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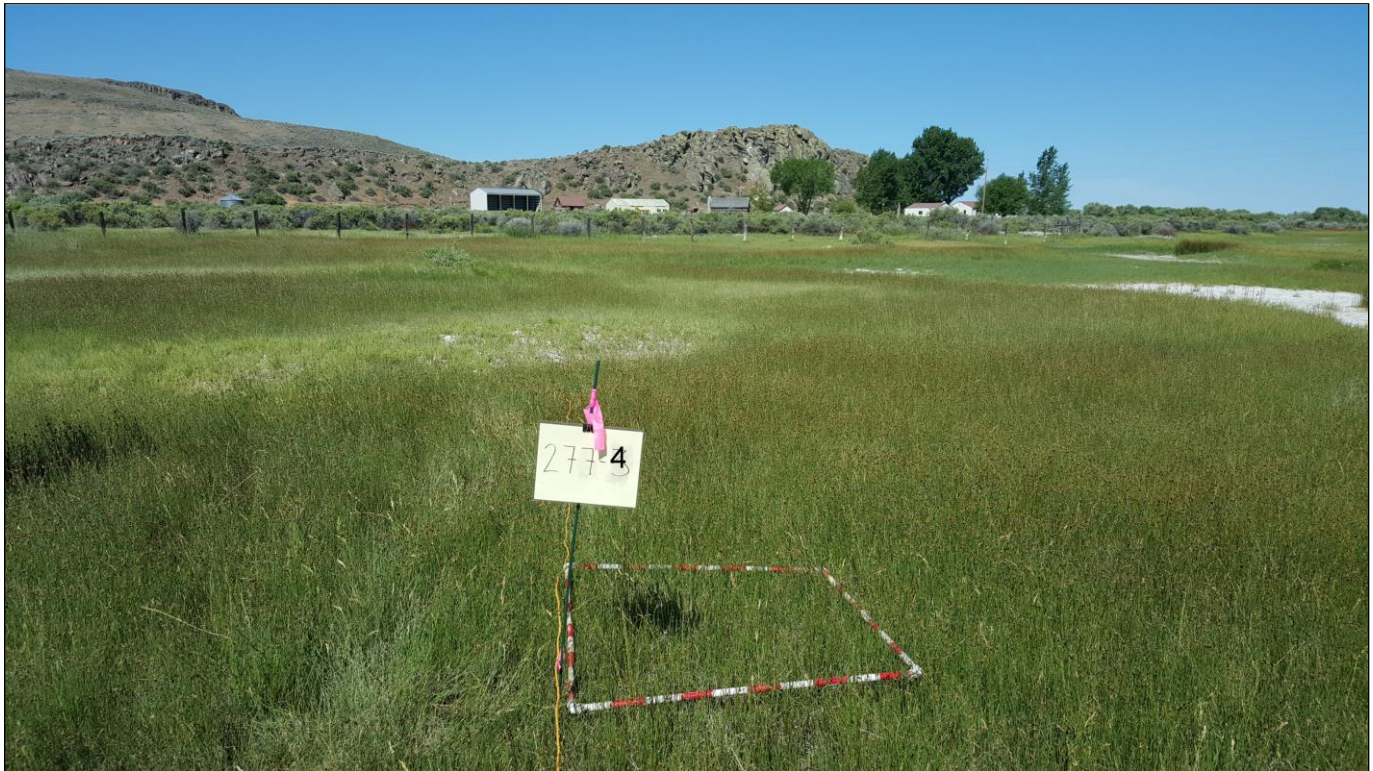
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**WET MEADOW PLANT ASSOCIATIONS, DOUBLE O UNIT, MALHEUR
NATIONAL WILDLIFE REFUGE, HARNEY COUNTY, OREGON**



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July 2016

Summary

This report summarizes vegetation data collected in July 2015 in wet meadow and marshy habitats on the Double O Unit of Malheur National Wildlife Refuge (MNWR). Because vegetation sampled at the Double O was wetter and more alkaline than wet meadows sampled at the south end of the refuge in 2012 and 2013 (Christy 2014), data from the Double O Unit were analyzed and summarized separately. A total of 83 plots were sampled in 2015, and analysis of the data identified 14 plant associations: *Alopecurus aequalis* - *Juncus balticus*, *Alopecurus pratensis* - *Potentilla anserina*, *Carex praegracilis* - *Juncus balticus*, *Cicuta douglasii* - *Carex nebrascensis*, *Distichlis spicata* - *Amphiscirpus nevadensis*, *Distichlis spicata* - *Nitrophila occidentalis*, *Eleocharis palustris* - *Juncus balticus*, *Eleocharis rostellata*, *Juncus balticus* - *Glaux maritima*, *Hippuris vulgaris* - *Triglochin maritima*, *Leymus triticoides* - *Juncus balticus*, *Schoenoplectus americanus*, *Spartina gracilis*, and *Triglochin maritima*. Plant associations spanned a wetland gradient from seasonally moist to seasonally or perennially flooded, but surface water had left most stands at time of sampling. Mean Wetland Indicator Status scores and species composition help to place the plant associations within gradients in soil moisture and alkalinity. Seven of the 14 plant associations are listed in the International Vegetation Classification, and the remaining types are provisional.

Acknowledgments

Jess Wenick and Chad Karges of Malheur National Wildlife Refuge (MNWR) provided guidance, logistical support, and funding to The Wetlands Conservancy (TWC) for this project. Esther Lev of TWC coordinated the project and provided guidance as a member of the Ecology Working Group (EWG). Vegetation sampling was done by Bruce Newhouse, Richard Brainerd, Jess Wenick, and Barry Smith.

Introduction

This report summarizes vegetation data collected in 2015 in the Double O Unit of the Malheur National Wildlife Refuge (MNWR). It incorporates portions of Christy (2014) that was based on field work done at the south end of MNWR in 2012 and 2013, between Krumbo Lane and Frenchglen. The US Fish and Wildlife Service (USFWS) contracted with The Wetlands Conservancy (TWC) to conduct the work as part of ongoing efforts by the Ecology Working Group (EWG) to better understand the composition and dynamics of these ecosystems. Results will be applied by EWG to development of state and transition models (STM) for managing wetlands on the MNWR.

Study area. The Double O Unit of MNWR is located at the northwestern edge of the Refuge, adjacent to Harney Lake (Figure 1). Topography of the Double O Unit is nearly flat, with an elevation gain of about 100 ft from north (4100 ft) to south (4200 ft) over a distance of about 6 miles. Target habitat was moist to wet meadow.

Wetlands on MNWR. Based on Cowardin et al. (1979), wetlands on the MNWR include palustrine, lacustrine, and riverine systems. Wetland types present include palustrine aquatic bed, emergent marsh,

seasonally wet meadow, willow shrub swamp, and playa. Vegetation is largely determined by hydroperiod, or how long water stays on the site, and by soil and water chemistry. Cowardin hydroperiods applicable to the MNWR include (a) permanently flooded—surface water present all year, (b) semipermanently flooded—surface water present most years, (c) seasonally flooded—surface water present for extended periods during part of the growing season, but absent by the end of the season, (d) saturated—soil perennially wet, but surface water seldom present, (e) intermittently flooded—surface water usually absent, sometimes present in wet years, and lacking any seasonal pattern, and (f) artificially flooded—amount and duration of flooding controlled by infrastructure. In addition to hydroperiod, wetland communities of the region are strongly influenced by alkaline and saline soils, which determine what plant species can survive at a given site (Lev et al. 2012).

Major **aquatic bed** vegetation on MNWR includes sago pondweed (*Potamogeton pectinatus*), coontail (*Ceratophyllum demersum*), pondweeds (*Zannichellia palustris*, *Potamogeton* spp.), white water buttercup (*Ranunculus aquatilis*), widgeongrass (*Ruppia maritima*), pond lily (*Nuphar polysepala*), and common bladderwort (*Utricularia macrorhiza*). These occur in lakes, ponds, and in channels of both the Blitzen River and irrigation canals. **Emergent marsh** communities include hardstem bulrush (*Schoenoplectus acutus*), cattails (*Typha latifolia*, *Typha angustifolia*), broadfruit bur-reed (*Sparganium eurycarpum*), and longroot smartweed (*Persicaria amphibia*). Water depths in marshes typically range from 2-3 inches to 2-3 feet, but in some years water levels recede completely to form seasonal **mud flat** communities. **Shrub swamp** or scrub-shrub on MNWR is primarily coyote willow (*Salix exigua*) with some box elder (*Acer negundo*) occurring along the floodplain of the Blitzen River. **Saline or alkaline wetlands** with intermittent hydroperiod, particularly **playas**, support more specialized shrub communities dominated by silver sagebrush (*Artemisia cana*) and greasewood (*Sarcobatus vermiculatus*), with basin wildrye (*Leymus cinereus*) and Nevada bluegrass (*Poa secunda*). Our study of seasonally **wet meadow** is described below, but included sampling of alkaline marsh, emergent marsh, and mud flats in order to place wet meadow within the context of hydrologic and salinity gradients.

Hydrology, soils, and vegetation on Double O Unit. Unlike most wetlands on MNWR that depend on variable precipitation and runoff from year to year, the OO Unit receives a more consistent supply of groundwater from numerous hot and cold springs in Warm Springs Valley, plus occasional inputs from Silver Creek during wet years. Like most bottomlands elsewhere on MNWR, the Double O Unit also contains an extensive network of dikes, ditches, and impoundments that divert water from the various springs and Silver Creek. Primary management activities affecting wet meadow vegetation in the study area are haying (baling and rake-bunch) and seasonal cattle grazing. In general, wet meadow in the study area can only produce one hay crop per year before summer drought induces dormancy (Cooper 1956; Rumberg 1963; Wenick 2000). Because the water supply is somewhat more consistent at Double O than elsewhere on MNWR, wetlands in the study area have somewhat more stable boundaries, though fluctuation of boundaries still occurs.

Located between the large playas of Silver Lake, Alkali Flat, Stinking Lake, and Harney Lake, the soils and wetlands of Warm Springs Valley and the Double O are markedly more alkaline than those at the south end of MNWR (Copeland 1979, Copeland and Greene 1982). The Double O supports extensive alkaline marsh vegetation that is much less common elsewhere on the Refuge.

Vegetation Classification. Analysis of plant species composition and percent cover helps to identify different types of vegetation present in the study area. The types are then compared with concepts known to the author or reported in the literature. The classification in this report follows the International

Vegetation Classification (IVC; FGDC 2008; Jennings et al. 2009). The IVC uses the plant association as the basic unit of classification, defined as having a distinct floristic composition, a more or less uniform appearance, and uniform habitat conditions. It applies to existing vegetation regardless of successional status. Each association is named after one or more diagnostic species in each vegetation layer. Dominant species in the herb layer are defined here as having at least 20% cover (U.S. Army Corps of Engineers 2008), or having the highest cover available in depauperate stands.

METHODS

Wet meadow vegetation on the Double O Unit of MNWR was sampled in July 2015. Two teams sampled vegetation simultaneously over a two week period. Sampling was done by Bruce Newhouse, Richard Brainerd, Jess Wenick, and Barry Smith.

Plot selection. Plot locations were selected to provide (1) general coverage across the sampling area, generally within one mile of the nearest road, (2) a representative sample of different plant associations occurring within the study area, and (3) a series of samples along presumed moisture gradients in several irrigated management units, extending from the driest points just north of diked impoundments to emergent marsh occurring at the head of the next impoundment to the north (Figure 1). To capture the range of variability present in wet meadow communities, plots that looked more or less uniform in composition were selected, as well as plots that looked different from one another. Wetland vegetation often contains nearly monotypic patches or clones of different species, and patches often end up being included in plots even if they are not obvious at first.

Vegetation sampling. Sampling followed the same methods described in Christy (2014). Each plot was circular, with a radius of 20 feet, covering a total area of about 0.25 acre (0.1 ha). GPS coordinates were recorded at the center point of each plot with consumer-grade Garmin units, with a general accuracy of ± 15 feet. Within each circular plot, plant species composition and absolute percent cover were sampled in four 1 m² quadrats installed 10 ft from the center point of the plot, with each quadrat placed in each of the four cardinal directions, adjusted to compass declination. Each quadrat was located to the right of the measuring tape when facing outward from the center point. Each quadrat was identified by a sign indicating the plot number (273-314, 401-440) and quadrat number (1-4) within each plot. When sampling of the four quadrats was completed, the remaining area within the circular plot was inspected and names of any additional species not captured in the quadrats were recorded. If any of these species were invasive, crude estimates (m²) of their cover in the plot were estimated. Voucher specimens were collected as needed to aid in identification of species, and will be deposited at the Oregon State University herbarium.

Photopoints. As done in 2012, eight photographs were taken in each plot, four showing the landscape view in each cardinal direction when facing outward from the center point (including the quadrat for that portion of the plot), and four showing a close-up of each of the four quadrats.

Ecological Integrity Assessment. Per direction from USFWS, NatureServe Ecological Integrity Assessment (EIA) methodology was not used in 2015.

Soils and depth to water table. A hand augur was not used in 2015 because of the high water table and relative uniformity of the soil.

Wetland Indicator Status (WIS). WIS variables for the Arid West were assigned to each species using the [2016 National Wetland Plant List](#) (Lichvar et al. 2016). I then assigned each WIS score a weighted number as follows: OBL=5, FACW=4, FAC=3, FACU=2, UPL=1. Bare ground, species not assigned a WIS, and taxa identified only to genus were excluded. I then calculated a mean WIS value for each plot, and from these I calculated a mean WIS for each plant association.

Data analysis. Plot data were transcribed into an MS Excel spreadsheet. For ease in interpretation of species names in output, 6-letter acronyms were used instead of the PLANTS acronyms, and are provided in Appendix 1. Species cover data from each of the four quadrats were then averaged to provide a mean value for each species in the plot. Plant associations were identified using cluster analysis and TWINSpan (McCune and Mefford 1999). Because plots sampled in 2015 were wetter and more alkaline than most plots sampled at the south end of MNWR in 2012-2013, the 2015 dataset (83 plots) was analyzed independent of the other plots. Based on experience gained from analyzing the 2012-2013 data, two TWINSpan runs analyzed the datasets (1) excluding bare ground and litter, and (2) excluding bare ground, litter, and several species common to many of the plots: *Juncus balticus*, *Poa secunda*, *Pyrocoma lanceolata*, and *Triglochin*. Both TWINSpan runs were useful in differentiating plant associations among the 83 plots. Using MS Excel, I then created stand tables for each association, summarizing each species' frequency, average percent cover, and maximum and minimum cover values.

Botanical nomenclature. Nomenclature follows the current [Oregon Flora Project checklist](#) (Jaster et al. 2016).

RESULTS

In 2015, a total of 83 plots were sampled in the Double O Unit (Figure 1), for a total of 332 quadrats and 908 observations for individual species, bare ground, litter, and moss. A total of 95 plant taxa were observed in the plots, 82 (86%) of which were native and 13 (14%) exotic (Appendix 1). Almost all vegetation sampled was herbaceous, with the exception of scant amounts of *Elaeagnus angustifolia* and *Sarcobatus vermiculatus*. Twenty-two new species of plants were observed in plots in 2015 (Table 1), including several obligate sodic species not recorded from plots sampled at the south end of MNWR: alkali birdbeak (*Chloropyron maritimum*), walking sedge (*Eleocharis rostellata*), sea milkwort (*Glaux maritima*), niterwort (*Nitrophila occidentalis*), red glasswort (*Salicornia rubra*), Nevada blue eyed grass (*Sisyrinchium halophilum*), alkali cordgrass (*Spartina gracilis*), and seaside arrowgrass (*Triglochin maritima*). Most of these species occur in both coastal salt marsh and interior alkaline wetlands, and are important components of the plant associations identified at Double O. Freshwater species seen at Double O but not at the south end of MNWR included *Castilleja minor*, *Cicuta douglasii*, *Hippuris vulgaris* and *Lycopus asper*. These may not have been seen at the south end because wetter stands were not sampled.

Microtopography was flat or slightly hummocky. Soils were alkaline clay loams of more or less uniform color. Hydrology ranged from dry to flooded, with most plots being moist, saturated, or flooded because

of perennial irrigation from the various springs in the area. A soil augur was not used. The water table was mostly at the surface, or occasionally 2 inches below the surface.

Because of the lack of topography and seeming uniformity of hydrologic conditions, most plots did not exhibit any environmental variables that would help differentiate vegetation. To compensate for the lack of useful environmental information on soils or depth to water table at the time of sampling, Wetland Indicator Status (WIS) is used as a surrogate indicator of hydroperiod for each plant association (Figures 2 and 3). WIS for each species is given in Appendix 1, and mean WIS for each plant association is given in Table 2.

Scientific Name	Common Name	Native/ Exotic
<i>Amphiscirpus nevadensis</i>	Nevada clubrush	N
<i>Bolboschoenus maritimus</i>	seacoast bulrush	N
<i>Castilleja minor</i>	seep paintbrush	N
<i>Chloropyron maritimum</i>	alkali birdbeak	N
<i>Cicuta douglasii</i>	Douglas water hemlock	N
<i>Elaeagnus angustifolia</i>	Russian olive	E
<i>Eleocharis rostellata</i>	walking sedge	N
<i>Erigeron lonchophyllus</i>	spear leaved fleabane	N
<i>Glaux maritima</i>	sea milkwort	N
<i>Hippuris vulgaris</i>	mare's tail	N
<i>Lycopus asper</i>	rough bugleweed	N
<i>Nitrophila occidentalis</i>	niterwort	N
<i>Ranunculus cymbalaria</i>	shore buttercup	N
<i>Salicornia rubra</i>	red glasswort	N
<i>Sarcobatus vermiculatus</i>	greasewood	N
<i>Schoenoplectus americanus</i>	three-square	N
<i>Sisyrinchium halophilum</i>	Nevada blue eyed grass	N
<i>Spartina gracilis</i>	alkali cordgrass	N
<i>Sphenopholis obtusata</i>	prairie wedgegrass	N
<i>Symphyotrichum ascendens</i>	long leaved aster	N
<i>Thelypodium integrifolium</i>	entire leaved thelypody	N
<i>Triglochin maritima</i>	seaside arrowgrass	N

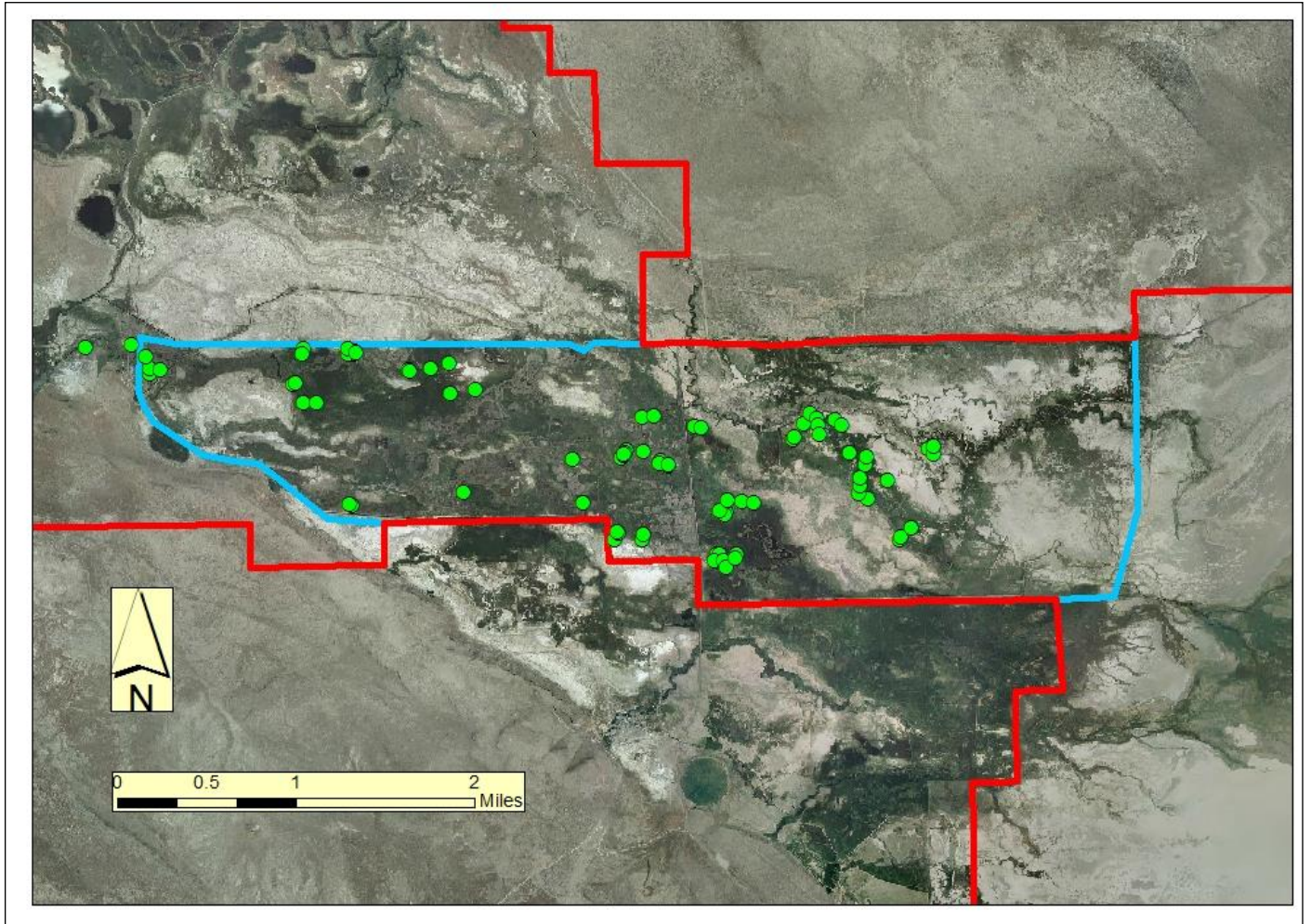


Figure 1. 2015 MNWR wet meadow sampling area, showing locations for 82 plots. Red = Refuge boundary, blue = Double O Unit. Imagery from 2005 NAIP.

1. Plant Associations

Fourteen plant associations were identified from 83 plots recorded on the Double O (Table 2). Four plots were excluded, 1 being mostly unvegetated, 1 unclassifiable, and 2 dominated by weedy *Cirsium arvense* and *Lepidium latifolium*. Descriptions for each plant association are given in Section 4 below.

All of the 14 plant associations described in this report were significantly wetter and had different dominant or codominant species than the wet meadow associations described in Christy (2014). When codominant species at Double O were the same as those identified in plant association names at the south end of MNWR (e.g., *Alopecurus pratensis*, *Carex nebrascensis*, *Carex praegracilis*, *Distichlis spicata*, *Eleocharis palustris*, *Juncus balticus*, *Leymus triticoides*), new names were assigned to distinguish them by adding a new codominant species. Some of these associations are represented in the IVC, but most are not. They may simply be local wet and alkaline variants of previously described types, or may be more widespread in the region but undersampled, and hence appearing anomalous here. Nevertheless, they are included here for the sake of completeness and may be useful at least at the local level.

Compared to plots at the south end of MNWR, almost all plots at Double O had consistently high values for bare ground and litter, ranging from large amounts of dead biomass in wetter sites, or naturally bare ground and mud flats. Moss was scarce and restricted to wetter sites. The *Carex praegracilis* - *Juncus balticus* and *Juncus balticus* - *Glaux maritima* associations were the most diverse, with 53 and 52 species, respectively. The *Alopecurus pratensis* - *Potentilla anserina*, *Eleocharis rostellata*, and *Triglochin maritima* associations had the lowest species diversity and the largest amount of bare ground, most of it mud flat. As observed in Christy (2014), perennially wet and more alkaline associations had low species diversity. Some of the more prominent wet meadow plant associations seen at the south end of MNWR but not recorded at Double O included *Carex aquatilis*, *Carex pellita*, *Carex sheldonii*, *Muhlenbergia asperifolia*, *Persicaria lapathifolia*, *Phalaris arundinacea*, and *Potentilla rivalis*.

Table 2. Plant associations identified on Double O Unit, 2015. For Wetland Indicator Status, 5 = OBL, 4 = FACW, 3 = FAC. Bare ground, species not assigned a WIS, and taxa identified only to genus were excluded.

Scientific name	Common name	# plots	# species	Mean Wetland Indicator Status
<i>Alopecurus aequalis</i> - <i>Juncus balticus</i>	shortawn foxtail - Baltic rush	2	13	4.5
<i>Alopecurus pratensis</i> - <i>Potentilla anserina</i>	meadow foxtail - silverweed	1	8	3.9
<i>Carex praegracilis</i> - <i>Juncus balticus</i>	clustered field sedge - Baltic rush	13	53	4.1
<i>Cicuta douglasii</i> - <i>Carex nebrascensis</i>	Douglas water hemlock - Nebraska sedge	1	25	4.4
<i>Distichlis spicata</i> - <i>Amphiscirpus nevadensis</i>	inland saltgrass - Nevada clubrush	11	26	4.1
<i>Distichlis spicata</i> - <i>Nitrophila occidentalis</i>	inland saltgrass - niterwort	12	21	3.6
<i>Eleocharis palustris</i> - <i>Juncus balticus</i>	common spikerush - Baltic rush	4	19	4.6

<i>Eleocharis rostellata</i>	walking sedge	1	8	4.1
<i>Juncus balticus</i> - <i>Glaux maritima</i>	Baltic rush - sea milkwort	12	52	4.1
<i>Hippuris vulgaris</i> - <i>Triglochin maritima</i>	mare's tail - seaside arrowgrass	4	26	4.8
<i>Leymus triticoides</i> - <i>Juncus balticus</i>	beardless wildrye - Baltic rush	10	29	3.7
<i>Schoenoplectus americanus</i>	three-square	2	24	4.1
<i>Spartina gracilis</i>	alkali cordgrass	4	14	4.0
<i>Triglochin maritima</i>	seaside arrowgrass	1	7	4.4

2. Relative hydrology and classification of plant associations at Double O

As done in Christy (2014), mean Wetland Indicator Status (WIS) was used as a surrogate to approximate the hydroperiod for each of the 14 associations identified on the Double O Unit (Table 2, Figures 2 and 3). No changes in WIS were detected between the 2013 and 2016 publications, so the values in Christy (2014) remain the same for comparison of associations at the south end of MNWR with those at the Double O.

When compared to Table 2 and Figures 2 and 3 in Christy (2014), all but one plant associations at Double O are significantly wetter than those at the south end of MNWR (Table 3, Figures 2 and 3). Most cluster around FACW, while the mostly aquatic *Hippuris vulgaris* - *Triglochin maritima* association was close to OBL. Although in many ways similar to plant associations described from the south end of MNWR, those at Double O appear to differ sufficiently to justify having different names. Few of these appear to duplicate associations already described in the IVC, or to occur within the range of variation described for published associations. Rather than stretch the concepts in the IVC to accommodate different hydrology and alkalinity, new names are applied here to help differentiate them, at least at the local level.

Scientific name	Mean WIS 2012-2013	Mean WIS 2015
<i>Alopecurus pratensis</i> vs. <i>Alopecurus pratensis</i> - <i>Potentilla anserina</i>	3.8	3.9
<i>Carex praegracilis</i> vs. <i>Carex praegracilis</i> - <i>Juncus balticus</i>	3.2	4.1
<i>Carex nebrascensis</i> vs. <i>Cicuta douglasii</i> - <i>Carex nebrascensis</i>	4.2	4.4
<i>Distichlis spicata</i> vs. <i>Distichlis spicata</i> - <i>Amphiscirpus nevadensis</i>	3.1	4.1
<i>Distichlis spicata</i> vs. <i>Distichlis spicata</i> - <i>Nitrophila occidentalis</i>	3.1	3.6
<i>Eleocharis palustris</i> vs. <i>Eleocharis palustris</i> - <i>Juncus balticus</i>	4.6	4.6
<i>Juncus balticus</i> vs. <i>Juncus balticus</i> - <i>Glaux maritima</i>	3.7	4.1
<i>Leymus triticoides</i> vs. <i>Leymus triticoides</i> - <i>Juncus balticus</i>	3.1	3.7

Figure 2 shows only means for the *Alopecurus pratensis* - *Potentilla anserina*, *Cicuta douglasii* - *Carex nebrascensis*, *Eleocharis rostellata*, and *Triglochin maritima* associations because each was represented by only one plot, while *Hippuris vulgaris* - *Triglochin maritima* had four plots of equal value. Similarly, in Figure 3, not enough samples were available to generate box plots for the *Alopecurus aequalis* - *Juncus balticus*, *Alopecurus pratensis* - *Potentilla anserina*, *Cicuta douglasii* - *Carex nebrascensis*, *Eleocharis rostellata*, *Schoenoplectus americanus*, *Spartina gracilis*, and *Triglochin maritima* associations.

Definitions of indicator status for species in the [2016 National Wetland Plant List](#) (NWPL) are strictly qualitative (Lichvar et al. 2016):

- 5: OBL (Obligate wetland) = almost always is a hydrophyte, rarely in uplands
- 4: FACW (Facultative wetland) = usually is a hydrophyte but occasionally found in uplands
- 3: FAC (Facultative) = commonly occurs as either a hydrophyte or non-hydrophyte
- 2: FACU (Facultative upland) = occasionally is a hydrophyte but usually occurs in uplands
- 1: UPL (Upland) = rarely is a hydrophyte, almost always in uplands

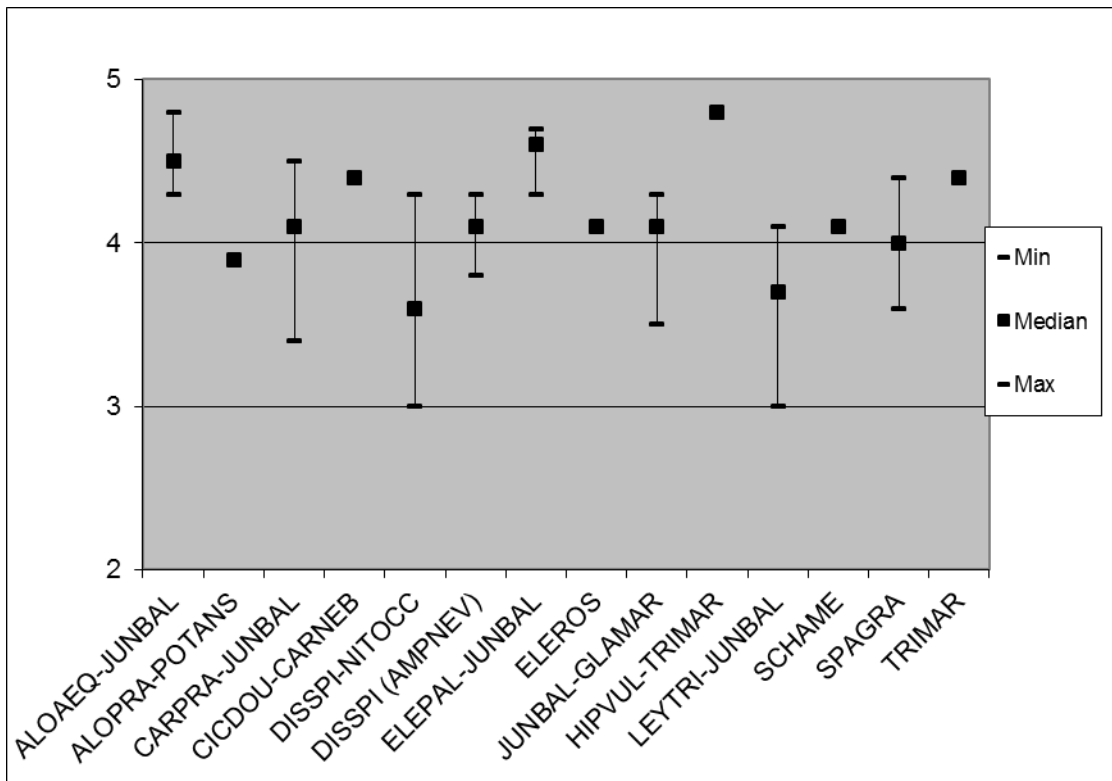


Figure 2. Line plots of mean Wetland Indicator Status (WIS) for all 19 plant associations at MNWR. WIS: 5 = OBL, 4 = FACW, 3 = FAC, 2 = FACU. *Alopecurus pratensis* - *Potentilla anserina*, *Cicuta douglasii* - *Carex nebrascensis*, *Eleocharis rostellata*, and *Triglochin maritima* show only mean values because each was represented by only one plot, while *Hippuris vulgaris* - *Triglochin maritima* had four plots of equal value.

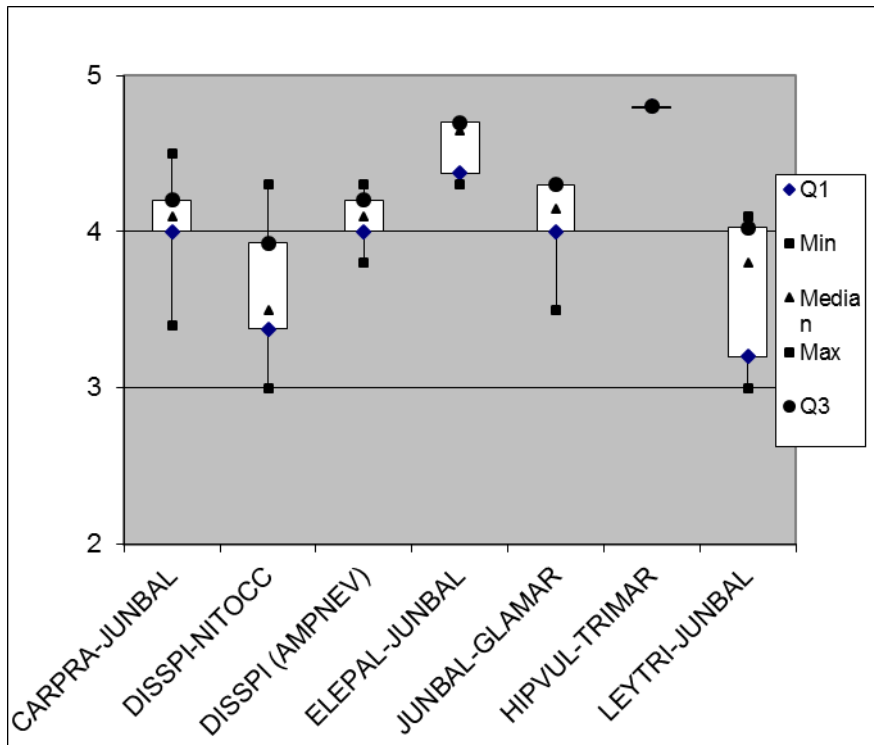


Figure 3. Box plots of mean Wetland Indicator Status (WIS) for 7 plant associations at MNWR with four or more samples. WIS: 5 = OBL, 4 = FACW, 3 = FAC, 2 = FACU. The *Alopecurus aequalis* - *Juncus balticus*, *Alopecurus pratensis* - *Potentilla anserina*, *Cicuta douglasii* - *Carex nebrascensis*, *Eleocharis rostellata*, *Schoenoplectus americanus*, *Spartina gracilis*, and *Triglochin maritima* associations are excluded because they had fewer than four samples, the minimum needed to generate box plots. *Hippuris vulgaris* - *Triglochin maritima* had four plots of equal value.

3. Exotic species

Thirteen exotic species were recorded in the plots in 2015. Only two these (*Lepidium latifolium* and *Polypogon monspeliensis*) occurred in more than 15% of the plots (Table 4). These figures reflect only presence of exotics in the plots sampled, and not their relative abundance on the Double O Unit of the Refuge. As has been seen elsewhere on MNWR, invasive species, particularly reed canary grass, perennial pepperweed, and meadow foxtail have impacted a number of wet meadow communities on the Double O Unit, but mostly to a lesser extent because of the more consistent hydrology and elevated alkalinity. Of these taxa, perennial pepperweed tolerates alkalinity and is the most intractable problem species at Double O.

Table 4. Exotic species identified in plots (n=83 plots) on Double O Unit of MNWR, 2015.			
Scientific name	Common name	Number of plots with species	Percent of plots containing species
<i>Agrostis gigantea</i>	red top	5	0.6
<i>Agrostis stolonifera</i>	creeping bentgrass	2	2.4
<i>Alopecurus pratensis</i>	meadow foxtail	6	7.2
<i>Bromus tectorum</i>	cheatgrass	1	1.2
<i>Chenopodium album</i>	lambsquarters	6	7.2
<i>Cirsium arvense</i>	Canada thistle	6	7.2
<i>Cirsium vulgare</i>	bull thistle	1	1.2
<i>Elaeagnus angustifolia</i>	Russian olive	1	1.2
<i>Lactuca serriola</i>	prickly lettuce	2	2.4
<i>Lepidium latifolium</i>	perennial pepperweed	19	22.9
<i>Polypogon monspeliensis</i>	annual rabbitfoot grass	16	19.3
<i>Rumex crispus</i>	curly dock	7	8.4
<i>Veronica anagallis-aquatica</i>	water speedwell	1	1.2

4. Descriptions of plant associations

This section describes each of the 14 plant associations identified on the Double O Unit of MNWR. Four associations were described from only 1 plot. These may simply be local wet and alkaline variants of previously described types, or may be more widespread in the region but undersampled, and hence appearing anomalous here. Nevertheless, they are included here for the sake of completeness and may be useful at least at the local level.

Abbreviated stand tables are included here, and complete stand tables are available from the author in Excel format. Each description includes the status of each association in the IVC, its global and state (subnational) conservation rank (ORBIC rank), habitat, hydrology, species composition, ecology, and a photograph. Unless noted otherwise, additional sources for descriptions of plant associations can be found by following the link to the IVC classification page.

Alopecurus aequalis - *Juncus balticus* Association

Shortawn foxtail - Baltic rush

Classification:

IVC: provisional

ORBIC rank: G3G4SU

Plots sampled at MNWR: 2

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to perennially flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Alopecurus aequalis</i>	100.0	75.0	52.5	97.5
<i>Juncus balticus</i>	100.0	6.6	0.8	12.5
Bare/ litter	100.0	3.8	2.3	5.3
<i>Eleocharis palustris</i>	100.0	1.9	0.3	3.5
<i>Alopecurus pratensis</i>	50.0	5.6	0.0	11.3
<i>Lycopus asper</i>	50.0	2.5	0.0	5.0
<i>Potentilla anserina</i>	50.0	1.6	0.0	3.3
<i>Triglochin maritima</i>	50.0	1.5	0.0	3.0
<i>Senecio hydrophilus</i>	50.0	0.8	0.0	1.5
<i>Polypogon monspeliensis</i>	50.0	0.4	0.0	0.8
<i>Schoenoplectus acutus</i>	50.0	0.3	0.0	0.5
<i>Carex praegracilis</i>	50.0	0.1	0.0	0.3
<i>Hordeum jubatum</i>	50.0	0.1	0.0	0.3
<i>Rumex crispus</i>	50.0	0.1	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is seasonally moist to perennially flooded flats. At the time of sampling in July, plots ranged from moist to flooded. Mean WIS is 4.5, the plots ranging from 25-75% wetter than FACW. At Double O, the association overlaps primarily with the *Cicuta douglasii* - *Carex nebrascensis*, *Eleocharis palustris* - *Juncus balticus*, and *Triglochin maritima* associations (Figure 2).

Vegetation: Thirteen species were observed in the two plots sampled (Table 2), but most occur with low frequency and cover. Up to 5 percent of the surface is bare ground. *Alopecurus aequalis* is the primary species with an average cover of 75 percent, ranging to 98 percent. *Juncus balticus* and *Eleocharis palustris* are the second most important components, occurring at low frequency and cover up to only 13 percent. The exotic forage species *Alopecurus pratensis* occurs with up to 11 percent cover, and is probably close to the limit of its tolerance to moisture and alkalinity. Alkaline components are indicated by *Polypogon monspeliensis*, *Schoenoplectus acutus*, and *Triglochin maritima*.

Ecology and condition: *Alopecurus aequalis* occurs across a broad spectrum of fresh to slightly brackish wetlands across Oregon, and is considered a weedy native increaser in some parts of its range (Carsey et al. 2003). *Potentilla anserina* is also a weedy native increaser. These species are good indicators of seasonally flooded flats with low cover of competing vegetation, and they colonize mud flats as water levels recede.

Classification: The *Alopecurus aequalis* - *Juncus balticus* association has yet to be included in the IVC. It closely approximates and is probably the same as the *Alopecurus aequalis* Herbaceous Vegetation of Carsey et al. (2003).

Conservation: Carsey et al. (2003) assigned a rank of G3G4 to this association, based on their knowledge of its distribution, but its status in Oregon is unknown. Threats are unknown at this point.



Figure 4. *Alopecurus aequalis* - *Juncus balticus* association, Double O.

Alopecurus pratensis - *Potentilla anserina* Association

Meadow foxtail - silverweed

Classification:

IVC: provisional

ORBIC rank: GUSU

Plots sampled at MNWR: 1

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Alopecurus pratensis</i>	100.0	56.3	56.3	56.3
Bare/ litter	100.0	21.3	21.3	21.3
<i>Potentilla anserina</i>	100.0	16.3	16.3	16.3
<i>Juncus balticus</i>	100.0	2.3	2.3	2.3
<i>Eleocharis palustris</i>	100.0	1.3	1.3	1.3
<i>Carex praegracilis</i>	100.0	0.8	0.8	0.8
<i>Lepidium latifolium</i>	100.0	0.8	0.8	0.8
<i>Glaux maritima</i>	100.0	0.3	0.3	0.3
<i>Poa secunda</i>	100.0	0.3	0.3	0.3

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist

Soils: silty clay loam

Habitat, uses, hydrology: Habitat at Double O is seasonally moist meadow. *Alopecurus pratensis* is an exotic, invasive grass that is a moderately to highly important forage species throughout the region. In the single plot sampled at Double O in July, the soil was moist. Mean WIS is 3.9, slightly drier than FACW. Hydrologically, the association overlaps with the *Carex praegracilis* - *Juncus balticus*, *Distichlis spicata* - *Amphiscirpus nevadensis*, *Distichlis spicata* - *Nitrophila occidentalis*, *Juncus balticus* - *Glaux maritima*, *Leymus triticoides* - *Juncus balticus*, and *Spartina gracilis* associations, but its mean value is closest to the last two associations (Figures 2 and 3). Despite the similarities in hydrology and the wide hydrological amplitude of *Alopecurus pratensis*, only one plot was identified at Double O.

Vegetation: Only eight species were recorded at the single plot sampled at Double O (Table 2). Not much can be said about this vegetation type because of the small sample size. The plot was separated from the *Alopecurus pratensis* association because of its slightly wetter, alkaline, and more sparse vegetation. *Potentilla anserina* and *Glaux maritima* made the WIS score slightly wetter, and *Potentilla anserina* was chosen as a codominant name to distinguish this type from the ruderal *Alopecurus pratensis* association that is widespread elsewhere at MNWR. *Potentilla anserina* is a good indicator of seasonally flooded flats with low cover of competing vegetation, and it colonizes mud flats as water levels recede. An alkaline component is indicated by *Glaux maritima* and *Poa secunda*.

Ecology and condition: *Alopecurus pratensis* is viable across a broad spectrum of native plant associations at MNWR, but was not sampled widely at Double O. Its overlapping mean WIS value with six other associations at Double O indicates its potential versatility in wetter and more alkaline settings.

Classification: The *Alopecurus pratensis* - *Potentilla anserina* association has not been included in the IVC. Presumably it is a facies of the *Alopecurus pratensis* Western Ruderal Herbaceous Vegetation that is currently included in the IVC from previous work done at MNWR in 2012-2013.

Conservation: *Alopecurus pratensis* is a threat to riparian and wetland areas throughout the region because it spreads rapidly and replaces native vegetation (Christy 2014). Fire, herbicides, prolonged inundation during the growing season, and excavation of root mats have been used in local applications, but these treatments are too expensive to apply at a landscape scale.



Figure 5. *Alopecurus pratensis* - *Potentilla anserina* association, Double O.

Carex praegracilis - *Juncus balticus* Association

Clustered field sedge - Baltic rush

Classification:

IVC: provisional

ORBIC rank: GUSU

Plots sampled at MNWR: 13

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Carex praegracilis</i>	100.0	24.5	1.5	48.8
Bare/ litter	100.0	19.2	2.8	54.5
<i>Juncus balticus</i>	100.0	12.5	1.0	23.8
<i>Potentilla anserina</i>	66.7	6.5	0.0	21.3
<i>Triglochin maritima</i>	66.7	3.8	0.0	30.0
<i>Lycopus asper</i>	66.7	1.3	0.0	6.5
<i>Schoenoplectus americanus</i>	66.7	0.8	0.0	5.3
<i>Leymus triticoides</i>	50.0	1.9	0.0	12.0
<i>Pyrocoma lanceolata</i>	50.0	1.0	0.0	4.8
<i>Glaux maritima</i>	41.7	4.8	0.0	18.8
<i>Senecio hydrophilus</i>	41.7	0.6	0.0	4.8
<i>Cicuta douglasii</i>	41.7	0.5	0.0	4.8
<i>Calamagrostis stricta</i>	41.7	0.3	0.0	1.5
<i>Hordeum jubatum</i>	41.7	0.2	0.0	1.3
<i>Alopecurus aequalis</i>	33.3	2.6	0.0	23.8
<i>Lepidium latifolium</i>	33.3	2.6	0.0	26.3
<i>Agrostis gigantea</i>	33.3	1.9	0.0	21.3
<i>Eleocharis palustris</i>	33.3	1.0	0.0	10.8
<i>Distichlis spicata</i>	33.3	0.7	0.0	6.5
<i>Ranunculus cymbalaria</i>	33.3	0.1	0.0	0.5

Habitat, uses, hydrology:

Habitat at Double O is

seasonally moist flats. At the time of sampling in July, plots ranged from dry to flooded, with most being moist. Mean WIS is 4.1, the plots ranging from halfway between FAC and FACW, to halfway between FACW and OBL. Hydrologically, it overlaps with all named types except the wettest *Hippuris vulgaris* - *Triglochin maritima* association, but it is notable that most plots are FACW or wetter (Figures 2 and 3).

Vegetation: The *Carex praegracilis* - *Juncus balticus* association is the most diverse wet meadow community sampled on the Double O. With 53 species recorded in the 13 plots sampled (Table 2), composition is highly variable and reflects both a history of disturbance and a broad ecological amplitude, ranging from moist sites to seasonally dry alkaline sites. A similar pattern was seen in the *Carex praegracilis* association at the south end of MNWR, but at Double O *Carex praegracilis* is significantly more sparse, with an average cover of 25 percent and ranging up to to 49 percent. *Juncus balticus* is present in all plots, with average cover slightly higher than in the *Carex praegracilis* association. The *Carex praegracilis* - *Juncus balticus* association is distinguished from preceding by a greater complement of wetland species (e.g., *Alopecurus aequalis*, *Cicuta douglasii*, *Lycopus asper*), alkaline species (*Distichlis spicata*, *Glaux maritima*, *Schoenoplectus americanus*, *Triglochin maritima*), and the native increaser *Potentilla anserina*. Although frequency of exotic *Lepidium latifolium* and *Agrostis gigantea* is only 33 percent, they constituted 21 to 26 percent cover in some stands, which is problematic in the case of *Lepidium latifolium* because of its invasive tendencies.

Ecology and condition: Many of the dry soils had a crust composed of alkali salts that precipitate when the water table recedes. Presumably, this association is at a lower risk threshold than the *Carex praegracilis* association because of reduced competition from *Alopecurus pratensis* due to the greater alkalinity of the plots at Double O. Stands may be at risk from invasive *Lepidium latifolium*, which is plentiful in some plots.

Classification: The plots at MNWR are not consistent with the description in the IVC for the *Carex praegracilis* association.

Conservation: ORBIC has assigned a rank of GUSU to this association, based on the relative dearth of information about its distribution, abundance, and threats. Most occurrences are probably privately owned and difficult to protect.

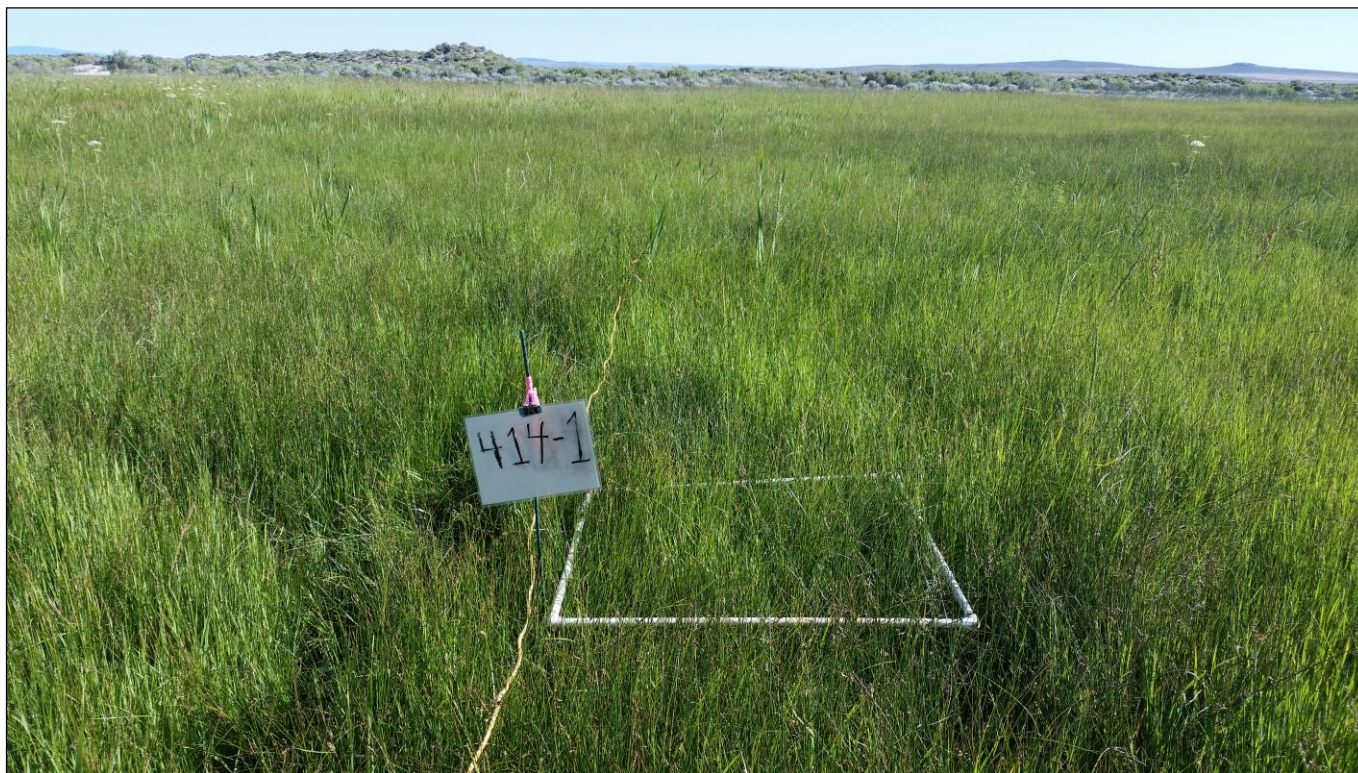


Figure 6. *Carex praegracilis* - *Juncus balticus* association, Double O.

Cicuta douglasii - *Carex nebrascensis* Association

Douglas water hemlock - Nebraska sedge

Classification:

IVC: provisional

ORBIC rank: GUSU

Plots sampled at MNWR: 1

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Cicuta douglasii</i>	100.0	23.3	23.3	23.3
<i>Carex nebrascensis</i>	100.0	20.8	20.8	20.8
<i>Juncus balticus</i>	100.0	14.0	14.0	14.0
<i>Agrostis gigantea</i>	100.0	9.8	9.8	9.8
Bare/ litter	100.0	9.0	9.0	9.0
<i>Trifolium wormskioldii</i>	100.0	7.0	7.0	7.0
<i>Carex praegracilis</i>	100.0	3.3	3.3	3.3
<i>Carex pellita</i>	100.0	2.5	2.5	2.5
<i>Mimulus guttatus</i>	100.0	2.0	2.0	2.0
<i>Senecio hydrophilus</i>	100.0	1.3	1.3	1.3

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: perennially moist to flooded

Soils: silty clay loam

Habitat, uses, hydrology: Habitat at Double O is saturated flats near springs. Only one plot was sampled at Double O. This type is somewhat wetter and more alkaline than the *Carex nebrascensis* association at the south end of MNWR. The association is of medium height, on soils saturated by discharge from springs. When dry enough, stands historically may have been grazed and cut for hay, but *Cicuta douglasii* is notoriously toxic to both humans and livestock (USDA Agricultural Research Service 2006). At the time of sampling at Double O in July, the water table was at the surface, the soils saturated. Mean WIS is 4.4, midway between FACW and OBL, slightly wetter than the *Carex nebrascensis* association. Hydrologically, it overlaps with the *Alopecurus aequalis* - *Juncus balticus*, *Eleocharis palustris* - *Juncus balticus*, and *Triglochin maritima* associations (Figure 2).

Vegetation: The single plot sampled was moderately diverse, with 25 species recorded (Table 2). *Cicuta douglasii* and *Carex nebrascensis* are codominant, with cover averaging 20 and 23 percent, respectively, and ranging from 20 to 23 percent. *Juncus balticus* is the next most common species, with 14 percent cover, while the remaining species have less than 10 percent cover. *Agrostis gigantea* is the only exotic species present. *Cicuta douglasii* was not recorded in any plots at the south end of MNWR. *Carex praegracilis* indicates some alkaline influence not present in the *Carex nebrascensis* association.

Ecology and condition: Little is known about the ecology of this vegetation type. The dense root mass of *Carex nebrascensis* makes it resistant to soil compaction and erosion, and the species is widely used in restoration work (Tilley et al. 2012), but the wetter soil makes it more vulnerable to damage from livestock. *Cicuta douglasii* is an indicator of perennially wet soils in both fresh and alkaline wetlands (Christy 2005; Lichvar et al. 2016).

Classification: The plots at MNWR are not consistent with the description in the IVC for the *Carex nebrascensis* association.

Conservation: ORBIC has assigned a rank of GUSU to this association, based on the relative dearth of information about its distribution, abundance, and threats. Most occurrences are probably privately owned and difficult to protect.



Figure 7. *Cicuta douglasii* - *Carex nebrascensis* association, Double O.

Distichlis spicata - *Amphiscirpus nevadensis* Association

Inland saltgrass - Nevada clubrush

Classification:

IVC: *Distichlis spicata* - (*Scirpus nevadensis*) Herbaceous
Vegetation

ORBIC rank: G4S3

Plots sampled at MNWR: 11

Species	Freq	Percent cover		
		Ave	Min	Max
Bare/ litter	100.0	34.8	6.0	60.0
<i>Amphiscirpus nevadensis</i>	100.0	29.7	14.3	48.8
<i>Distichlis spicata</i>	100.0	15.8	1.0	55.0
<i>Triglochin maritima</i>	90.9	1.1	0.0	3.3
<i>Nitrophila occidentalis</i>	81.8	6.3	0.0	24.0
<i>Pyrrocoma lanceolata</i>	54.5	1.7	0.0	12.5
<i>Spartina gracilis</i>	45.5	3.6	0.0	18.5
<i>Chloropyron maritimum</i>	45.5	2.6	0.0	22.5
<i>Juncus balticus</i>	36.4	0.4	0.0	1.8
<i>Carex praegracilis</i>	18.2	0.2	0.0	1.8

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to perennially flooded

Soils: silty clay loam

Habitat, uses, hydrology: Habitat at Double O is well to poorly drained alkaline flats and depressions. Hummocks and vernal pools are present in some plots. *Distichlis spicata* can provide valuable late-season forage (Skaradek and Miller 2010). Sites have low productivity and are not used for haying. At Double O, stands were only sampled in intermittently to seasonally moist meadow, avoiding adjoining stands of *Leymus cinereus* and *Sarcobatus vermicularis*. At the time of sampling at Double O in July, plots ranged from dry to moist. Mean WIS is 4.1, with plots ranging from 25% drier to wetter than FACW. Hydrologically, it overlaps the alkaline phases of the *Carex praegracilis* - *Juncus balticus* and *Juncus balticus* - *Glaux maritima* associations, but it is notable that most plots are FACW or wetter (Figures 2 and 3).

Vegetation: Species composition is moderately diverse in this association, with 26 species recorded in the 11 plots sampled (Table 2). *Amphiscirpus nevadensis* (= *Scirpus nevadensis*) and *Distichlis spicata* are more or less codominant, with cover averaging 16 to 30 percent and ranging from 1 to 55 percent. Vegetation is of moderate height in mesic plots, but only ankle high on highly sodic sites. Plots average 35 percent bare ground composed of a salt crust, which ranges from 6 to 60 percent cover. Secondary but frequent species are all alkaline indicators, including *Carex praegracilis*, *Chloropyron maritimum*, *Nitrophila occidentalis*, *Spartina gracilis*, and *Triglochin maritima*. Vegetation is of moderate height, but is dwarfed in very saline habitats. Stands are adjacent to stands of *Leymus cinereus* and *Sarcobatus vermiculatus* that occupy slightly higher ground.

Ecology and condition: Both *Distichlis spicata* and *Amphiscirpus nevadensis* are strongly rhizomatous, tolerant of moderate grazing, and their roots resist trampling. If grazed heavily, *Distichlis spicata* will decline and may be replaced by less desirable warm-season grasses such as *Hordeum jubatum* (Costello 1944, Jones and Walford 1995). The plots at Double O are too alkaline for either *Alopecurus pratensis* or *Phalaris arundinacea*, so these species most likely will never be competitive in this habitat, and few threats are thought to exist. Ground squirrels created mounding in one of the plots.

Classification: The plots at MNWR are consistent with the description in the IVC, although the IVC concept has more bare ground, more *Amphiscirpus* at least in depressions, and less *Distichlis*. These differences do not warrant a new name for the plots at Double O.

Conservation: ORBIC has assigned a rank of G4S3 to this association, based on the high number of occurrences rangewide. Threats are limited at this point.



Figure 8. *Distichlis spicata* - *Amphiscirpus nevadensis* association on mesic site, Double O.



Figure 9. *Distichlis spicata* - *Amphiscirpus nevadensis* association with sparse cover, Double O.

Distichlis spicata - *Nitrophila occidentalis* Association

Inland saltgrass - niterwort

Classification:

IVC: provisional

ORBIC rank: G4S3

Plots sampled at MNWR: 12

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to perennially flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Distichlis spicata</i>	100.0	38.5	1.0	73.8
Bare/ litter	100.0	36.8	5.0	95.0
<i>Nitrophila occidentalis</i>	75.0	7.8	0.0	51.3
<i>Juncus balticus</i>	33.3	2.6	0.0	24.3
<i>Leymus triticoides</i>	25.0	3.3	0.0	33.3
<i>Chloropyron maritimum</i>	25.0	1.6	0.0	18.3
<i>Amphiscirpus nevadensis</i>	25.0	1.3	0.0	10.8
<i>Suaeda calceoliformis</i>	25.0	1.0	0.0	8.5
<i>Triglochin maritima</i>	25.0	0.8	0.0	6.8
<i>Puccinellia nuttalliana</i>	16.7	2.3	0.0	27.5
<i>Carex praegracilis</i>	16.7	0.9	0.0	8.8
<i>Pyrocoma lanceolata</i>	16.7	0.7	0.0	8.5
<i>Pascopyrum smithii</i>	16.7	0.3	0.0	3.5
<i>Hordeum jubatum</i>	16.7	0.1	0.0	0.5
<i>Poa secunda</i>	16.7	0.0	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is alkaline flats and depressions. Salt deposits are usually present and conspicuous on the surface, which may be hummocky. Sites have low productivity and are not used for haying. At Double O, only herbaceous stands were sampled, avoiding adjacent stands of *Leymus cinereus* and *Sarcobatus vermiculatus*. When sampling was done at Double O in July, seven of the twelve plots were dry, four were moist at the surface, and one was saturated. Mean WIS is 3.6, ranging from FAC to about 25 percent wetter than FACW, with most plots clustered in the wetter half of FAC. This is the driest of the wetland communities sampled at Double O, and the one with the greatest amplitude for moisture.

Vegetation: Species diversity is relatively sparse in this association, with 21 species recorded in the 12 plots sampled (Table 2). Vegetation is of moderate height in mesic plots, but only ankle high on highly sodic sites. Bare salt-encrusted ground averages 37 percent, and ranges from 5 to 95 percent cover, the latter intergrading with barren flats. *Distichlis spicata* is the dominant species with average cover of 39 percent and ranging from 1 to 74 percent. *Nitrophila occidentalis* is the second most abundant species, and though not in every plot, it is included here in the name of the plant association to represent the extremely alkaline phase of the *Distichlis spicata* association. Secondary but sometimes abundant species are *Juncus balticus*, *Leymus triticoides*, and *Puccinellia nuttalliana*. Stands are adjacent to *Leymus cinereus* and *Sarcobatus vermiculatus* that occur on slightly higher ground.

Ecology and condition: Ecologically, this association is probably similar to the *Distichlis spicata* - *Amphiscirpus nevadensis* association and the *Sarcobatus vermiculatus* / *Nitrophila occidentalis* - *Suaeda moquinii* Shrubland of the IVC. They tolerate to moderate grazing, but much the *Distichlis spicata* - *Nitrophila occidentalis* association is drier and more alkaline. The low diversity is attributable to the limited number of plants adapted to the extreme soil and moisture conditions. This association is probably the least favorable for any of the exotic species at MNWR.

Classification: There is some similarity to the IVC *Sarcobatus vermiculatus* / *Nitrophila occidentalis* - *Suaeda moquinii* Shrubland, but plots at the Double O are wetter and lack shrubs.

Conservation: ORBIC has assigned a rank of G4S3 to this association, based on the high number of occurrences rangewide. Threats are limited at this point.



Figure 10. *Distichlis spicata* - *Nitrophila occidentalis* association on mesic site, Double O.



Figure 11. *Distichlis spicata* - *Nitrophila occidentalis* association with sparse cover, Double O.

Eleocharis palustris - *Juncus balticus* Association

Common spikerush - Baltic rush

Classification:

IVC: *Eleocharis palustris* - *Juncus balticus* Herbaceous
Vegetation

ORBIC rank: G2G4SU

Plots sampled at MNWR: 4

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to perennially flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Eleocharis palustris</i>	100.0	50.1	27.8	73.8
Bare/ litter	100.0	22.3	11.8	34.5
<i>Juncus balticus</i>	75.0	7.6	0.0	23.8
<i>Schoenoplectus americanus</i>	75.0	2.6	0.0	7.5
<i>Triglochin maritima</i>	75.0	1.1	0.0	3.3
<i>Alopecurus aequalis</i>	50.0	3.3	0.0	13.0
<i>Schoenoplectus acutus</i>	50.0	2.1	0.0	7.5
<i>Eleocharis rostellata</i>	50.0	1.4	0.0	4.3
<i>Lepidium latifolium</i>	25.0	3.9	0.0	15.5
<i>Hordeum jubatum</i>	25.0	0.6	0.0	2.5
<i>Veronica anagallis-aquatica</i>	25.0	0.4	0.0	1.8
<i>Typha</i>	25.0	0.4	0.0	1.5
<i>Lycopus asper</i>	25.0	0.3	0.0	1.0
<i>Calamagrostis stricta</i>	25.0	0.2	0.0	0.8
<i>Cicuta douglasii</i>	25.0	0.2	0.0	0.8
<i>Senecio hydrophilus</i>	25.0	0.2	0.0	0.8
<i>Carex praegracilis</i>	25.0	0.1	0.0	0.5
<i>Alopecurus pratensis</i>	25.0	0.1	0.0	0.3
<i>Rumex crispus</i>	25.0	0.1	0.0	0.3
<i>Sium suave</i>	25.0	0.1	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is in seasonally moist to perennially flooded marshes.

Eleocharis palustris is a native spikerush of moderate forage value (Kovalchik and Clausnitzer 2004). At the time of sampling at Double O in July, two stands had standing water, one had saturated soil, and one had moist soil. Mean WIS is 4.6, ranging between 25 and 75 percent wetter than FACW. Hydrologically, it overlaps with the *Alopecurus aequalis* - *Juncus balticus*, *Cicuta douglasii* - *Carex nebrascensis*, and *Triglochin maritima* associations (Figures 2 and 3).

Vegetation: Nineteen species were recorded in the four plots sampled at Double O (Table 2). *Eleocharis palustris* is the primary species with an average cover of 50 percent, and ranging from 28 to 74 percent cover. Although not present in all plots, *Juncus balticus* can have up to 24 percent cover. Patches of *Alopecurus aequalis* covered up to 16 percent in two plots. Alkalinity is indicated by the presence of *Carex praegracilis*, *Eleocharis rostellata*, *Schoenoplectus americanus*, and *Triglochin maritima*. Most remaining associated species occur with low frequency and cover, and include a mix of freshwater species. Exotic *Lepidium latifolium* and *Alopecurus pratensis* occur in 25 percent of the plots. *Lepidium latifolium* is potentially problematic because of its invasive tendencies, averaging 4 percent cover but ranging to 16 percent in one plot.

Ecology and condition: *Eleocharis palustris* is mostly restricted to the edges and interiors of marshes, where fluctuating water levels enable it to thrive as an early seral species. At Double O, wetter stands appear to be associated with *Schoenoplectus americanus*, *Schoenoplectus acutus*, and *Typha (angustifolia, latifolia)* which outcompete *Eleocharis* on wetter sites. These competing species are slightly different from the *Sparganium emersum* and *Sparganium eurycarpum* that compete with the *Eleocharis palustris* association described in Christy (2014). Soil pH for *Eleocharis palustris* ranges from 4.0 to 8.0, which would seem to accommodate alkaline species seen at the Double O (Hauser 2006).

Classification: The plots at Double O are not consistent with the description of the *Eleocharis palustris* association in the IVC (e.g., Carsey et al. 2003). Although this association has the same mean WIS as the *Eleocharis palustris* association described in Christy (2014), it is segregated here as the IVC *Eleocharis palustris* - *Juncus balticus* Herbaceous Vegetation association described from Utah and Wyoming. This is done to distinguish its more alkaline component indicated by the presence of *Carex praegracilis*, *Eleocharis rostellata*, *Schoenoplectus americanus*, and *Triglochin maritima*. It is also similar to the IVC *Schoenoplectus americanus* - *Eleocharis palustris* Herbaceous Vegetation from the Rocky Mountain states and potentially Nevada, but *Schoenoplectus americanus* has much lower cover at Double O.

Conservation: ORBIC has assigned a rank of G2G4SU to this association, based on the relative dearth of information about its distribution, abundance, and threats in the state.

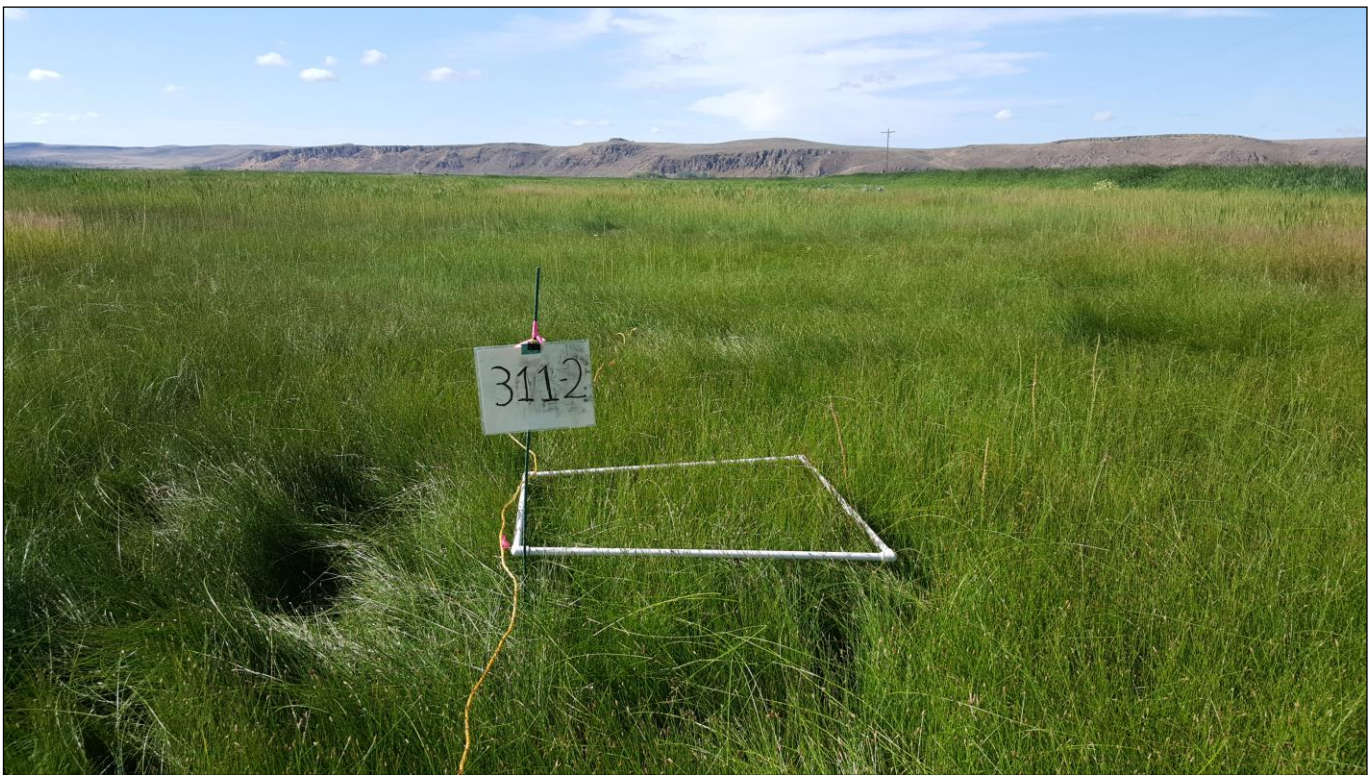


Figure 12. *Eleocharis palustris* - *Juncus balticus* association, Double O.

Eleocharis rostellata Association

Walking sedge

Classification:

IVC: *Eleocharis rostellata* Herbaceous Vegetation

ORBIC rank: G3SU

Plots sampled at MNWR: 1

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Eleocharis rostellata</i>	100.0	32.5	32.5	32.5
Bare/ litter	100.0	26.8	26.8	26.8
<i>Juncus balticus</i>	100.0	21.3	21.3	21.3
<i>Carex praegracilis</i>	100.0	11.3	11.3	11.3
<i>Spartina gracilis</i>	100.0	3.3	3.3	3.3
<i>Pyrrocoma lanceolata</i>	100.0	2.5	2.5	2.5
<i>Amphiscirpus nevadensis</i>	100.0	0.5	0.5	0.5
<i>Leymus triticoides</i>	100.0	0.5	0.5	0.5
<i>Triglochin maritima</i>	100.0	0.5	0.5	0.5

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to perennially flooded

Soils: silty clay loam

Habitat, uses, hydrology: Habitat at the single plot sampled at Double O is a moist flat, located between flooded *Typha* marsh and higher ground with *Sarcobatus vermiculatus*. Seeds of *Eleocharis rostellata* are eaten by waterfowl, but it has poor forage value for livestock (Carsey et al. 2003). At the time of sampling on at Double O in July, the single stand sampled was moist at the surface. Mean WIS is 4.1, slightly wetter than FACW. Hydrologically, the single plot overlaps with the *Carex praegracilis* - *Juncus balticus*, *Distichlis spicata* - *Amphiscirpus nevadensis*, *Distichlis spicata* - *Nitrophila occidentalis* associations, *Juncus balticus* - *Glaux maritima*, *Schoenoplectus americanus*, and *Spartina gracilis* associations (Figures 2).

Vegetation: Only eight species were recorded in the single plot sampled (Table 2). *Eleocharis rostellata* is the primary species with a cover of 33 percent. *Juncus balticus* and *Carex praegracilis* were secondary species with covers of 27 and 21 percent, respectively. Bare ground had a cover of 27 percent, but presence of a salt crust was not recorded. In addition to *Eleocharis rostellata*, both *Amphiscirpus nevadensis* and *Spartina gracilis* also indicate alkalinity.

Ecology and condition: *Eleocharis rostellata* is often associated with warm or mineral springs with calcareous or alkaline water (Jankovsky-Jones et al. 2001; Carsey et al. 2003). Stands are often patchy and irregular in size, and restricted to saturated ground, and in most states from which it has been reported consider it of conservation concern.

Classification: The plot at Double O is consistent with the description in the IVC. Both dense monotypic and sparse stands have been reported (Jankovsky-Jones et al. 2001; Carsey et al. 2003).

Conservation: ORBIC has assigned a rank of G3SU to this association, based on the relative dearth of information about its distribution, abundance, and threats. It is surely undersampled in Oregon, and has no doubt been confused with *Eleocharis palustris*. Disturbance and hydrologic alterations are cited as threats (Jankovsky-Jones et al. 2001; Carsey et al. 2003).

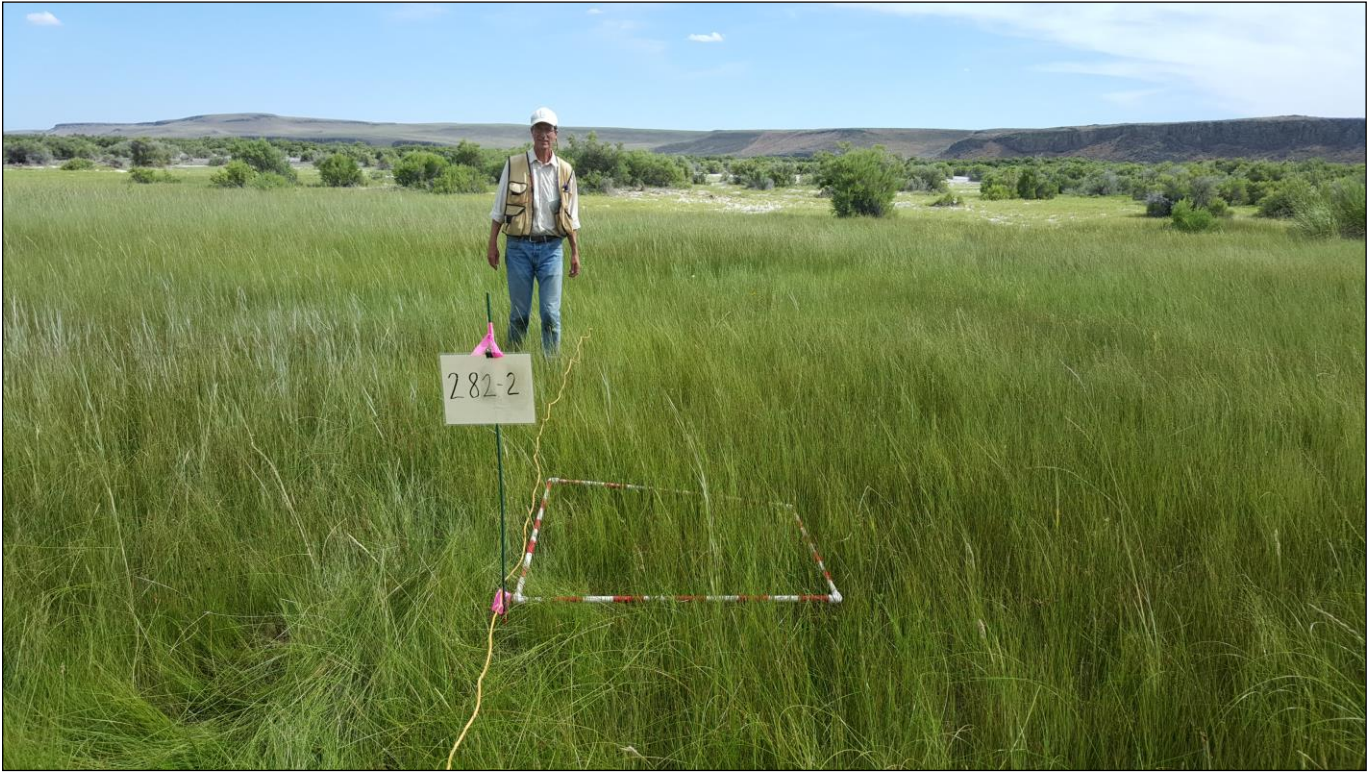


Figure 13. *Eleocharis rostellata* association, Double O.

Hippuris vulgaris - *Triglochin maritima* Association

Mare's tail - seaside arrowgrass

Classification:

IVC: provisional

ORBIC rank: G3SU

Plots sampled at MNWR: 4

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: perennially moist to perennially flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Hippuris vulgaris</i>	100.0	28.7	4.5	53.8
Bare/ litter	100.0	16.0	5.8	21.3
<i>Triglochin maritima</i>	100.0	15.8	0.3	45.0
<i>Sparganium eurycarpum</i>	75.0	9.8	0.0	19.3
<i>Typha latifolia</i>	75.0	3.0	0.0	7.0
<i>Juncus balticus</i>	75.0	2.6	0.0	7.0
<i>Sagittaria latifolia</i>	75.0	0.5	0.0	0.8
<i>Schoenoplectus americanus</i>	50.0	3.4	0.0	12.5
<i>Alisma triviale</i>	50.0	2.1	0.0	4.5
<i>Cicuta douglasii</i>	50.0	1.2	0.0	4.0
<i>Alisma</i>	50.0	0.4	0.0	1.3
<i>Eleocharis palustris</i>	50.0	0.4	0.0	1.3
<i>Carex pellita</i>	50.0	0.2	0.0	0.5
<i>Beckmannia syzigachne</i>	50.0	0.1	0.0	0.3
<i>Carex nebrascensis</i>	50.0	0.1	0.0	0.3
<i>Polygonum monspeliensis</i>	50.0	0.1	0.0	0.3
<i>Senecio hydrophilus</i>	50.0	0.1	0.0	0.3
<i>Sium suave</i>	50.0	0.1	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is saturated to flooded flats hydrated by springs. Stands seen elsewhere occur in the littoral zone between deeper marsh or open water and seasonally wet meadow (Christy et al. 2001). Stands are usually flooded until at least midsummer. In general, these sites are too wet to be of forage value to livestock. At the time of sampling at Double O in July, the soil surface was saturated to flooded. Mean WIS is 4.8, very close to OBL, the wettest of any plant associations sampled at Double O, and with no hydrology overlapping other associations (Figures 2 and 3).

Vegetation: Twenty-six species were recorded from the 4 plots sampled at Double O (Table 2), composed mostly of native wetland species. *Hippuris vulgaris* is the primary species, with an average cover of 29 percent and ranging from 5 to 54 percent. *Triglochin maritima* is codominant, with an average cover of 16 percent and ranging from less than 1 to 45 percent. Bare ground or standing water averages 16 percent and ranges from 6 to 21 percent. The remaining species occur at medium to low frequencies and cover, except for *Schoenoplectus americanus* and *Sparganium eurycarpum* that can range to 13 and 19 percent cover, respectively. An aquatic to seasonally emergent component is indicated by *Alisma triviale*, *Beckmannia syzigachne*, *Cicuta douglasii*, *Hippuris vulgaris*, *Sagittaria latifolia*, *Senecio hydrophilus*, and *Sium suave*, and *Typha latifolia*. An alkaline component is indicated by *Bolboschoenus maritimus*, *Polygonum monspeliensis*, *Triglochin maritima*, and *Schoenoplectus americanus*.

Ecology and condition: The *Hippuris vulgaris* - *Triglochin maritima* association is transitional to deeper marsh associations that were not sampled at Double O, primarily the *Typha* (*angustifolia*, *latifolia*) and *Sparganium eurycarpum* associations. These sites receive heavy use by amphibians and invertebrates for breeding and feeding. Water often becomes stagnant and hot in summer. Stands are too wet to support invasive *Lepidium latifolium*.

Classification: The plots sampled at Double O differ from the IVC's *Hippuris vulgaris* Herbaceous Vegetation association, which based on freshwater stands in montane and coastal wetlands. *Triglochin*

maritima is recognized here as a codominant species, representing an alkaline element that segregates the freshwater variant from those at Double O and elsewhere in the arid west.

Conservation: ORBIC assigned a rank of G3SU to this association. Presumably it is fairly widespread but undersampled in the arid west. Little information is available about its distribution, abundance, and threats in Oregon.



Figure 14. *Hippuris vulgaris* - *Triglochin maritima* association, Double O.

Juncus balticus - *Glaux maritima* Association

Baltic rush - sea milkwort

Classification:

IVC: *Glaux maritima* Herbaceous Vegetation

ORBIC rank: G3SU

Plots sampled at MNWR: 12

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
Bare/ litter	100.0	14.0	3.3	41.8
<i>Juncus balticus</i>	100.0	4.0	0.3	16.3
<i>Glaux maritima</i>	91.7	29.3	0.0	70.0
<i>Potentilla anserina</i>	91.7	24.8	0.0	58.8
<i>Poa secunda</i>	75.0	2.4	0.0	16.3
<i>Carex praegracilis</i>	66.7	6.0	0.0	16.8
<i>Chloropyron maritimum</i>	66.7	0.9	0.0	5.5
<i>Triglochin maritima</i>	58.3	1.7	0.0	10.3
<i>Schoenoplectus americanus</i>	50.0	1.5	0.0	12.0
<i>Distichlis spicata</i>	50.0	1.3	0.0	10.3
<i>Pyrrocoma lanceolata</i>	41.7	1.2	0.0	4.0
<i>Castilleja minor</i>	41.7	0.2	0.0	0.8
<i>Lycopus asper</i>	33.3	0.5	0.0	3.8
<i>Amphiscirpus nevadensis</i>	33.3	0.3	0.0	2.5
<i>Hordeum jubatum</i>	33.3	0.3	0.0	2.3
<i>Eleocharis palustris</i>	25.0	3.1	0.0	30.0
<i>Muhlenbergia asperifolia</i>	25.0	1.0	0.0	11.0
<i>Senecio hydrophilus</i>	25.0	0.5	0.0	5.3
<i>Polypogon monspeliensis</i>	25.0	0.2	0.0	1.0
<i>Zeltnera exaltata</i>	25.0	0.2	0.0	1.0

Habitat, uses, hydrology: Habitat at Double O is flat to hummocky. Depending on hydrology, stands can be tall or short. At the time of sampling at Double O in July, plots were dry to moist. Mean WIS is 4.1, slightly wetter than FACW. Hydrologically, it overlaps with the *Carex praegracilis* - *Juncus balticus*, *Distichlis spicata* - *Amphiscirpus nevadensis*, *Distichlis spicata* - *Nitrophila occidentalis*, *Eleocharis rostellata*, *Leymus triticoides* - *Juncus balticus*, *Schoenoplectus americanus*, and *Spartina gracilis* associations (Figures 2 and 3).

Vegetation: Fifty-two species were recorded in the 12 plots sampled at Double O (Table 2). *Juncus balticus* has the highest frequency of any species, but an average cover of only 4 percent, ranging to 16 percent. In contrast, *Glaux maritima* and *Potentilla anserina* are present in 92 percent of the plots, with average covers of 29 and 25 percent, but ranging to 70 and 58 percent, respectively. *Eleocharis palustris* occurs with up to 30 percent cover. Almost all other species are good indicators of alkaline conditions. In low-stature stands, *Potentilla anserina* is particularly conspicuous, while *Glaux maritima* is present but often inconspicuous.

Ecology and condition: The *Juncus balticus* - *Glaux maritima* association occurs over a moderately broad hydrology, from 50% wetter than FAC to 25 percent wetter than FACW, though most plots fall in the latter category. Strong alkalinity is indicated by the many plants typical of these soils. Stands may be near both deeper marsh types and greasewood - saltgrass stands on more elevated sites.

Classification: Plots at Double O are consistent with the IVC's *Glaux maritima* Herbaceous Vegetation. *Juncus balticus* is added to the name here because it is codominant at Double O as well as in other publications (e.g., Carsey et al. 2003), although cover of *Juncus balticus* is lower at Double O than reported elsewhere. Use of just *Glaux maritima* in the name of the association is somewhat misleading because *Juncus balticus* is consistently present in plots, and because *Glaux maritima* may not be particularly conspicuous in the stands.

Conservation: ORBIC assigned a rank of G3SU to this association. Presumably it is fairly widespread but undersampled in the arid west. Little information is available about its distribution, abundance, and threats in Oregon.

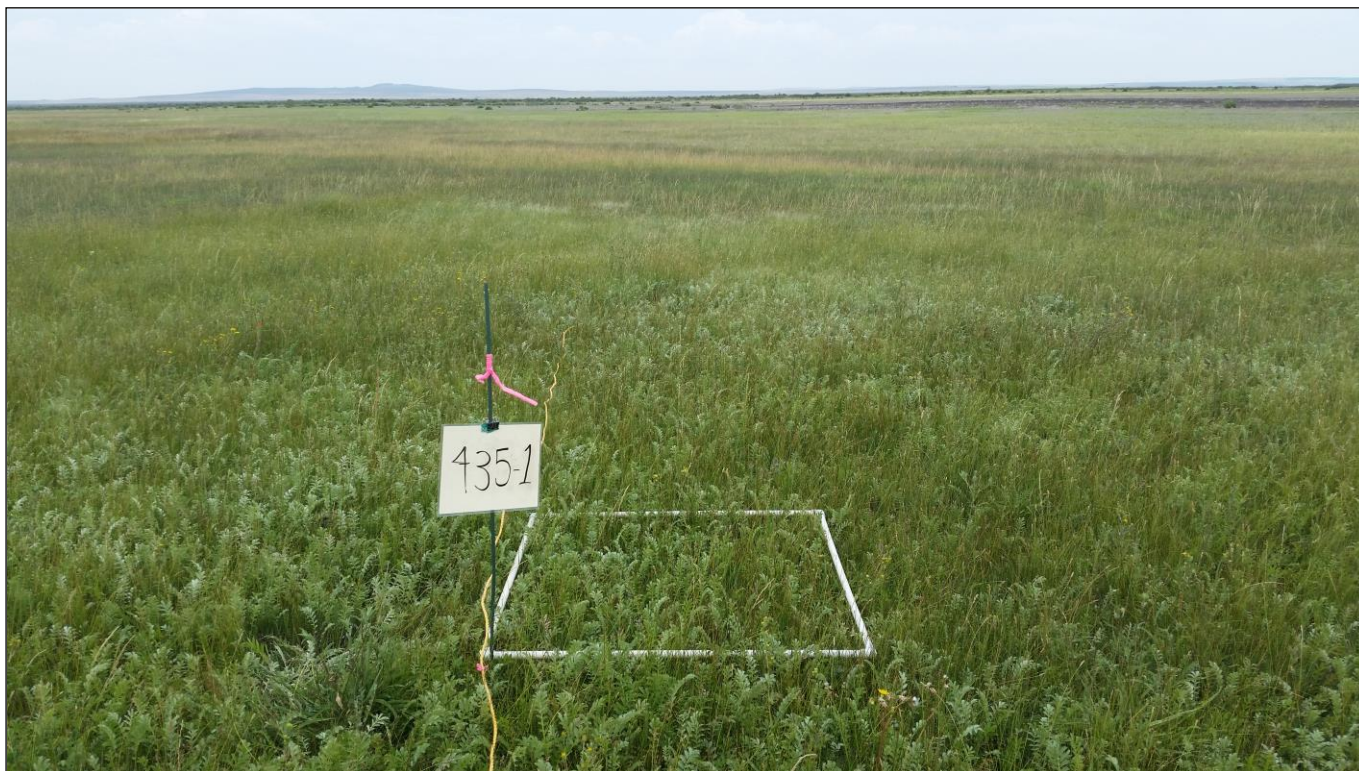


Figure 15. *Juncus balticus* - *Glaux maritima* association, short expression, Double O.

Leymus triticoides - *Juncus balticus* Association

Beardless wildrye - Baltic rush

Classification:

IVC: provisional

ORBIC rank: GUSU

Plots sampled at MNWR: 10

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally wet to moist.

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Leymus triticoides</i>	100.0	57.5	20.8	82.5
Bare/ litter	100.0	16.9	7.8	27.5
<i>Juncus balticus</i>	70.0	4.6	0.0	24.0
<i>Pyrrcoma lanceolata</i>	70.0	0.5	0.0	1.8
<i>Carex praegracilis</i>	60.0	8.7	0.0	35.8
<i>Lepidium latifolium</i>	60.0	1.2	0.0	4.3
<i>Alopecurus aequalis</i>	40.0	2.6	0.0	18.5
<i>Distichlis spicata</i>	40.0	2.3	0.0	8.0
<i>Glaux maritima</i>	40.0	0.3	0.0	1.0
<i>Schoenoplectus acutus</i>	40.0	0.2	0.0	0.8
<i>Carex pellita</i>	30.0	0.4	0.0	2.8
<i>Poa secunda</i>	30.0	0.1	0.0	0.3
<i>Potentilla anserina</i>	20.0	0.8	0.0	6.0
<i>Lycopus asper</i>	20.0	0.1	0.0	0.8
<i>Chenopodium album</i>	20.0	0.1	0.0	0.8
<i>Triglochin maritima</i>	20.0	0.1	0.0	0.8
Unknown	20.0	0.1	0.0	0.5
<i>Amphiscirpus nevadensis</i>	20.0	0.1	0.0	0.5
<i>Spartina gracilis</i>	20.0	0.1	0.0	0.5
<i>Muhlenbergia asperifolia</i>	20.0	0.1	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is

seasonally to perennially moist flats. At the time of sampling at Double O in July, 1 stand was saturated, 6 were moist, and 3 were dry. Mean WIS is 3.7, significantly wetter than the widespread *Leymus triticoides* association elsewhere on MNWR that has a mean WIS of 3.1. It has a broad hydrologic range, extending from FAC to slightly wetter than FACW, but most plots cluster closer to FACW than FAC.

Hydrologically, it overlaps with all associations recorded at Double O except for the wetter *Alopecurus aequalis* - *Juncus balticus*, *Cicuta douglasii* - *Carex nebrascensis*, *Eleocharis palustris* - *Juncus balticus*, *Hippuris vulgaris* - *Triglochin maritima*, and *Triglochin maritima* associations (Figures 2 and 3). The *Leymus triticoides* association is a drier vegetation type ranging from FAC to slightly wetter than FACW (Figure 2).

Vegetation: Twenty-nine species were recorded from the 10 plots sampled at Double O (Table 2).

Leymus triticoides is the primary species, with an average cover of 58 percent and ranging up to 83 percent. Vegetation in most stands is of moderate height, but one stand with saturated soil was shoulder height. *Juncus balticus* is the next most frequent species, with an average cover of only 5 percent but ranging up to 24 percent. Compared to the *Leymus triticoides* association, only two exotic species (*Cirsium arvense*, *Lepidium latifolium*) were recorded at Double O, although *Lepidium* occurs in 60 percent of the plots, but with low cover. Freshwater wetland indicators not present in the *Leymus triticoides* association include *Alopecurus aequalis*, *Lycopus asper*, *Lycopus asper*, and *Potentilla anserina*. Alkaline wetland indicators not present in the *Leymus triticoides* association include *Amphiscirpus nevadensis*, *Glaux maritima*, *Schoenoplectus acutus*, *Spartina gracilis*, and *Triglochin maritima*. Bare ground in the *Leymus triticoides* - *Juncus balticus* association is about half of what was recorded for the *Leymus triticoides* association.

Ecology and condition: Differences in species composition and extent of bare ground in the *Leymus triticoides* - *Juncus balticus* association and the *Leymus triticoides* association are presumably attributable to the effects of a higher water table and alkalinity at Double O.

Classification: The plots sampled at Double O differ from the *Leymus triticoides* - *Poa secunda* association in the IVC. They appear to be closer to the *Leymus triticoides* - *Juncus balticus* association described by Easterday and Mamone (1980) from the Warner Valley, although this type is currently not included in the IVC.

Conservation: ORBIC assigned a rank of G3SU to this association. Presumably it is fairly widespread but undersampled in the arid west. Little information is available about its distribution, abundance, and threats in Oregon.



Figure 16. *Leymus triticoides* - *Juncus balticus* association, Double O.

Schoenoplectus americanus Association

Three-square

Classification:

IVC: *Schoenoplectus americanus* Western Herbaceous
Vegetation

ORBIC rank: G3SU

Plots sampled at MNWR: 2

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
<i>Schoenoplectus americanus</i>	100.0	33.1	32.5	33.8
Bare/ litter	100.0	17.0	16.8	17.3
<i>Triglochin maritima</i>	100.0	7.3	6.0	8.5
<i>Distichlis spicata</i>	100.0	6.8	0.8	12.8
<i>Nitrophila occidentalis</i>	100.0	5.8	0.3	11.3
<i>Juncus balticus</i>	100.0	5.0	0.8	9.3
<i>Glaux maritima</i>	100.0	4.8	0.3	9.3
<i>Polypogon monspeliensis</i>	100.0	2.5	1.8	3.3
<i>Senecio hydrophilus</i>	100.0	0.4	0.3	0.5
<i>Bolboschoenus maritimus</i>	100.0	0.3	0.3	0.3
<i>Poa secunda</i>	50.0	7.3	0.0	14.5
<i>Eleocharis palustris</i>	50.0	6.3	0.0	12.5
<i>Carex praegracilis</i>	50.0	0.6	0.0	1.3
<i>Lepidium latifolium</i>	50.0	0.6	0.0	1.3
<i>Hordeum jubatum</i>	50.0	0.5	0.0	1.0
<i>Agoseris</i>	50.0	0.1	0.0	0.3
<i>Alopecurus aequalis</i>	50.0	0.1	0.0	0.3
<i>Lycopus asper</i>	50.0	0.1	0.0	0.3
<i>Pyrocoma lanceolata</i>	50.0	0.1	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is seasonally moist alkaline meadow. *Schoenoplectus americanus* is moderately palatable to livestock (Jankovsky-Jones 2001). At the time of sampling at Double O in July, the two plots sampled had moist soil. Mean WIS is 4.1, slightly wetter than FACW. Hydrologically, it overlaps with the *Carex praegracilis* - *Juncus balticus*, *Distichlis spicata* - *Amphiscirpus nevadensis*, *Distichlis spicata* - *Nitrophila occidentalis*, *Eleocharis rostellata*, *Juncus balticus* - *Glaux maritima*, *Leymus triticoides* - *Juncus balticus*, and *Spartina gracilis* associations (Figure 2).

Vegetation: Twenty-four species were seen in the two plots sampled (Table 2), but not much information can be extracted from the small sample size. *Schoenoplectus americanus* is the primary species with an average cover of 33 percent. Bare soil averages 17 percent cover. Many of the remaining species are indicators of alkaline wetlands: *Bolboschoenus maritimus*, *Distichlis spicata*, *Glaux maritima*, *Nitrophila occidentalis*, *Polypogon monspeliensis*, and *Triglochin maritima*. Vegetation is of moderate height, but *Schoenoplectus americanus* reportedly can reach as high as 9 feet (Jankovsky-Jones 2001). *Schoenoplectus pungens* looks very similar to *S. americanus* and may also be present in these stands. It is a known component of alkaline wetlands in eastern Oregon.

Ecology and condition: Stands of *Schoenoplectus americanus* at Double O are in good condition. They are sediment traps and have been used for in wetland restoration work because of their high seed production and drought tolerance. They are also used by wildlife for food and cover (Jankovsky-Jones 2001). *Lepidium latifolium* occurs in this association and is a potential problem.

Classification: Plots at Double O are consistent with the IVC's *Schoenoplectus americanus* Western Herbaceous Vegetation.

Conservation: ORBIC assigned a rank of G3SU to this association. Presumably it is fairly widespread but undersampled in the arid west. Little information is available about its distribution, abundance, and threats in Oregon.

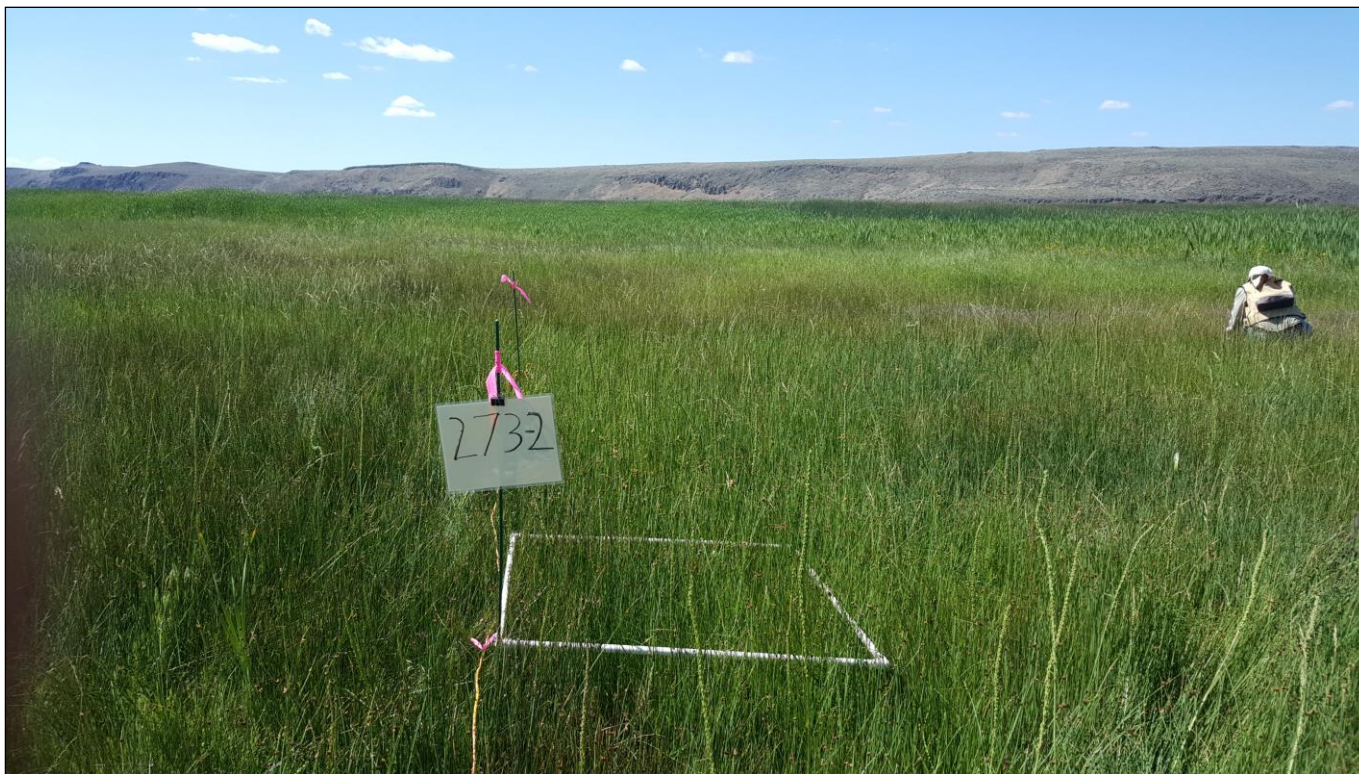


Figure 17. *Schoenoplectus americanus* association, Double O.

Spartina gracilis Association

Alkali cordgrass

Classification:

IVC: *Spartina gracilis* Herbaceous Vegetation.

ORBIC rank: GUSU

Plots sampled at MNWR: 4

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to saturated

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
Bare/ litter	100.0	32.3	17.3	55.3
<i>Spartina gracilis</i>	100.0	31.0	15.3	45.0
<i>Distichlis spicata</i>	100.0	15.4	0.3	33.3
<i>Nitrophila occidentalis</i>	100.0	3.6	0.3	10.5
<i>Amphiscirpus nevadensis</i>	75.0	6.8	0.0	15.8
<i>Triglochin maritima</i>	75.0	5.2	0.0	20.0
<i>Carex praegracilis</i>	75.0	1.6	0.0	2.8
<i>Pyrocoma lanceolata</i>	50.0	0.3	0.0	1.0
<i>Leymus triticoides</i>	25.0	1.6	0.0	6.5
<i>Chloropyron maritimum</i>	25.0	1.4	0.0	5.5
<i>Juncus balticus</i>	25.0	0.4	0.0	1.8
<i>Schoenoplectus americanus</i>	25.0	0.1	0.0	0.5
<i>Poa secunda</i>	25.0	0.1	0.0	0.3
<i>Pyrocoma racemosa</i>	25.0	0.1	0.0	0.3
<i>Thelypodium integrifolium</i>	25.0	0.1	0.0	0.3

Habitat, uses, hydrology: Habitat at Double O is seasonally moist to saturated flats. At the time of sampling at Double O in July, three of the four plots sampled were dry at the surface, and one was saturated. Mean WIS is 4.0, or FACW. Hydrologically, it overlaps with eight of the fourteen associations identified at Double O (Figures 2 and 3).

Vegetation: Fourteen species were recorded in the four plots sampled (Table 2). Low species diversity is typical for this association, but stands may be either dense or open (Carsey et al. 2003; Crawford 2003). *Spartina gracilis* is the primary species, with average cover of 32 percent, and ranging from 17 to 55 percent. *Distichlis spicata* and *Nitrophila occidentalis* are also present in all plots, the former with up to 33 percent cover. *Triglochin maritima* was present in three plots with up to 20 percent cover. Almost all other species present are indicators of alkaline soil. Bare, salt-encrusted soil is present in all plots, with an average cover of 32 percent, and ranging from 17 to 55 percent. Vegetation is mostly of low stature.

Ecology and condition: Little information is available on the ecology of the *Spartina gracilis* association, except for its ability to tolerate extreme alkali and recover from sedimentation (Carsey et al. 2003). Gopher mounds were common in the plots sampled at Double O. Stands reported from eastern Washington were only found in riparian areas (Crawford 2003).

Classification: Plots at Double O are consistent with the IVC's *Spartina gracilis* Herbaceous Vegetation. Although this association is included in the IVC, it is ranked GU because of its broad distribution throughout western North America, but lack of much plot documentation to identify regional variants with any certainty.

Conservation: ORBIC assigned a rank of GUSU to this association. Presumably it is fairly widespread but undersampled in the arid west. Little information is available about its distribution, abundance, and threats in Oregon.

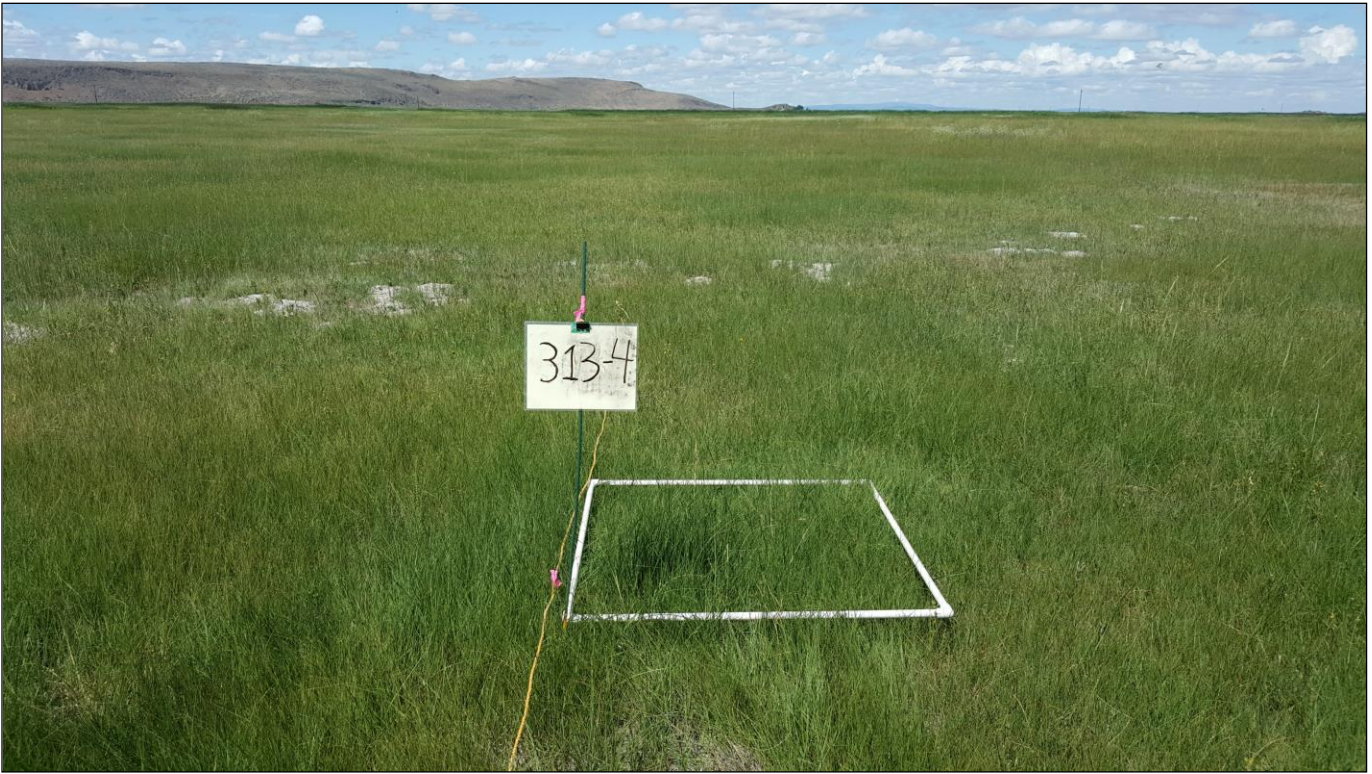


Figure 18. *Spartina gracilis* association, Double O.

***Triglochin maritima* Association**

Seaside arrowgrass

Classification:

IVC: *Triglochin maritima* Herbaceous Vegetation
Vegetation

ORBIC rank: GUSU

Plots sampled at MNWR: 1

Environment:

Elevation (ft): 4000-4200

Slope (deg): 0

Landform position: flats

Hydrology: seasonally moist to flooded

Soils: silty clay loam

Species	Freq	Percent cover		
		Ave	Min	Max
Bare/ litter	100.0	54.0	54.0	54.0
<i>Triglochin maritima</i>	100.0	30.0	30.0	30.0
<i>Juncus balticus</i>	100.0	12.3	12.3	12.3
<i>Schoenoplectus americanus</i>	100.0	1.5	1.5	1.5
<i>Polypogon monspeliensis</i>	100.0	0.8	0.8	0.8
<i>Pyrocoma lanceolata</i>	100.0	0.8	0.8	0.8
<i>Senecio hydrophilus</i>	100.0	0.8	0.8	0.8
<i>Eleocharis palustris</i>	100.0	0.5	0.5	0.5

Habitat, uses, hydrology: Habitat at Double O is seasonally flooded flats. When the single plot was sampled at Double O, the soil surface was moist. Mean WIS is 4.4, about half way between FACW and OBL. It overlaps primarily with the *Alopecurus aequalis* - *Juncus balticus* and *Eleocharis palustris* - *Juncus balticus* associations (Figure 2).

Vegetation: Only seven species were recorded in the single plot sampled at Double O (Table 2). With such a small sample size, not much information is available for this association. *Triglochin maritima* is the primary species, with an average cover of 54 percent. *Juncus balticus* is a secondary species with 12 percent, and the remaining species occur at low cover values. Bare ground had a cover of 54 percent. In addition to *Triglochin maritima*, *Polypogon monspeliensis*, *Pyrocoma lanceolata*, and *Schoenoplectus americanus* are all indicators of alkaline soil.

Ecology and condition: There is little information on the ecology of the *Triglochin maritima* association in the arid west. A distantly related type (*Triglochin maritimum* - *Triglochin palustre* Herbaceous Vegetation) from Colorado occurs on perennially-hydrated organic soils in calcareous peatlands (Carsey et al. 2003), and is remotely similar to a spring-fed fen at Sycan Marsh in Lake County, Oregon (Christy 2005).

Classification: Plots at Double O are consistent with the IVC's *Triglochin maritima* Herbaceous Vegetation. Although this association is included in the IVC, it is ranked GU because of its broad distribution throughout western North America, but lack of much plot documentation to identify regional variants with any certainty.

Conservation: ORBIC assigned a rank of GUSU to this association. Presumably it is fairly widespread but undersampled in the arid west. Little information is available about its distribution, abundance, and threats in Oregon.



Figure 19. *Triglochin maritima* association, Double O.

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APPENDIX 1. Plant taxa observed in plots in 2015, Double O Unit, with 2016 Wetland Indicator Status. n/a = Wetland Indicator Status not available.

Scientific Name	Common Name	Native/ Exotic	Acronym	Wetland Indicator Status
<i>Agoseris</i>	n/a	n/a	AGOSER	n/a
<i>Agrostis gigantea</i>	red top	E	AGRGIG	FACW
<i>Agrostis</i>	n/a	n/a	AGROST	n/a
<i>Agrostis stolonifera</i>	creeping bentgrass	E	AGRSTO	FACW
<i>Alisma</i>	n/a	n/a	ALISMA	n/a
<i>Alisma triviale</i>	American water plantain	N	ALITRI	OBL
<i>Alopecurus aequalis</i>	shortawn foxtail	N	ALOAEQ	OBL
<i>Alopecurus</i>	n/a	n/a	ALOPEC	n/a
<i>Alopecurus pratensis</i>	meadow foxtail	E	ALOPRA	FACW
<i>Amphiscirpus nevadensis</i>	Nevada clubrush	N	AMPNEV	OBL
Asteraceae	n/a	n/a	ASTERA	n/a
Bare/ litter	n/a	n/a	BARE	n/a
<i>Beckmannia syzigachne</i>	American sloughgrass	N	BECSYZ	OBL
<i>Bolboschoenus maritimus</i>	seacoast bulrush	N	BOLMARP	OBL
<i>Bromus tectorum</i>	cheatgrass	E	BROTEC	n/a
<i>Calamagrostis stricta</i>	northern reed grass	N	CALSTRI	FACW
<i>Carex</i>	n/a	n/a	CAREX	n/a
<i>Carex nebrascensis</i>	Nebraska sedge	N	CARNEB	OBL
<i>Carex pellita</i>	woolly sedge	N	CARPEL	OBL
<i>Carex praegracilis</i>	clustered field sedge	N	CARPRA2	FACW
<i>Castilleja minor</i>	seep paintbrush	N	CASMINE	OBL
<i>Castilleja</i>	n/a	n/a	CASTIL	n/a
<i>Chenopodium album</i>	lambquarters	E	CHEALB	FACU
<i>Chenopodium</i>	n/a	n/a	CHENOP	n/a
<i>Chloropyron maritimum</i>	alkali birdbeak	N	CHLMARC	OBL
<i>Cicuta douglasii</i>	Douglas water hemlock	N	CICDOU	OBL
<i>Cirsium arvense</i>	Canada thistle	E	CIRARV	FACU
<i>Cirsium scariosum</i>	meadow thistle	N	CIRSCA	FAC
<i>Cirsium</i>	n/a	n/a	CIRSIU	n/a
<i>Cirsium vulgare</i>	bull thistle	E	CIRVUL	FACU
<i>Crepis runcinata</i>	fiddleleaf hawksbeard	N	CRERUNH	FACU
Unknown	n/a	n/a	DICOT	n/a
<i>Distichlis spicata</i>	inland saltgrass	N	DISSPI	FAC
<i>Elaeagnus angustifolia</i>	Russian olive	E	ELAANG	FAC
<i>Eleocharis acicularis</i>	needle spikerush	N	ELEACI	OBL
<i>Eleocharis</i>	n/a	n/a	ELEOCH	n/a
<i>Eleocharis palustris</i>	common spikerush	N	ELEPAL	OBL
<i>Eleocharis rostellata</i>	walking sedge	N	ELEROS	OBL
<i>Elymus lanceolatus</i>	streambank wheatgrass	N	ELYLAN	UPL
<i>Erigeron lonchophyllus</i>	spear leaved fleabane	N	ERILON	FACW
<i>Glaux maritima</i>	sea milkwort	N	GLAMAR	FACW
<i>Gratiola</i>	n/a	n/a	GRATIO	n/a
<i>Hippuris vulgaris</i>	mare's tail	N	HIPVUL	OBL
<i>Hordeum brachyantherum</i>	meadow barley	N	HORBRA	FACW

<i>Hordeum jubatum</i>	foxtail barley	N	HORJUB	FAC
<i>Iva axillaris</i>	povertyweed	N	IVAAXI	FAC
<i>Juncus balticus</i>	Baltic rush	N	JUNBAL	FACW
<i>Juncus</i>	n/a	n/a	JUNCUS	n/a
<i>Lactuca serriola</i>	prickly lettuce	E	LACSER	FACU
<i>Lepidium latifolium</i>	perennial pepperweed	E	LEPLAT	FAC
<i>Leymus triticoides</i>	beardless wildrye	N	LEYTRI	FAC
<i>Lycopus asper</i>	rough bugleweed	N	LYCASP	OBL
<i>Micranthes</i>	n/a	n/a	MICRAN	n/a
<i>Mimulus guttatus</i>	yellow monkeyflower	N	MIMGUT	OBL
Moss	n/a	n/a	MOSS	n/a
<i>Muhlenbergia asperifolia</i>	Muhlenbergia asperifolia	N	MUHASP	FACW
<i>Nitrophila occidentalis</i>	niterwort	N	NITOC	FACW
<i>Pascopyrum smithii</i>	western wheatgrass	N	PASSMI	FAC
<i>Persicaria amphibia</i>	water smartweed	N	PERAMP	OBL
<i>Poa</i>	n/a	n/a	POA	n/a
Poaceae	n/a	n/a	POACEA	n/a
<i>Poa secunda</i>	one sided bluegrass	N	POASEC	FACU
<i>Polypogon monspeliensis</i>	annual rabbitfoot grass	E	POLMON	FACW
<i>Polypogon</i>	n/a	n/a	POLYPO	n/a
<i>Potentilla anserina</i>	silverweed	N	POTANS	OBL
<i>Potentilla gracilis</i>	Potentilla gracilis	N	POTGRA	FAC
<i>Puccinellia lemmonii</i>	Lemmon's alkaligrass	N	PUCLEM	FACW
<i>Puccinellia nuttalliana</i>	Nuttall's alkaligrass	N	PUCNUT	FACW
<i>Pyrrocoma lanceolata</i>	Pyrrocoma lanceolata	N	PYRLAN	FAC
<i>Pyrrocoma</i>	n/a	n/a	PYRROC	n/a
<i>Ranunculus cymbalaria</i>	shore buttercup	N	RANCYM	n/a
<i>Rumex crispus</i>	curly dock	E	RUMCRI	FAC
<i>Sagittaria latifolia</i>	wapato	N	SAGLAT	OBL
<i>Salicornia rubra</i>	red glasswort	N	SALRUB	OBL
<i>Sarcobatus vermiculatus</i>	greasewood	N	SARVER	FACU
<i>Schoenoplectus acutus</i>	hardstem bulrush	N	SCHACU	OBL
<i>Schoenoplectus americanus</i>	three-square	N	SCHAME	OBL
<i>Senecio hydrophilus</i>	water ragwort	N	SENHYD	OBL
<i>Sisyrinchium halophilum</i>	Nevada blue eyed grass	N	SISHAL	FACW
<i>Sisyrinchium</i>	n/a	n/a	SISYRIN	n/a
<i>Sium suave</i>	hemlock waterparsnip	N	SIUSUA	OBL
<i>Sparganium eurycarpum</i>	broadfruit burreed	N	SPAEUR	OBL
<i>Spartina gracilis</i>	alkali cordgrass	N	SPAGRA	FACW
<i>Sphenopholis obtusata</i>	prairie wedgegrass	N	SPHOBT	FAC
<i>Suaeda calceoliformis</i>	Pursh seepweed	N	SUACAL	FACW
<i>Symphotrichum ascendens</i>	long leaved aster	N	SYMASC	FAC
<i>Thelypodium integrifolium</i>	entire leaved thelypod	N	THEINT	FACW
<i>Trifolium variegatum</i>	whitetip clover	N	TRIVAR	FAC
<i>Trifolium wormskioldii</i>	springbank clover	N	TRIWOR	FACW
<i>Triglochin maritima</i>	seaside arrowgrass	N	TRIMAR	OBL
<i>Typha</i>	n/a	n/a	TYPHA	n/a
<i>Typha latifolia</i>	common cattail	N	TYPLAT	OBL
<i>Veronica anagallis-aquatica</i>	water speedwell	E	VERANA	OBL
<i>Veronica peregrina var. xalapensis</i>	hairy purslane speedwell	N	VERPER	FAC
<i>Zeltnera exaltata</i>	western centaury	N	ZELEXA	FACW

