive livestock or native ungulate use can impact riparian woodlands by altering nutrient concentrations and cycles, changing surface and subsurface water movement and infiltration, shifting species composition, and reducing regeneration of woody species (Kauffman and Krueger 1984; Elmore and Kauffman 1984; Weixelman et al. 1997; Flenniken et al. 2001; Kauffman et al. 2004).

Management effects on woody riparian vegetation can be obvious, e.g., removal of vegetation by dam construction, roads, logging, or they can be subtle, e.g., removing beavers from a watershed, removing large woody debris, or construction of a weir dam for fish habitat. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors.

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The system remains relatively common the landscape but has likely experience some degradation.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: These shrublands are found along riparian landforms in the subalpine and montane areas of East Cascades, Okanogan, northern Rockies, and Blue Mountainseastern Washington. Measured extent was ~38,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 22,032 acres (~89 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to montane regions within eastern Washington. Next, total acreage of palustrine forested wetlands (most of which would be included in this system; the remaining would be included within Northern Rocky Mountain Conifer Swamp) in that area were summed. The results showed that 6,068 acres (~25 km2) of such wetlands occur within the extent of this system. Both estimates fall within the "G=20-100km2" rating.

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are just a few element occurrences in the Washigton Natural Heritage Program database . However, as demonstrated by various USFS classification efforts (e.g., Kovalchik and Clausnitzer 2004) there are many more occurrences on the landscape. Most high-elevation streams in the north portion of the East Cascades, Okangaon Highlands, Northern Rockies, and Blue Mountains support this Ecological System.

Element State Rank Report - Draft

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Woodland*** **Elcode:** CES306.833

Common Name: Rocky Mountain Subalpine-Montane Riparian Woodland **Subnational ID:** 18284

Population Size: =

Comments:

Number of Viable EOs: E = Many (41-125) **% of Range with Good Viability:**

Comments: Much of this system occurs on public lands and most occurences are in assumed to be in good condition. Logging probably has impacted structure of many stands and road may have impact some occurrences.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Roads and logging are primary threats.High seems to harsh;

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	D = Low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	D = Low
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: It is not known how much has historically been lost. Most of the sytem occurs on public lands so development is an unlikely source of loss. Logging may have resulted in conversion to other wetland types. Roads and logging have degraded some occurrences.

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: It is not known how much has historically been lost. Most of the sytem occurs on public lands so development is an unlikely source of loss. Logging may have resulted in conversion to other wetland types. Roads and logging have degraded some occurrences.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

Scientific Name: ***Rocky Mountain Subalpine-Montane Riparian Woodland*** **Elcode:** CES306.833

Common Name: Rocky Mountain Subalpine-Montane Riparian Woodland **Subnational ID:** 18284

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Gregory, Stanley V., Swanson, Frederick J., McKee, Arthur W. and Cummins, Kenneth W. 1991. An Ecosystem Perspective of Riparian Zones: Focus on Links Between Land and Water. BioScience, Vol. 41. 540 - 551.

Kovalchik, B.L. and R.R. Clausnitzer. 2004. Classification and Management of Aquatic, Riparian, and Wetland Sites on the National Forests of Eastern Washington. Series Description. United States Dept. of Agriculture. Forest Service. Pacific Northwest Research Station. General Technical Report PNW-GTR-593

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***Temperate Pacific Freshwater Aquatic Bed*** **Elcode:** CES200.876

Common Name: Temperate Pacific Freshwater Aquatic Bed **Subnational ID:** 18258

Descriptors

Element Description: This systems consists of rooted or floating aquatic plants confined to lakes, ponds, and slow-moving portions of rivers and streams. In large bodies of water, they are usually restricted to the littoral region where penetration of light is the limiting factor for growth. The system is found in water too deep for emergent vegetation. A variety of rooted or floating aquatic herbaceous species may dominate, including Azolla spp., Nuphar lutea, Polygonum spp., Potamogeton spp., Ranunculus spp., and Wolffia spp. Submerged vegetation, such as Myriophyllum spp., Ceratophyllum spp., and Elodea spp., is often present.

Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roads or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive. Excess nutrient inputs could lead to the establishment of non-native species and/or dominance of native increasing species. A keystone species, the beaver, has been trapped to near extirpation in parts of the Pacific Northwest and its population has been regulated in others. This has led to a decrease in herbaceous wetlands (including aquatic bed habitat) on the landscape.

Rank

S Rank: S3 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This system remains relatively abundant on the landscape and may have even increase in some urban areas due to increased runoff creating more open wate wetlands. However, many occurrences are degraded due to development, agriculture, and logging.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: This system is found throughout western Washington in nearshore environments of lakes, in ponds, slow moving streams, and peatland pools. It ranges from low to high elevations.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 556 acres (~2 km2). The National Wetland Inventory (NWI) maps were filtered for palustrine aquatic bed and showed an estimated 4,219 acres (~17 km2) within western Washington. The NWI estimates is assumed to be more accurate.

Population and EOs

Number of EOs: E = > 300

Comments: There are 21 element occurrencs in the Washington Natural Heritage Program database; however, field observations and various literature sources clearly indicate that many more occurences are on the landscape.

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: All the element occurences in the WNHP database have good to excellent integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 82% of potential vernal pools (see comments for area of occupancy metrics) within the Columbia Basin had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. However, many occurences have been impacted by water quality degradation, hydrological alterations, and nonnative species and as such 82% is assumed to be an significant overestimate of the area of this Ecological System with good/excellent integrity.

Number Protected EOs:

Comments:

Threats

Threats: B = High

Comments: Water quality degradation, hydrological alterations, and nonnative species are signficant stressors associated with roads, agriculture, logging, and development.

Threat Category: 1 - Residential & commercial development Level of Threat: C = Medium

Comments:

Scientific Name: ***Temperate Pacific Freshwater Aquatic Bed*** **Elcode:** CES200.876

Common Name: Temperate Pacific Freshwater Aquatic Bed **Subnational ID:** 18258

Threat Category:	1.1 - Housing & urban areas	Level of Threat:	C = Medium
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	D = Low
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	C = Medium
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	C = Medium
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	C = Medium
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	C = Medium
Comments:			
Threat Category:	9 - Pollution	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.1 - Domestic & urban waste water	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.2 - Industrial & military effluents	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.3 - Agricultural & forestry effluents	Level of Threat:	C = Medium
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: There are no data sources that provide reliable estimates of loss. In fact, some stressors may have changed hydrology in favor of this system but increasing inundation of some depressions from increase runoff . High elevation examples have likely not been affected to any significant degree . Based on personal observations, grazing, roads, logging, and nonnative species continue to impact many occurrences. Some loss may occur due to road construction.

Long-term Trend: F = Decline of 10-30%

Comments: There are no data sources that provide reliable estimates of loss. In fact, some stressors may have changed hydrology in favor of this system but increasing inundation of some depressions from increase runoff . High elevation examples have likely not been affected to any significant degree . Based on personal observations, grazing, roads, logging, and nonnative species continue to impact many occurrences. Some loss may occur due to road construction.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Scientific Name: ***Temperate Pacific Freshwater Aquatic Bed*** **Elcode:** CES200.876

Common Name: Temperate Pacific Freshwater Aquatic Bed **Subnational ID:** 18258

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***Temperate Pacific Freshwater Emergent Marsh*** **Elcode:** CES200.877

Common Name: Temperate Pacific Freshwater Emergent Marsh **Subnational ID:** 18259

Descriptors

Element Description: The Temperate Pacific Freshwater Emergent Marsh system includes wetlands or the portion of wetlands dominated by emergent (mostly graminoid) species where standing water is seasonally or more typically semi-permanently present. This system mostly occurs as a small patch and confined to limited areas in suitable floodplain or basin topography. Freshwater marshes are found at all elevations below timberline throughout the temperate Pacific Coast and above lower treeline in the dry shrub steppe landscape in eastern Washington . However, the dynamic hydrological regimes, high nutrient status, and relatively warm growing season of lowlands in western Washington make this system more abundant at lower than at higher elevations (MacKenzie and Moran 2004). At higher elevations, marshes are most commonly found along wave-washed lakeshores and stream floodplains where continuous, oxygenated water flow prevents peat accumulation and keeps nutrient availability high, whereas, peatlands tend to form in isolated basins at higher elevations (MacKenzie and Moran 2004). Marsh development along riparian areas is driven by the magnitude and frequency of flooding, valley and substrate type, and beaver activity. Seasonal and episodic flooding scour depressions in the floodplain, create side channels and floodplain sloughs, and force channel migration which can result in oxbows. Marsh vegetation establishes in those landforms if there is semi-permanent to permanent water. Marshes also occur near the fringes of lakes and ponds where their development is dictated by shoreline gradient and fluctuation of lake or pond levels. Relatively flat or gently sloping shorelines support a much larger marsh system than steep sloping shorelines. Water is at or above the surface for most of the growing season .In some areas water levels fluctuate with dramatic drawdowns that can expose bare soil by later summer. The frequency and magnitude of water level fluctuations determine the extent of each marsh zone (floating, submerged, emergent, etc.). Water level fluctuations also support the development of different marsh zones (floating, submergent, emergent, etc.) which vary according to the degree of inundation. Soils are muck or mineral, and water is nutrient rich. High nutrients favor aggressive species resulting in relatively low diversity of plant species (MacKenzie and Moran 2004). Freshwater marshes are dominated by emergent herbaceous species, mostly graminoids (Carex, Scirpus and/or Schoenoplectus, Eleocharis, Juncus, Typha latifolia) with some forbs. Trees, shrubs and bryophytes are typically absent or very sparse (MacKenzie and Moran 2004). Occurrences of this system typically are found in a mosaic with other wetland systems. Common emergent and floating vegetation includes species of Scirpus and/or Schoenoplectus, Typha, Eleocharis, Sparganium, Sagittaria, Bidens, Cicuta, Rorippa, Mimulus, and Phalaris. When associated with relatively deep water, this system may co-occur with the Temperate Pacific Freshwater Aquatic Bed system with floating-leaved genera such as Lemna, Potamogeton, Polygonum, Nuphar, Hydrocotyle, and Brasenia being dominant. A consistent source of freshwater is essential to the function of these systems.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of marshes in western Washington . Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader. Human land uses both within the marshes as well as in adjacent upland areas have reduced connectivity between wetland patches and upland areas. Land uses in contributing watershed have the potential to contribute excess nutrients into to the system which could lead to the establishment of non-native species and/or dominance of native disturbance-increasing species. In general, excessive livestock or native ungulate use leads to a shift in plant species composition. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Although most wetlands some receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, grazed, and farmed extensively in the lowlands of Washington . Montane wetlands are less altered than lowland wetlands even though they have undergone modification as well. A keystone species, the beaver, has been trapped to near extirpation in parts of the Pacific Northwest and its population has been regulated in others. Herbaceous wetlands (including freshwater emergent marsh) have decreased along with the diminished influence of beavers on the landscape.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: Although this system remains widespread on the landscape many, if not most, have been degraded by numerous stressors. Also, the system has likely experience significant decline in extent (even though it remains widespread). Although this ecological system remains widespread on the current landscape, it has experienced significant direct loss of occurrences. Even more significantly is the degree to which extant occurrences have been degraded from adjacent development, agriculture, timber activitiy, roads, and water management.

Scientific Name: ***Temperate Pacific Freshwater Emergent Marsh*** **Elcode:** CES200.877

Common Name: Temperate Pacific Freshwater Emergent Marsh **Subnational ID:** 18259

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: Within Washington, these herbaceous dominated wetlands occurs at all elevations but are most abundant in the lowlands. They range from seasonally to permanently flooded wetlands found in depressions, along streams, and shorelines.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 141,759 acres (~573 km2) while National Wetland Inventory (NWI) maps estimated 24,914 acres (~121 km2). All palustrine emergent wetlands were used in the NWI analysis, which likely represents a slight overestimate of this Ecological System since systems like North Pacific Bog and Fen (in part) and Willamette Valley Wet Prairie are likely included in the palustrine emergent wetland category. Its not known exactly how much of these latter two systems occurs, thus its difficult to know for certain how much the NWI this estimate might be inflated. However, it is unlikley to be more than 20km which means a more refined NWI estimate for Temperate Pacific Freshwater Emergent Marsh is near the break point for metrics ratings "G=20-100 km2" and "H=100-500km2". However, the NatureServe estimate is almost five times as much as NWI. This is believed to be a gross overestimate; however, the "H=100-500 km2" rating was chosen to reflect the disparity between the two.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are 68 element occurrences records in Washington Natural Heritage Program's database. Undoubtedly many more on landscape but most are degraded and thus not considered for inclusion in WNHP's database.

Population Size: =

Comments:

Number of Viable EOs: D = Some (13-40) **% of Range with Good Viability:** E = Good (21-40%)

Comments: Of the 68 element occurrences in WNHP's database, 35 have good to excellent ecological integrity. A Level 1 (remote-sensing based) Ecological Integrity Asssessment was conducted across Washington State (based on NWI maps) and that analysis showed that nearly 58% of all palustrine emergent wetlands had a good to excellent integrity (Rocchio et al. 2014). However, Rocchio et al. (2014) also showed a noisy relationship between Level 1 and Level 2 (rapid, field-based) EIA scores. Based on this and field experience of the author, 58% is assumed to be an overestimate of the area of this Ecological System with good/excellent integrity. Thus, the metri rating "E=good (21-40%)" was chosen. Field experience suggests that roads, forestry, development, and nonnative species have degraded numerous occurrences of this Ecological System, especially in the Puget lowlands.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Development, roads, forestry, grazing, dams, pollution, and nonnative species are common threats to the ecological integrity of this system.

Threat Category: 1 - Residential & commercial development Level of Threat: B = High
Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: B = High
Comments:

Threat Category: 1.2 - Commercial & industrial areas Level of Threat: C = Medium
Comments:

Threat Category: 2 - Agriculture & aquaculture Level of Threat: D = Low
Comments:

Threat Category: 2.3 - Livestock farming & ranching Level of Threat: D = Low
Comments:

Threat Category: 4 - Transportation & service corridors Level of Threat: B = High
Comments:

Scientific Name: ***Temperate Pacific Freshwater Emergent Marsh*** **Elcode:** CES200.877

Common Name: Temperate Pacific Freshwater Emergent Marsh **Subnational ID:** 18259

Threat Category: 4.1 - Roads & railroads Level of Threat: B = High
Comments:

Threat Category: 5 - Biological resource use Level of Threat: B = High
Comments:

Threat Category: 5.3 - Logging & wood harvesting Level of Threat: B = High
Comments:

Threat Category: 7 - Natural system modifications Level of Threat: C = Medium
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: C = Medium
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments: phalaris, iris,

Threat Category: 8.2 - Problematic native species/diseases Level of Threat: B = High
Comments: expansion of typha latifolia

Threat Category: 9 - Pollution Level of Threat: C = Medium
Comments:

Threat Category: 9.1 - Domestic & urban waste water Level of Threat: C = Medium
Comments:

Threat Category: 9.2 - Industrial & military effluents Level of Threat: C = Medium
Comments:

Threat Category: 9.3 - Agricultural & forestry effluents Level of Threat: C = Medium
Comments:

Trends

Short-term Trend: F **=** Decline of 10-30%

Comments: It is not known how much wetland regulations slowed the direct loss of this wetland type from the Washington landscape. Development pressure has increased within the Puget Sound region within the last 25 years. Even if regulations helped stem significant loss of wetlands development, agriculture, and timber activitiy have surely degraded ecological integrity of remaining wetlands in the Puget lowlands due to alterations from ditching, increase sediment and hydrological inputs, draining, nonnative species, and nutrient loading.

Long-term Trend: F = Decline of 10-30%

Comments: There are no data sources with reliable estimates of loss of this ecological system (Landfire's Environmental Potential Map did not explicitly map this ecological system). Prior to wetland regulations, many loss due to agriculture and development. The only statewide estimate of wetland loss is from Dahl (1990) which estimated that WA has lost 31% of its historical wetland acreage. It is not known how much of this loss included this ecological system but it is likely a significant part of this number. In addition to outright loss, many occurrences of this ecological system have undergone extensive degradation or change (being converted from one wetland type to another) due to stressors such as ditching, draining, nonnative species, agriculture and development. Changes in ecological integrity have occurred due to hydrological alterations, invasive species, and sediment/nutrient alterations.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Scientific Name: ***Temperate Pacific Freshwater Emergent Marsh*** **Elcode:** CES200.877

Common Name: Temperate Pacific Freshwater Emergent Marsh **Subnational ID:** 18259

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Dahl, T.E. 1990. Wetland Losses in the United States 1780's to 1980's. U.S. Dept. of the Interior, Fish & Wildlife Service, Washington D.C.,13pp.

MacKenzie, W.H. and J.R. Moran. 2004. Wetlands of British Columbia. A Guide to Identification. Research Branch, B.C. Ministry of Forestry, Victoria, British Columbia

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 17-Feb-2015

Internal Notes:

Scientific Name: ***Temperate Pacific Freshwater Mudflat*** **Elcode:** CES200.878

Common Name: Temperate Pacific Freshwater Mudflat **Subnational ID:** 18301

Descriptors

Element Description: Freshwater sparsely vegetated mud to extensive sods of herbaceous vegetation, which occur primarily in seasonally flooded shallow mudflats on floodplains, especially along the lower Columbia River. Dominated mainly by low-stature annual plants. During any one year, mudflats may be absent because of year-to-year variation in river water levels. Mudflats must be exposed before the vegetation develops from the seedbank. They range in physiognomy from sparsely vegetated mud to extensive sods of herbaceous vegetation. The predominant species include Eleocharis obtusa, Lilaeopsis occidentalis, Crassula aquatica, Limosella aquatica, Gnaphalium palustre, Eragrostis hypnoides, and Ludwigia palustris.

Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roads or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. Excess nutrient inputs could lead to the establishment of non-native species and/or dominance of native increasing species. Hydrological alterations in the upper Columbia River drainage (e.g. large dams on the mainstem) have likely decreased the extent of this system due to the decreased sediment load carried by the river and the changes in the flooding regime. Dredging activities could remove sediment source while also creating new mudflats via spoil deposits.

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The author has had no field experience with this system but based on available data, the calculated S1 ranks is appropriate. The extent of this sytems has most likely been dramatically reduced and extant occurrences exist under a highly modified hydrological regime and nonnative species can be problematic in those sites.

Range

Range Extent: C = 250-1000 square km (about 100-400 square miles)

Comments: This systems occurs primarily in seasonally flooded, shallow mudflats on floodplains, especially along the lower Columbia River. Extent was measure to be approximately 415 km2, thus the "C=250-1000 km2" rating was chosen.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 2,926 acres (~12 km2) of this system occurs in Washington. GIS files from the Columbia River Estuary Ecosystem Classification project were used to estimate geomorphic landforms that could support mudflats (e.g., channle bars, floodplains, intermittently exposed areas, etc.) within the range of this ecological system. That analysis showed 2,831 acres (~ 11 km2) of possible mudflats, a number very similar to the Ecological System map estimate (Simenstad et al. 2011). The National Wetland Inventory (NWI) maps were clipped to the areas along the lower Columbia River within Washington . Then only areas with palustrine unconsolidated bottom or shore with seasonaly flooding modifiers were included in the calculation. The result was 92 acres (~0.4 km2) of wetlands with moderate probability of being freshwater mudflats. This is most likely and underestimate while the other two estimates are likely overestimates. Based on these variable estimates and professional opinion , the "E=2-5 km2" rating was chosen.

Population and EOs

Number of EOs: U = Unknown

Comments: No element occurrences have been documented in Washington Natural Heritage Program 's database. This is primarily due to lack of focused surveys.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** C = Small (5-10%)

Comments: There is little inventory data available to assess this. However, dams along the Columbia River have altered ecological processes associated with this system. Dams have flattened the annual hydrological variability by decreasing high flows and increasing low flows and also decreasing velocity of water flows (NRC 2004). One effect of those changes is assumed to be less extent of mudflats since these areas would have been maintained by seasonal flooding, which would keep some areas free of perennial or woody vegetation, followed by subsequent low flows which would expose areas of primarily bare sediment. Thus, the dams on the Columbia River are assumed to have decreased extent and degraded quality of remaining sites. No data was found to provide specific information about how the current hydrological patterns have maintained mudflats. A conservative estimate of "C=5-10%" of area with good ecological integrity was selected.

Number Protected EOs:

Scientific Name: ***Temperate Pacific Freshwater Mudflat*** **Elcode:** CES200.878

Common Name: Temperate Pacific Freshwater Mudflat **Subnational ID:** 18301

Comments:

Threats

Threats: A = Very high

Comments: Dams and their negative effects on hydrological processes associated with the maintenance of this system is the primary threat. Nonnative species can also be problematic.

Threat Category: 7 - Natural system modifications Level of Threat: B = High
Comments:

Threat Category: 7.2 - Dams & water management/use Level of Threat: B = High
Comments:

Threat Category: 8 - Invasive & other problematic species, genes & diseases Level of Threat: B = High
Comments:

Threat Category: 8.1 - Invasive non-native/alien species/diseases Level of Threat: B = High
Comments:

Trends

Short-term Trend: D = Decline of 50-70%

Comments: Dams, irrigation withdrawals, and hydroelectric production was initiated on the Columbia River in the early 1930s. These activities, specifically the dams, have flattened the annual hydrological variability by decreasing high flows and increasing low flows and also decreasing velocity of water flows (NRC 2004). One effect of those changes is assumed to be less extent of mudflats since these areas would have been maintained by seasonal flooding, which would keep some areas free of perennial or woody vegetation, followed by subsequent low flows which would expose areas of primarily bare sediment. Thus, the dams on the Columbia River are assumed to have decreased extent and degraded quality of remaining sites. No data was found to provide specific information about how the current hydrological patterns have maintained mudflats.

Long-term Trend: E = Decline of 30-50%

Comments: Dams, irrigation withdrawals, and hydroelectric production was initiated on the Columbia River in the early 1930s. These activities, specifically the dams, have flattened the annual hydrological variability by decreasing high flows and increasing low flows and also decreasing velocity of water flows (NRC 2004). One effect of those changes is assumed to be less extent of mudflats since these areas would have been maintained by seasonal flooding, which would keep some areas free of perennial or woody vegetation, followed by subsequent low flows which would expose areas of primarily bare sediment. Thus, the dams on the Columbia River are assumed to have decreased extent and degraded quality of remaining sites. No data was found to provide specific information about how the current hydrological patterns have maintained mudflats.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

National Research Council (NRC). 2004. Managing the Columbia River. Instream Flows. Water Withdrawals, and Salmon Survival. National Research Council of the National Academies. The National Acadamies Press. Washington D.C.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Scientific Name: ***Temperate Pacific Freshwater Mudflat*** **Elcode:** CES200.878

Common Name: Temperate Pacific Freshwater Mudflat **Subnational ID:** 18301

Simenstad, C.A., J.L. Burke, J.E. O'Connor, and C. Cannon. 2011. Columbia River Estuary Ecosystem Classification--Concept and Application. U.S. Department of Interior, Geological Survey. Open-Filed Report 2011-1228. GIS layers downloaded from Lower Columbia Estuary Partnership's website: http://www.estuarypartnership.org/

Version

Version Author: Joe Rocchio **Version Date:** 04-Mar-2015

Internal Notes:

Scientific Name: ***Temperate Pacific Intertidal Mudflat*** **Elcode:** CES204.879

Common Name: Temperate Pacific Intertidal Mudflat **Subnational ID:** 18302

Descriptors

Element Description: This system includes sparsely vegetated mudflats which occur within intertidal zones along the outer coast and along the shorelines of Puget Sound. These mudflats form a narrow band along oceanic inlets, and are more extensive at the mouths of larger rivers. Algae are the dominant vegetation on mudflats where little vascular vegetation is present due to the daily (in some cases twice daily) tidal flooding of salt or brackish water. Characteristic species include Vaucheria longicaulis and Enteromorpha spp.

The dredging and filling of marshes and tidal flats to serve various human needs remove estuarine vegetation. Channel flow, tidal inundation, and fresh water discharges are disrupted by construction of seawalls, jetties, dikes, and dams. The physical and chemical conditions of these habitats are degraded by the discharge of municipal, industrial, and agricultural effluents. Functional plant and animal communities are altered by domestic and agricultural runoff of pesticides , herbicides, and fertilizers. Invasions of exotic plants (e.g., Spartina) and invertebrates (e.g., green crabs) pose significant, long-term ecological and economic threats to this habitat. Large tracts of habitat have been lost and converted for coastal development. Additionally, upland activities occurring throughout the watershed, including logging, mining, and hydroelectric power development, can have destructive impacts downstream in estuarine and bay environments.

Rank

S Rank: S3S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: There are few data sources to help rate metrics. In addition, the author has had little field-based experience with the system.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: This sparsely vegetated mudflat occurs within intertidal zones along the outer coast, the Columbia River estuary, and along shorelines of the Puget Sound. Extent was measure to be approximately ~7500 km2. However, this was a coarse measure and likely a large overestimate. The "E=5,000-20,000 km2" rating was chosen.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 78,602 acres (~318 km2) of this system occurs in Washington. In the lower Lower Columbia River estuary alone, 15,187 acres (~61 km2) has been estimated (Marcoe and Pilson 2011). The National Wetland Inventory (NWI) maps were filtered for Estuarine, Unconsolidated Shore polygons of which intertidal flats woulbe likely be classified. That analysis showed 50,816 acres (~206 km2) of such wetlands in western Washington. Based on these variable estimates, the "H=100-500 km2" rating was chosen.

Population and EOs

Number of EOs: AC = 1 - 80

Comments: No element occurrences have been documented in Washington Natural Heritage Program 's database. This is primarily due to lack of focused surveys. However, there are definitely numerous occurrences on the landscape.

Population Size: =

Comments:

Number of Viable EOs: **% of Range with Good Viability:** U = Unknown

Comments: There are no reliable data sources to estimate current ecological integrity of this system. Some areas are undoubtedly impacted by nearshore development and changes in water quality.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Some areas are undoubtedly threatened by nearshore development and changes in water quality. However, very little is known current threats and their impacts. Thus, there is low confidence in the "Medium" rating.

Threat Category: 1 - Residential & commercial development Level of Threat: C = Medium

Comments:

Threat Category: 1.1 - Housing & urban areas Level of Threat: D = Low

Comments:

Scientific Name: ***Temperate Pacific Intertidal Mudflat*** **Elcode:** CES204.879

Common Name: Temperate Pacific Intertidal Mudflat **Subnational ID:** 18302

Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	D = Low
Comments:			
Threat Category:	9 - Pollution	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.1 - Domestic & urban waste water	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.2 - Industrial & military effluents	Level of Threat:	C = Medium
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: Marcoe and Pilson (2011) estimated that between 1870-2011 there was a slight net gain of this system (increase of 2,739 acres) in the Lower Columbia River estuary. It is unclear whether this trend would hold true across the entire range of this sytem. As noted above, there are no data to estimate change in ecological integrity, although with the amount of development and asociated water quality issues around the Puget Sound and along the Columbia river degradation of some occurrences would be expected.

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: Marcoe and Pilson (2011) estimated that between 1870-2011 there was a slight net gain of this system (increase of 2,739 acres) in the Lower Columbia River estuary. It is unclear whether this trend would hold true across the entire range of this sytem. As noted above, there are no data to estimate change in ecological integrity, although with the amount of development and asociated water quality issues around the Puget Sound and along the Columbia river degradation of some occurrences would be expected.

Other Factors

Intrinsic Vulnerability: A = Highly vulnerable

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Marcoe, K. and S. Pilson. 2011. Habitat Change in the Lower Columbia River and Estuary, 1870-2011. Lower Columbia River Estuary Partnership. Portland, Or. Online: http://www.estuarypartnership.org/historical-habitat-change-lower-columbia-river-1870-2010

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 04-Mar-2015

Internal Notes:

Scientific Name: ***Temperate Pacific Subalpine-Montane Wet Meadow*** **Elcode:** CES200.998

Common Name: Temperate Pacific Subalpine-Montane Wet Meadow **Subnational ID:** 18260

Descriptors

Element Description: The Temperate Pacific Subalpine-Montane Wet Meadow ecological system is a high-elevation (montane to alpine) wetland mostly found west of or near the Cascade crest and in the Olympics. Sites have mineral soils and are dominated by herbaceous species, typically graminoids on wet sites with very low-velocity surface and subsurface water flows. It is a small patch system which occurs among montane and subalpine forests from California' s Transverse and Peninsular ranges north to the Alaskan coastal forests at varying elevations depending on latitude . Sites are open wet depressions, basins and flats that are usually seasonally wet, often drying by late summer. Many sites occur in a tension zone between perennial wetlands and uplands, where water tables fluctuate in response to long-term climatic cycles. Seasonal surface water depths rarely exceed a few centimeters if present. Soils show typical hydric soil characteristics, including high organic content (often with histic epipedons) and/or low chroma and redoximorphic features. Site often are associated with groundwater discharge or seasonally high water tables. The system is often tightly associated with snowmelt and typically not subjected to high disturbance events such as flooding.

 The Temperate Pacific Subalpine-Montane Wet Meadow ecological system occurs as a mosaic of several plant associations with various dominant herbaceous species that may include Camassia quamash, Carex bolanderi, Carex utriculata, Carex exsiccata, Dodecatheon jeffreyi, Glyceria striata (= Glyceria elata), Carex nigricans, Calamagrostis canadensis, Juncus nevadensis, Caltha leptosepala ssp. howellii, Veratrum californicum, and Scirpus and/or Schoenoplectus spp. Trees occur peripherally or on elevated microsites and include Picea engelmannii, Abies lasiocarpa, Abies amabilis, Tsuga mertensiana, and Chamaecyparis nootkatensis. Common shrubs may include Salix spp., Vaccinium uliginosum, and Betula nana.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of wetlands in western Washington . Higher elevation wetlands are less altered than lowland wetlands even though they have undergone modification as well. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can induce lower water tables and contribute excess nutrients and sediment. Increased nutrients can alter species composition by allowing aggressive, invasive species to displace native. Human land uses in adjacent and upland areas can fragment the landscape and thereby reduce connectivity between wet meadow patches and between wetland and upland areas. The intensity and types of land use within and near wet meadows can have a significant affect on plant community composition. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. Livestock management can impact wet meadows by compacting soil, pugging (creation of pedestals by hooves) on the soil surface, altering nutrient concentrations and cycles, changing surface and subsurface water movement and infiltration, and shifting species composition. In general, excessive livestock or native ungulate use leads to a shift in plant species composition. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Although most wetlands some receive regulatory protection at the national, state, and county level, many wetlands have been and continued to be filled, drained, and grazed in the Washington. Montane wetlands are less altered than lowland wetlands even though they have undergone modification as well. Non-native species can displace native species, alter hydrology, alter structure, and affect food web dynamics by changing the quantity , type, and accessibility to food for fauna. Wetland dominated by non-native, invasive species typically support fewer native animals.

Rank

S Rank: S4 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: The system is not thought to have experience much direct loss. Some changes in ecological integrity may have occurred at some sites.

Range

Range Extent: F = 20,000-200,000 square km (about 8000-80,000 square miles)

Comments: These high elevation wet meadows are found in the Cascades and Olympic mountains of western Washington. Measured extent was ~35,000 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***Temperate Pacific Subalpine-Montane Wet Meadow*** **Elcode:** CES200.998

Common Name: Temperate Pacific Subalpine-Montane Wet Meadow **Subnational ID:** 18260

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 6,918 acres (~28 km2) of this system occurs in Washington. The National Wetland Inventory (NWI) maps were clipped to montane regions within western Washington. Next, total acreage of palustrine emergent wetlands was calculated. This values could also include other systems like Temperate Pacific Freshwater Emergent Marsh and North Pacific Bog and Fen. The results showed that 40,722 acres (~165 km2) of such wetlands occur within the extent of this system. NatureServe's estimate is more in line with field observations and the selected rank was based on that.

Population and EOs

Number of EOs: C = 21 - 80

Comments: There are 16 element occurrences in Washington Natural Heritage Program's database. There are more on the landscape.

Population Size: **=**

Comments:

Number of Viable EOs: **% of Range with Good Viability:** F = Excellent (>40%)

Comments: Much of this system occurs on public lands and most occurences are in assumed to be in good condition. Roads may have impacted some sites and logging might have as well.

Number Protected EOs:

Comments:

Threats

Threats: C = Medium

Comments: Roads and other structure may be impacting hydrology. Logging within watershed of these systems may be impacting hydrology.High seems like an overestimate

Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	D = Low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	D = Low
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	D = Low
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	D = Low
Comments:			
Threat Category:	5 - Biological resource use	Level of Threat:	C = Medium
Comments:			
Threat Category:	5.3 - Logging & wood harvesting	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	D = Low
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	D = Low
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	D = Low
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	D = Low
Comments:			

Trends

Short-term Trend: G **=** Relatively Stable (<=10% change)

Comments: There are no data to make reliable estimates. However, it is likely this system has not experienced much direct loss. Any change is likely due to changes in ecological integrity but assumed to be minimal.

Long-term Trend: G = Relatively Stable (<=10% change)

Comments: There are no data to make reliable estimates. However, it is likely this system has not experienced much direct loss. Any change is likely due to changes in ecological integrity but assumed to be minimal.

Scientific Name: ***Temperate Pacific Subalpine-Montane Wet Meadow*** **Elcode:** CES200.998

Common Name: Temperate Pacific Subalpine-Montane Wet Meadow **Subnational ID:** 18260

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Joe Rocchio **Version Date:** 06-Mar-2015

Internal Notes:

Scientific Name: ***Temperate Pacific Tidal Salt and Brackish Marsh*** **Elcode:** CES200.091

Common Name: Temperate Pacific Tidal Salt and Brackish Marsh **Subnational ID:** 18442

Descriptors

Element Description: This is a small patch system is found along the Pacific Coast, from south- central Alaska to the central California coast. In Washington, it occurs in large bays on the outer coast and around the waters of Puget Sound. Occurrences are confined primarily to inter-tidal portions of estuaries, coastal lagoons and bays, and behind sand spits or other locations protected from wave action. Their associated specific environments are defined by ranges of salinity, tidal inundation regime, and soil texture. This system is characterized as being dominated by emergent vegetation whose composition is influence by tidal fluctuations and varying degree of salinity (saline to brackish). Marine salt water circulation through a marsh is most important factor in marsh plant species distribution. Vegetation patches usually occur as zonal mosaics of multiple communities. Zones vary in location and abundance with daily and seasonal dynamics of freshwater input balanced against evaporation and tidal flooding of saltwater. Summer-dry periods result in decreased freshwater inputs and thus higher salinity levels. Hyper-saline environments within salt marshes occur in "salt pans" where tidal water collects and evaporates.

Characteristic plant species include Distichlis spicata, Glaux maritima, Jaumea carnosa, Salicornia spp., Suaeda spp., and Triglochin spp. Low marshes are located in areas that tidally flood every day and are dominated by a variety of low-growing forbs and low to medium-height graminoids, especially Salicornia virginica, Distichlis spicata, Schoenoplectus maritimus (= Scirpus maritimus), Schoenoplectus americanus (= Scirpus americanus), Carex lyngbyei, and Triglochin maritima. High marshes are located in areas that flood infrequently and are dominated by medium-tall graminoids and low forbs, especially Deschampsia caespitosa, Argentina egedii (=Potentilla pacifica), Juncus balticus, and Symphyotrichum subspicatum (= Aster subspicatus). Transition zone (slightly brackish) marshes are often dominated by Typha spp. or Schoenoplectus acutus (= Scirpus acutus), Atriplex prostrata (= Atriplex triangularis) and Phragmites spp.

Historic and contemporary land use practices have impacted hydrologic, geomorphic, and biotic structure and function of salt marshes in Washington. Natural sedimentation from the watershed changes elevation and the influence of marine water in a salt marsh. Reservoirs, water diversions, ditches, roads, and human land uses in the contributing watershed can also have a substantial impact on the hydrological regime. Channel flow, tidal inundation, and fresh water discharges are disrupted by construction of seawalls, jetties, dikes, and dams. Direct alteration of hydrology (i.e., channeling, draining, damming) or indirect alteration (i.e., roading or removing vegetation on adjacent slopes) results in changes in amount and pattern of herbaceous wetland habitat. Plant species composition in the salt marsh varies along the salinity gradient of the estuary so that altered tidal or freshwater sources change expected species distributions based on their tolerance of saline conditions. If the alteration is long term, wetland systems may reestablish to reflect new hydrology, e.g., cattail is an aggressive invader. Human land uses both within the marshes as well as in adjacent upland areas have reduced connectivity between wetland patches and upland areas. Land uses in contributing the watershed have the potential to contribute excess nutrients into to the system which could lead to the establishment of non-native species and/or dominance of native increasing species. Invasive weeds, such as Spartina spp. are problems in many of these marshes. In general, excessive livestock or native ungulate use leads to a shift in plant species composition. Non-native plants or animals, which can have wide-ranging impacts, also tend to increase with these stressors. Although most wetlands receive regulatory protection at the national, state, and county level, many have been and continued to be filled, drained, grazed, and farmed extensively.

Rank

S Rank: S2 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: A significant amount of this ecological system has been lost in specific ares within its range . Degradation has occurred across much of its range and in most occurrences.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: This system occurs along the outer coast, especially Grays Harbor to Willapa Bay and in the Puget Sound region.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological System map (Sayre et al. 2009) estimates 50,791 acres (~205 km2). The National Wetland Inventory (NWI) mapped an estimated 24,914 acres (~100 km2) of palustrine emergent wetlands within western Washington. However, this value also includes six other Ecological Systems found in western dominated by herbaceous vegetation. Collins and Sheikh (2005) estimate about 13,974 acres (56 km2) of tidal marsh occur today in the Puget Sound alone.The "H=100-500km2" was chosen to represent the variation in estimates. The actual area of occupancy is assumed to be at the low end of this range.

Scientific Name: ***Temperate Pacific Tidal Salt and Brackish Marsh*** **Elcode:** CES200.091

Common Name: Temperate Pacific Tidal Salt and Brackish Marsh **Subnational ID:** 18442

Population and EOs

Number of EOs: D = 81 - 300

Comments: There are 158 element occurrences in WNHP database. Collins and Sheikh (2005) estimate 290 tidal marsh "complexes" in the Puget Sound alone. It was difficult to determine how the scale of Collins and Sheikh's (2005) complex compared to a WNHP element occurrence. As a conservative estimate the "D=81-300" rating was chosen.

Population Size: =

Comments:

Number of Viable EOs: E = Many (41-125) **% of Range with Good Viability:** D = Moderate (11-20%)

Comments: About 138 of the 158 element occurrences in the WNHP database have an A or B rank. However, many of these ranks are 20+ years old and many have likely degraded since they were first documented, thus the rating for number of occurrences was downgraded. It is assumed here that the majority of tidal marshes have fair integrity due to changes to the tidal prism, invasive species such as Spartina, nonnative grasses in high marsh zones (Agrostis), and water quality issues associated with both marine and freshwater inputs.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Invasive species, hydrological alterations, agriculture, roads, and development have resulted in numerous stressors.

Threat Category:	1 - Residential & commercial development	Level of Threat:	C = Medium
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	C = Medium
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	C = Medium
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	C = Medium
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.2 - Problematic native species/diseases	Level of Threat:	C = Medium
Comments:			

Trends

Short-term Trend: D = Decline of 50-70%

Comments: Collins and Sheikh (2005) estimated that approximately 81% of the historical extent of tidal marshes in Washington have been lost (13,794 of 72,895 acres remaining). Borde et al. (2003) estimate that 70% of tidal marshes have been lost from the Columbia River estuary. Only 3% loss has been estimated for Willapa Bay (Borde et al. 2003). No estimates were found for Grays Harbor but a significant amount of tidal marshes there have been cut off from tidal waters (Callaway et al. 2012). It isn't clear how much of this has occurred in the past 50 years or beyond. What isn't included in this estimate is the degradation of remaining tidal marshes which is assumed to have been quite high due to nonnative species, hydrological alterations, and water quality issues.

Scientific Name: ***Temperate Pacific Tidal Salt and Brackish Marsh*** **Elcode:** CES200.091

Common Name: Temperate Pacific Tidal Salt and Brackish Marsh **Subnational ID:** 18442

Long-term Trend: D = Decline of 50-70%

Comments: Collins and Sheikh (2005) estimated that approximately 81% of the historical extent of tidal marshes in Washington have been lost (13,794 of 72,895 acres remaining). Borde et al. (2003) estimate that 70% of tidal marshes have been lost from the Columbia River estuary. Only 3% loss has been estimated for Willapa Bay (Borde et al. 2003). No estimates were found for Grays Harbor but a significant amount of tidal marshes there have been cut off from tidal waters (Callaway et al. 2012). It isn't clear how much of this has occurred in the past 50 years or beyond. What isn't included in this estimate is the degradation of remaining tidal marshes which is assumed to have been quite high due to nonnative species, hydrological alterations, and water quality issues.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Borde, A.B., R.M. Thom, S. Rumrill, and L.M. Miller. 2003. Geospatial habitat change analysis in Pacific Northwest coastal estuaries.Estuaries 26: 1104-1116.

Callaway, J.C., A.B. Border, H.L. Diefenderfer, V.T. Parker, J.M. Rybczyk, and R.M. Thom. 2012. Pacific Coast Tidal Wetlands. In "Wetland Habitats of North America" D.P. Batzer and A.H. Baldwin, Editors. University of California Press.

Collins, B.D. and A.J. Sheikh. 2005. Historical reconstruction, classification, and change analysis of Puget Sound tidal marshes. Puget Sound River History Project. University of Washington. Seattle, WA.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.

Version

Version Author: Joe Rocchio **Version Date:** 19-Feb-2015

Internal Notes:

Scientific Name: ***Willamette Valley Upland Prairie and Savanna*** **Elcode:** CES204.858

Common Name: Willamette Valley Upland Prairie and Savanna **Subnational ID:** 18261

Descriptors

Element Description: Most sites are topo-edaphically dry and experience extreme soil drought in the summer. In the South Puget Sound, this system occurs as large patches, usually associated with deep, gravelly/sandy glacial outwash that is excessively well drained within more forested landscapes. Landforms are usually flat, rolling, or gently sloping, and often part of extensive plains.
These upland prairies and savannas are thought to have developed during the relatively hot and dry Hypsithermal period about10,000 to 7,000 b.p. Thereafter, a cooler and moister climate has prevailed creating suitable conditions for encroachment of woody vegetation into many prairies. Historically, frequent fires or extreme environmental conditions (e.g., drier climate and/or excessively drained soils) prevented the establishment of shrubs and trees. The high frequency of fires (< 10 years) was a result of occasional lightning strikes but more often from intentional ignition by indigenous inhabitants who set fires to encourage to the growth of food plants such as Camassia quamash and Pteridium aquilinum and to control the encroachment of woody vegetation. Fires are thought to have occurred every few years (Chappell and Kagan 2001). Annual soil drought during the summer made it difficult for woody species (especially trees) to establish in these grasslands. However, occasionally Quercus garryana and Pseudotsuga menziesii would establish and survive long enough to be resistant to frequent fires thereby creating savanna conditions. Following European settlement of the region, anthropogenic fire became less frequent resulting in widespread encroachment of the prairies and savannas by woody vegetation, especially conifers.
Historically, these prairies and savannas are dominated by a native bunchgrass, Festuca idahoensis ssp. roemeri and, to a lesser degree, Danthonia californica and Carex inops ssp. inops, along with abundant and diverse perennial forbs such as Achillea millefolium, Apocynum androsaemifolium, Brodiaea coronaria ssp. coronaria, Camassia quamash ssp. azurea or ssp. maxima, Campanula rotundifolia, Eriophyllum lanatum var. leucophyllum, Fragaria virginiana, Fritillaria affinis var. affinis, Hieracium cynoglossoides, Lomatium utriculatum, Lotus micranthus, Microseris laciniata, Prunella vulgaris ssp. lanceolata, Ranunculus occidentalis var. occidentalis, Sericocarpus rigidus, Viola adunca, and Zigadenus venenosus var. venenosus (Dunwiddie et al. 2006). Elymus trachycaulus, E. glaucus, Koeleria macrantha, and Stipa lemmonii can be locally important. Savannas with scattered deciduous (Quercus garryana) and/or coniferous (Pseudotsuga menziesii, Pinus ponderosa) trees are rarely found now, but such savannas historically covered about one-third of the total acreage. Shrubs such as Symphoricarpos albus, Rosa nutkana, Toxicodendron diversilobum, Amelanchier alnifolia, and Arctostaphylos uva-ursi are common shrubs. Dunwiddie et al. (2006) recorded 278 plant taxa within the South Puget Sound prairies. Of these, 164 (59%) were native species, while 111 (40%) were non-native and four (~1%) were of uncertain origin. Forbs comprised a majority of the species (74%) while graminoids (17%), shrubs (8%), and trees (2%) were of less importance (Dunwiddie et al. 2006). Most of the native forbs were perennial (70%) while most of the nonnative forbs were annuals and biennials. The majority of graminoids were perennial, whether native (94%) or nonnative (67%) (Dunwiddie et al. 2006). In many extant prairies, moss (e.g., Racomitrium canescens) and lichen (Cladina mitis)cover is high between bunchgrasses, however some researchers postulate that more frequent fires would have resulted in less moss and lichen cover and a higher cover and diversity of native annual species (Dunwiddie et al. 2006).

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: This type is very rare; over 90% conversion to to anthopogenic land uses or forest. Exotic and native plant (e.g., woody species) invasion continues and almost all sites require management. Few viable occurrrence exist.

Range

Range Extent: D = 1000-5000 square km (about 400-2000 square miles)

Comments: Within Washington, this system is limited to dry soils in Puget Lowland south to Vancouver , WA.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Comments: NatureServe's Ecological Systems map (Sayre et al. 2009) estimates 62sqkm while Chappell et al. (2001) estimated 19 sqkm of native grassland remaining.

Population and EOs

Number of EOs: B = 6 - 20

Comments: 18 WANHP plant association EOs in this system on 13 sites.

Population Size: =

Comments:

Scientific Name: ***Willamette Valley Upland Prairie and Savanna*** **Elcode:** CES204.858

Common Name: Willamette Valley Upland Prairie and Savanna **Subnational ID:** 18261

Number of Viable EOs: C = Few (4-12) **% of Range with Good Viability:**

Comments: WANHP has 1 AB-rank and 3 B-rank plant association element occurrences at 3 sites. NatureSserve's Landscape Condition Model (Comer and Hak 2009) estimated that 0% of mapped extant praireis had >80% LCM index score, indicating no high quality occurences remain.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: Invasion by extoic species. Maintenance of native plants requires burning and other management techniques. Fragmentation and isolation effects are pervasive. See Dennehy and others 2011Invasion by extoic species. Maintenance of native plants requires burning and other management techniques. Fragmentation and isolation effects are pervasive.

Threat Category:	1 - Residential & commercial development	Level of Threat:	C = Medium
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	D = Low
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	D = Low
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	AB = Very high - high
Comments:			
Threat Category:	7.1 - Fire & fire suppression	Level of Threat:	AB = Very high - high
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			
Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	AB = Very high - high
Comments:			
Threat Category:	8.2 - Problematic native species/diseases	Level of Threat:	AC = Very high - medium
Comments:			

Trends

Short-term Trend: E **=** Decline of 30-50%

Comments: Best professional judgment was used to estimate this metric.

Long-term Trend: A **=** Decline of >90%

Comments: Estimates based on evaluation of current land uses on prairie soils as noted by Chappell et al. (1999) and Caplow and Miller (2004).

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Scientific Name: ***Willamette Valley Upland Prairie and Savanna*** **Elcode:** CES204.858

Common Name: Willamette Valley Upland Prairie and Savanna **Subnational ID:** 18261

Caplow, F. and J. Miller. 2004. Southwestern Washington Prairies: Using GIS to find rare plant habitat in historic prairies. Washington Natural Heritage Program , Washington State Department of Natural Resources. Natural Heritage Report 2004-02, Prepared for the U.S. Fish and Wildlife Service Region 1, Section 6 funding. December 2004. Online. Available: http://www1.dnr.wa.gov/nhp/refdesk/pubs/sw_prairies.pdf (Accessed 2008).

Chappell, C. B., M. S. Mohn Gee, B. Stephens, R. Crawford, and S. Farone. 2001. Distribution and decline of native grasslands and oak woodlands in the Puget Lowland and Willamette Valley ecoregions , Washington. Pages 124-139 in Reichard, S. H., P.W. Dunwiddie, J. G. Gamon, A.R. Kruckeberg, and D.L. Salstrom, eds. Conservation of Washington's rare plants and ecosystems. Washington Native Plant Society, Seattle, Wash. 223 pp.

Chappell, C.B. and J. Kagan. 2001. Westside Grasslands. In Johnson, D.H. and T.A. O'Neil. 2001. Wildlife-Habitat Relationships in Oregon and Washington 41-43pp. Oregon State University Press, Corvallis, OR

Comer, P. and J. Hak. 2009. NatureServe Landscape Condition Model. Internal documentations for NatureServe Vista decision support software engineering. NatureServe, Boulder, CO.

Dennehy, C., E. R. Alverson, H. E. Anderson, D. R. Clements, R. Gilbert , and T. N. Kaye. 2011. Management strategies for invasive plants in Pacific Northwest prairies, savannas, and oak woodlands. Northwest Science 85:329-351.

Dunwiddie, P., E. Alverson, A. Stanley, R. Gilbert, S. Pearson, D. Hays, J. Arnett, E. Delvin, D. Grosboll, and C. Marschner. 2006. The Vascular Plant Flora of the South Puget Sound Prairies, Washington, USA. Davidsonia:14(2):51-69

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Version

Version Author: Rex Crawford **Version Date:** 23-Oct-2014

Internal Notes:

Scientific Name: ***Willamette Valley Wet Prairie*** **Elcode:** CES204.874

Common Name: Willamette Valley Wet Prairie **Subnational ID:** 18299

Descriptors

Element Description: The wet prairies of southwest Washington and the Willamette Valley of Oregon (hereafter referred to as 'Willamette Valley wet prairies') are often perched on clay-rich soils and historically covered large areas. The South Puget Sound wet prairies differ from Willamette Valley wet prairies in that they are associated with permeable glacial outwash and thus are restricted to swales and riparian areas where surface topography intersects local groundwater tables and in other areas with local aquitards. The aquitards are likely the result of overflow deposition or temporary impoundment of glacial melt-water (Easterly et al. 2005). Aquitards may have also formed from lahars or volcanic ash (Easterly et al. 2005). In addition to having different soil characteristics, the South Puget Sound wet prairies were much more localized than Willamette Valley wet prairies.

The wet prairies in the South Puget Sound have been drastically reduced in extent and remaining wet prairies are so altered that the original composition, diversity and structure of the vegetation are largely unknown (Easterly et al. 2005). However, the South Puget Sound wet prairies are thought to be floristically similar to the Willamette Valley, of which more natural remnants remain. Based on the composition of the Willamette Valley wet prairies, it is thought that the South Puget Sound Prairie wet prairies were dominated primarily by graminoids, especially Deschampsia caespitosa, Camassia quamash, Carex densa, and Carex unilateralis, and to a lesser degree by forbs (e.g., Isoetes nuttallii) or shrubs (e.g., Rosa nutkana). Chappell et al. (2004) compiled a list of species known from prairies in the Willamette Valley, Puget Trough and Georgia Basin ecoregion. This list has been maintained an updated by Alverson (2009b) and indicates which prairie-associated habitat type each species occurred in, including oak woodland and savanna, herbaceous balds and rock outcrops, upland prairies, seasonal wet prairies, and vernal pools and seepages.

This system was productive and likely dynamic due to frequency of fire. Vegetation composition may have changed rapidly between fires. Without frequent fires, woody species associated with riparian areas would likely have encroached into and dominated narrow wet prairie swales along riparian corridors (Easterly et al. 2005). Areas supporting larger and wider wet prairies, such as in outwash channels and depressions, would have been more isolated from woody encroachment and would likely have persisted longer than narrow stripsalong wooded riparian areas (Easterly et al. 2005). The composition of woody species would likely have included many that are present today, but likely in different proportions. Relatively fire-tolerant trees like Quercus garryana, Populus tremuloides and probably P. balsamifera ssp. trichocarpa, would have likely been more abundant than the fire intolerant Fraxinus latifolia, which is presumed to have increased since European settlement (Easterly et al. 2005). Shrubby species likely included Symphoricarpos albus, Crataegus douglasii, Rosa nutkana, R. pisocarpa, Oemleria cerasiformis, Amelanchier alnifolia, Spiraea douglasii and Salix spp. In addition, until recently Alnus sinuata was apparently common around wetland edges in the Tacoma area, and may have been a component of these systems and Pteridium aquilinum may have been aggressive and had significant cover in some sites (Easterly et al. 2005).

Wet prairies have been lost and/or degraded due to numerous anthropogenic land uses and activities. Due to their productive nature, many wet prairies were converted to agriculture use, others were overgrazed, and others experienced invasion of woody vegetation due to fire suppression. Many other sites have been altered by draining, roads, and groundwater withdrawal. Due to these impacts, wet prairies have been nearly extirpated in the South Puget Sound region. The hydrologic regime of remaining wet prairie sites has likely been altered by draining and/or recession of the water table (Easterly et al. 2005). Fire suppression, attenuation of salmon runs, and altered hydrology of the current landscape has likely had a profound influence on the ecological processes and dynamics, such as nutrient cycling and successional status, of remaining wet prairie sites (Easterly et al. 2005).

Rank

S Rank: S1 **S Rank Date:** 27-Mar-2015 **G_RANK:** GNR **G Rank Date:**

State Exemplary Site:

Rank Reasons: There is very little of this ecosytem remaining on the landscape and the few extant remnants have been heavily degraded.

Range

Range Extent: E = 5000-20,000 square km (about 2000-8000 square miles)

Comments: This system includes wet meadows largely restricted to oak/prairie landscapes of South Puget Sound, Lewis and Cowlitz counties, and Clark County. The measured extent was ~5,600 km2.

Area of Occupancy Cell Size:

Number of Occupied Cells:

Scientific Name: ***Willamette Valley Wet Prairie*** **Elcode:** CES204.874

Common Name: Willamette Valley Wet Prairie **Subnational ID:** 18299

Comments: Ther are very few sites left with native vegetation (between 5-10) and all of them are very small.NatureServe's Ecological System map (Sayre et al. 2009) estimates 103 acres (~0.42km2) of this system occurs in Washington which is likely an accurate estimate. NWI maps were not a useful data source as the attributes didn't allow a fine enough filter to distingiush marshes from wet prairie. However, based on existing data sources (Chappell et al. 2001, Caplow and Miller 2004, and Easterly et al. (2005), and Kemper 2005) as well as field observations by the author, most extant occurrences with enough native vegetation to be considered still part of this Ecological System are very few and small. The larget remnant known is near Battleground and is about 45 acres while the high-quality remnant in Washington is only about 17 acres. Most other places with native vegetation are very small (~1 acre in extent or less).

Population and EOs

Number of EOs: A = 1 - 5

Comments: There are four element occurrences in the Washington Natural Heritage Program's database. There are unlikely for be more than a few additional sites worth considering as an element occurrences. There are numerous wet prairies on the landscape that are dominated by nonnative species (e.g. hay pastures or weedy fields) that may have a few native wet prairie species present but those sites would not meet the minimum criteria for this system. That said, such sites could still support rare plant and animals species and cultural values and should still be considered for conservation of those resources.

Population Size: =

Comments:

Number of Viable EOs: B = Very few (1-3) **% of Range with Good Viability:** B = Very small (<5%)

Comments: Only one of the four element occurrences has good ecological integrity. As noted above, there are numerous wet prairies on the landscape that are dominated by nonnative species (e.g. hay pastures or weedy fields) that may have a few native wet prairie species present but are too degraded to meet the minimum criteria for this system.

Number Protected EOs:

Comments:

Threats

Threats: A = Very high

Comments: A large variety of threats are associated with extant occurrences including development, agriculture, nonnative species, water management, roads, etc.

Threat Category:	1 - Residential & commercial development	Level of Threat:	B = High
Comments:			
Threat Category:	1.1 - Housing & urban areas	Level of Threat:	B = High
Comments:			
Threat Category:	1.2 - Commercial & industrial areas	Level of Threat:	C = Medium
Comments:			
Threat Category:	2 - Agriculture & aquaculture	Level of Threat:	B = High
Comments:			
Threat Category:	2.1 - Annual & perennial non-timber crops	Level of Threat:	B = High
Comments:			
Threat Category:	2.3 - Livestock farming & ranching	Level of Threat:	C = Medium
Comments:			
Threat Category:	4 - Transportation & service corridors	Level of Threat:	C = Medium
Comments:			
Threat Category:	4.1 - Roads & railroads	Level of Threat:	C = Medium
Comments:			
Threat Category:	7 - Natural system modifications	Level of Threat:	C = Medium
Comments:			
Threat Category:	7.2 - Dams & water management/use	Level of Threat:	C = Medium
Comments:			
Threat Category:	8 - Invasive & other problematic species, genes & diseases	Level of Threat:	B = High
Comments:			

Scientific Name:	***Willamette Valley Wet Prairie***	**Elcode:**	CES204.874
Common Name:	Willamette Valley Wet Prairie	**Subnational ID:**	18299

Threat Category:	8.1 - Invasive non-native/alien species/diseases	Level of Threat:	B = High
Comments:			
Threat Category:	9 - Pollution	Level of Threat:	C = Medium
Comments:			
Threat Category:	9.1 - Domestic & urban waste water	Level of Threat:	C = Medium
Comments:			

Trends

Short-term Trend: A **=** Decline of >90%

Comments: Christy (2015) was used to estimate historic acreage of wet prairie in southwest Washington. The following categories were used in the estimate 1. grassy marsh;grassy swamp; 2. Marsh, composition unknown; includes "wet meadow"; 3. Seasonally or perennially wet prairie, "prairie marsh," "swamp prairie," marshy prairie."; and 4. Wet "brushy" or "bushy" prairie. May have hardhack, rose. Using these categories the estimates ranged from 5,844 acres or ~24 km2 (just using category #3) to 7,728 acres or ~31 km2 (using all four). Assuming the current estimate of area occuped is close to accurate, direct loss of this system has been >90%, at least in southwest Washington where the majority of this system historically occurred. Even though there are numerous seasonally flooded wetland left within the extent of this sytem, almost all of them are dominated by nonnative species and do not floristically resemble historical conditions of this sytem. That coversion from native wet prairie to nonnative domianted, novel wetlands is considered here be direct loss.

Long-term Trend: A = Decline of >90%

Comments: Christy (2015) was used to estimate historic acreage of wet prairie in southwest Washington. The following categories were used in the estimate 1. grassy marsh;grassy swamp; 2. Marsh, composition unknown; includes "wet meadow"; 3. Seasonally or perennially wet prairie, "prairie marsh," "swamp prairie," marshy prairie."; and 4. Wet "brushy" or "bushy" prairie. May have hardhack, rose. Using these categories the estimates ranged from 5,844 acres or ~24 km2 (just using category #3) to 7,728 acres or ~31 km2 (using all four). Assuming the current estimate of area occuped is close to accurate, direct loss of this system has been >90%, at least in southwest Washington where the majority of this system historically occurred. Even though there are numerous seasonally flooded wetland left within the extent of this sytem, almost all of them are dominated by nonnative species and do not floristically resemble historical conditions of this sytem. That coversion from native wet prairie to nonnative domianted, novel wetlands is considered here be direct loss.

Other Factors

Intrinsic Vulnerability: =

Comments:

Environmental Specificity: =

Comments:

Other Considerations:

Needs

Research Needs:

Inventory Needs:

Protection Needs:

Management Needs:

References

Citation

2009. Sayre, R., P. Comer, H. Warner, and J. Cress. 2009. A New Map of Standardized Terrestrial Ecosystems of the Conterminous United States: U.S. Geological Survey Professional Paper 1768, 17 p.

Caplow, F. and J. Miller. 2004. Southwestern Washington Prairies: Using GIS to find rare plant habitat in historic prairies. Washington Natural Heritage Program , Washington State Department of Natural Resources. Natural Heritage Report 2004-02, Prepared for the U.S. Fish and Wildlife Service Region 1, Section 6 funding. December 2004. Online. Available: http://www1.dnr.wa.gov/nhp/refdesk/pubs/sw_prairies.pdf (Accessed 2008).

Chappell, C. B., M. S. Mohn Gee, B. Stephens, R. Crawford, and S. Farone. 2001. Distribution and decline of native grasslands and oak woodlands in the Puget Lowland and Willamette Valley ecoregions , Washington. Pages 124-139 in Reichard, S. H., P.W. Dunwiddie, J. G. Gamon, A.R. Kruckeberg, and D.L. Salstrom, eds. Conservation of Washington's rare plants and ecosystems. Washington Native Plant Society, Seattle, Wash. 223 pp.

Scientific Name: ***Willamette Valley Wet Prairie*** **Elcode:** CES204.874

Common Name: Willamette Valley Wet Prairie **Subnational ID:** 18299

Christy, J.A. 2015. GLO historical vegetation of southwestern Washington, 1853-1910. ArcMap shapefile, Version 2015_02. Oregon Biodiversity Information Center, Portland State University.

Easterly, R.T., D.L. Salstrom, and C.B. Chappell. 2005. Wet Prairie Swales of the South Puget Sound, Washington. Reported Submitted to South Puget Sound Office of The Nature Conservancy. Olympia, WA.

NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Central Databases. NatureServe, Arlington, VA.

Rocchio, F.J., R.C. Crawford, and R. Niggemann. 2014. Freshwater Wetland Conservation Priorities for Western Washington. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA. Washington Department of Natural Resources, Natural Heritage Program. Olympia, WA.

Version

Version Author: Joe Rocchio **Version Date:** 05-Mar-2015

Internal Notes: