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2003-2004 Ute ladies'-tresses (*Spiranthes diluvialis*) monitoring, inventory, and surveys at Chester Wetlands, Idaho

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ABSTRACT

Ute ladies'-tresses (*Spiranthes diluvialis* Sheviak) is a white-flowered orchid that has been considered a conservation concern in the western United States since its description in 1984. It was listed as a Threatened species under the Endangered Species Act in 1992 due to its rarity, small population sizes, and threats of loss or modification of riparian habitats. Ute ladies'-tresses was discovered in 2002 at the Chester Wetlands segment of the Idaho Fish and Game Sand Creek Wildlife Management Area. In August and September 2003 and 2004, we conducted field surveys and inventory for Ute ladies'-tresses at the Chester Wetlands. We established 6 permanent habitat monitoring transects and baseline habitat information was collected at 4 transects in 2003 and 2 transects in 2004. First year results indicate that invasive exotic and noxious weed species are widespread and pose a potentially threat to all 6 transects monitored. The Chester Wetlands population is significant for the species' statewide conservation due to its large size, somewhat unusual habitat, and location outside the South Fork Snake River drainage (where all other known Ute ladies'-tresses populations occur in Idaho). In addition, a large-scale wetland enhancement project planned for Chester Wetlands will directly affect occupied Ute ladies'-tresses habitat. This report documents 2003 and 2004 survey, inventory, and baseline monitoring results and makes recommendations for monitoring and managing Ute ladies'-tresses at Chester Wetlands.

KEY WORDS

Chester Wetlands, habitat, Idaho, inventory, monitoring, population, rare plant, Sand Creek Wildlife Management Area, *Spiranthes diluvialis*, Ute ladies'-tresses, wetland

SUGGESTED CITATION

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INTRODUCTION

Ute ladies'-tresses (*Spiranthes diluvialis* Sheviak) is a white-flowered orchid first described as a species in 1984 (Sheviak 1984). It is found in various wetland and riparian habitats on alluvial substrates (Moseley 1998a). Elevations vary greatly throughout its range but are always low in relation to surrounding topography (Moseley 1998a). In 1992, the U.S. Fish and Wildlife Service (USFWS 1992) listed Ute ladies'-tresses as a Threatened species under the Endangered Species Act (ESA) due to its rarity, low population sizes, and threats of loss or modification of riparian habitats. At the time of listing, it was known only from Colorado, Utah, and one historical population in Nevada (Moseley 1997, 1998a). Its range now includes Nebraska, Colorado, Utah, Wyoming, Montana, Idaho, Nevada, and Washington.

Details regarding Ute ladies'-tresses population biology, habitat requirements, and rangewide conservation status have been treated by many authors (Arft 1995, USFWS 1995, Heidel 2001, Murphy 2000, Reidel 2002, Fertig et al. 2005). Ute ladies'-tresses flowers mid-August through mid-September (Moseley 1998b), with a 4-week offset possible within a population (Heidel 1998). Ute ladies'-tresses in Idaho have been found in association with various plant community types including silverberry (*Elaeagnus commutata*)/creeping bentgrass, coyote willow (*Salix exigua*)/creeping bentgrass, woolly sedge (*Carex pellita* [syn*. lanuginosa*]), horsetail (*Equisetum* spp.), and wandering spike-rush (*Eleocharis rostellata*; Moseley 1998b, 2000).. Ute ladies'-tresses are rarely found under the canopy of dense woody vegetation, but may occur at edges of shrub patches (Moseley 1998a). Look-alike species most likely to be found in Ute ladies'-tresses habitat include hooded ladies'-tresses (*Spiranthes romanzoffiana*) and northern bog-orchid (*Habenaria hyperborea*) (Moseley 1997, 2000; Murphy 2000). All plant species nomenclature follows USDA, Natural Resources Conservation Service (USDA 2004).

In 1996, Ute ladies'-tresses was discovered in riparian habitats on the floodplain of the South Fork Snake River, Idaho (Moseley 1997). In 2002, the Idaho Conservation Data Center (IDCDC) conducted rare plant surveys on 6 Idaho Department of Fish and Game (IDFG) Wildlife Management Areas (WMAs). These surveys resulted in the discovery of Ute ladies'-tresses at the Chester Wetlands Segment of the Sand Creek WMA (Chester Wetlands; Dixon et al. 2003, IDCDC 2006). There are currently 8 element occurrences (EOs), of which 7 EOs are on the South Fork Snake River and 1EO is at Chester Wetlands (Colket et al. 2006, IDCDC 2006). An EO is a specific geographic location where "a species or natural community is, or was, present" (NatureServe 2002:10). Element occurrences currently in the IDCDC database do not include an additional EO discovered in 2005 on the Fort Hall Indian Reservation in Bingham County, Idaho (C. Davis, BLM, personal communication).

A management plan for the species was developed by IDFG after the discovery of Ute ladies'-tresses at Chester Wetlands (IDFG 2002, 2003). The 2002 site management plan specified that surveys be conducted on the property to determine the presence of rare plant species and that plans be developed and implemented to provide protection and habitat security for species at risk. The primary goals in the 2003 management plan were to maintain known subpopulations and habitat of Ute ladies'-tresses (and to)

survey, map, and protect additional subpopulations and habitats as they are located (IDFG 2003:2).

Ducks Unlimited and IDFG plan to develop new ponds and enhance existing ponds to benefit waterfowl at Chester Wetlands. This project is being funded using federal money, requiring an assessment of potential impacts to Ute ladies'-tresses resulting from the project. Consultation was required once it was determined there would be potential impact to Ute ladies'-tresses (USFWS 1995, 1998). Our objectives in 2003 and 2004 were to conduct baseline monitoring and inventories of Ute ladies'-tresses, and continue to survey potential habitat at Chester Wetlands. This report summarizes results of surveys, inventory, and monitoring conducted in 2003 and 2004.

STUDY AREA

Chester Wetlands is located in Fremont County, Idaho. The land was purchased by The Nature Conservancy in 2001 and then sold to the IDFG, who currently manages it. Chester Wetlands is visited by nature watchers, hunters, researchers, and IDFG personnel. Except for IDFG access, motorized vehicles are not allowed. The wetlands, covering ca 308 ha, form in depressions that are intersected by a seasonally high groundwater table and augmented by irrigation. Uplands at the site cover ca 607 ha, much of which is seasonally irrigated. About 150 ha of this land is formerly cultivated cropland (now fallow) and the remainder was used for cattle pasture until 2002 when grazing was eliminated. The site includes a residence and several dirt access roads. Several irrigation ditches feed the area. Chester Wetlands also includes about 2.8 km (1.8 mi) of Henrys Fork riverfront lined by scrub-shrub communities and a low terrace of mesic graminoid vegetation wedged between the river and the Last Chance Canal. A diversion dam feeding this canal and other irrigation ditches occurs at the northwest corner of the site. The Last Chance Canal acts as a low levee, partially preventing the Henrys Fork from flooding other low-lying areas at the site.

Chester Wetlands is mostly underlain by basalt flows capped with a mosaic of deposits ranging from clay and silt to sand. The general topography of non-agricultural areas is composed of a series of sandy hummocks (likely old stabilized dunes) and moist swales. Drier sandy hummocks are dominated by sagebrush-steppe vegetation while the wetland swales are predominantly emergent wetlands dominated by creeping bentgrass (*Agrostis stolonifera*), a mix of native mesic graminoid species, and/or exotic weed patches. Common cattail (*Typha* spp.) and bulrush (*Schoenoplectus* [syn. *Scirpus*] spp.) dominate around seasonally to perennially flooded pond margins. There are also patches of cottonwood (*Populus* spp.)-dominated forested wetland and willow (*Salix* spp.)-dominated scrub-shrub wetland. This wetland mosaic is managed and being restored for wildlife habitat, as well as for recreational and educational opportunities.

METHODS

Survey and inventory

Potential habitat was identified by surveyors' knowledge of Ute ladies'-tresses habitat, as well as descriptive information in several reference sources (Arft 1995; USFWS 1995; Heidel 1998, 2001; Moseley 2000; Murphy 2000). Species recognition was achieved by surveyors' prior experience with and knowledge of Ute ladies'-tresses, and use of field keys. Surveys of potential habitat were conducted by meandering walking transects. Any new subpopulations were mapped using a navigation-grade GPS unit and information on habitat characteristics and condition collected.

An inventory of observable individuals (flowering or fruiting plants) was conducted at each prior known and newly discovered subpopulation. Observers methodically walked through subpopulations, counting each individual seen. Flags were used to keep track of individuals and removed after the count was completed. The habitat condition of prior known subpopulations was also updated.

Habitat monitoring

Establishment of permanent habitat monitoring transects and photo-point monitoring was completed as described by Murphy (2001) for monitoring Ute ladies'-tresses on the South Fork Snake River. The index of habitat change method (Murphy 2001) was used to monitor habitat. The index uses a relative scale with numeric values reflecting changes and threats to habitat quality. A checklist of habitat changes and threats, both human-caused and natural, was developed for the index of habitat change. The checklist includes important habitat attributes (i.e. habitat characteristics, changes, threats) that are assumed to affect Ute ladies'-tresses. These habitat attributes were divided into direct and indirect threat/change categories. Measurable indicators, or surrogates, for the habitat attributes were assigned numeric values reflecting different condition classes. For all attributes, the numeric values were 0, 1, or 2 (except the population tally, which included 4 classes). The zero class represents "the most suitable" habitat conditions—the higher the number, the less suitable the current habitat conditions. Attributes were evaluated within the subpopulation in 5 x 5 m sample blocks on each side of the permanently marked transects (Figure 1). Transects varied in length depending on the size of potential habitat at the Ute ladies'-tresses subpopulation.

Attributes were also evaluated at a broader scale outside transect sample blocks. Evaluation occurred both within 25 m of the subpopulation and at distances >25 m from the subpopulation at each transect. Measurements of the surrounding habitat are useful for assessing the risk of future impacts to Ute ladies'-tresses habitat. The 2003 management plan for Ute ladies'-tresses at Chester Wetlands specified that a "25 m buffer around occupied and immediately adjacent potential habitat as identified by surveys will be established and any activities that may adversely affect Ute ladies'-tresses at these sites will be avoided (IDFG 2003: 2)."

Minor modifications of the index of habitat change method (Murphy 2001) were made to meet needs at Chester Wetlands. We measured 6 additional attributes that were not measured at the South Fork Snake River (Murphy 2001) to better observe changes resulting from management at Chester Wetlands (e.g. exclusion of cattle grazing). They were: 1) number of trails of unknown origin; 2) cover of bare ground, rocks, and litter; 3) litter depth at the center of each sample cell; 4) vegetation height (at the center of each sample cell); 5) species richness; and 6) woody cover.

Past cattle browsing may have kept woody species (primarily willow) from encroaching on Ute ladies'-tresses habitat. Ute ladies'-tresses monitoring results suggest that an increase in woody cover could adversely affect its habitat (Murphy 2001). To address this, woody cover was measured along the perimeter of the habitat monitoring transect using a modified version of the line-intercept method (Figure 1; Elzinga et al. 1998). A measuring tape was stretched along each side of the habitat monitoring transect perimeter. The tape was stretched tightly to ensure a straight line along each side. The observer walked next to the tape and recorded where the tape vertically intercepted woody species cover. The canopy gap was considered closed unless the gap was >10 cm (Figure 2).

Appendix 1 contains an instruction key for evaluation of habitat attributes at each scale. Field-ready datasheets are in Appendix 2. Completed datasheets and photos are on file at the IDCDC in Boise.

RESULTS

Subpopulation survey and inventory

We observed 621 Ute ladies'-tresses at Chester Wetlands in 2003. Two new subpopulations were discovered making 11 known for the site. In 2004, a partial inventory was conducted with 218 Ute ladies'-tresses observed at 3 subpopulations. As of 2004, Ute ladies'-tresses were scattered throughout a 0.6 x 1.3 km (ca 78 ha) swath of suitable wetland habitat. Ute ladies'-tresses subpopulations were scattered from the southern end of the largest pond at the north end of Chester Wetlands southwest to the outlet of the largest pond in the southwestern portion of the site.

Habitat conditions at the transect scale

Permanently marked habitat monitoring transects were established at 6 of the 11 subpopulations (e.g., subpopulations 4 through 9) (Appendix 3). Transects 3, 4, 5, and 6 were monitored in 2003, and transects 1 and 2 were monitored in 2004.

Direct threats or changes to habitat were minimal at all 6 transects, except for 1 incident at transect 6 and wildlife activity (Table 1). At transect 6, there was a path of lightly trampled vegetation created when installing and monitoring a piezometer. No other evidence of hydrologic and fluvial geomorphic changes, off-highway vehicle (OHV) use, recreation impacts or other human-caused ground disturbance, fires, or human-caused mortality of Ute ladies'-tresses were observed. Varying degrees of wildlife bedding, trampling, trails, browsing, and burrowing were documented at all 6 transects. Transect

2 had a rodent trail and transect 3 had several gopher mounds. Transects 1 and 4 had browsing of a few Ute ladies'-tresses individuals by an undetermined animal. Transect 5 had light browsing of vegetation and gopher mounds. Wildlife activity at transect 6 was not specifically described.

Vegetation structure and composition was usually close to that expected in Ute ladies'-tresses habitat, except for noxious and/or highly invasive exotic species cover (i.e. mean attribute scores were < 1.0; Table 2). Mean graminoid cover was ≥40% at transects 1, 4, 5, and 6. Transects 2 and 3 had mean scores of 0.4 and 0.3 respectively, indicating mean graminoid cover of 3 to 39%. Baltic rush, Kentucky bluegrass (*Poa pratensis*), mat muhly (*Muhlenbergia richardsonis*), Nebraska sedge (*Carex nebrascensis*), creeping bentgrass, and swordleaf rush (*Juncus ensifolius*) were the most common graminoid species. Mean vegetation height ranged from 13.8 to 27.8 cm. Forb cover scores ranged from 0 to 0.5 at all transects, indicating that mean forb cover was ≤30%. Cinquefoil species (*Potentilla* spp.), field horsetail (*Equisetum arvense*), smooth horsetail, variegated horsetail (*Equisetum variegatum*), and white clover (*Trifolium repens*) were the most common forb species. Mean species richness was 3 to 5 species per sample block at transects 1 and 2 and >6 species per sample block at transects 4 and 6. Mean litter cover was ≥50% at all transects, except for transect 6 (which had 30 to 50% mean cover for bare ground, rocks, and litter). Mean litter depth ranged from 4.6 to 7.0 cm.

Mean woody cover scores ranged from 0 to 0.4 (Table 2). Mean woody species cover within sample blocks was 0 at transects 1 and 2, and <1% at all other transects. However, actual woody cover measured using the line intercept method was 1.9% at transect 3, 4.0% at transect 6, and 5.6% at transect 5 (Table 3). Willow species, including Bebb's, Geyer's, and whiplash (e.g., *Salix bebbiana*, *S. geyeriana*, and *Salix lucida* ssp. *caudata*), contributed most of the woody species cover. No woody species were detected using the line-intercept method at transect 4, but Wood's rose (*Rosa woodsii*) occurred within two sample blocks.

Five of the 6 transects had a mean score of ≥1.5 for noxious and/or highly invasive exotic species cover (Table 2). This score implies that mean cover of these species was >10% at the 5 transects. Transect 1 was the only transect with <10% mean cover of noxious and/or invasive exotic species. Field sowthistle (*Sonchus arvensis*) was the most frequently occurring and most abundant species at all transects, except for transect 3, where Canada thistle (*Cirsium arvense*) and field sowthistle were equally abundant.

Most transects had few Ute ladies'-tresses individuals within the transect sample blocks. Four of the 6 transects had scores ranging from 2.6 to 2.8, indicating a mean of 1 to10 Ute ladies'-tresses per sample block. Only transect 4 averaged >10 Ute ladies'-tresses per sample block. Transect 3 had only one sample block with 1 to 10 Ute ladies'-tresses.

Habitat conditions within 25 m transect buffer

Few habitat impacts were observed within 25 m of transects (Table 4). No evidence of OHV use, recreation impacts, or fire were observed at any transect. A lightly trampled human-caused trail leading from the newly installed piezometer to the dirt service road was observed at transect 6. There was also a culvert and canal located to the east of the transect 6. A service road occurred within 25 m of transect 2, but impacts to habitat were not noticeable.

Transects 1, 2, 3, 4, and 6 all received a score of 2 for invasion and colonization by noxious weeds. This score indicates that noxious weeds are common and widespread, usually in large colonies. Noxious weed colonies were primarily Canada thistle and field sowthistle, with smaller colonies of musk thistle (*Carduus nutans*) observed at transect 6. Transect 5 received a score of 1, which indicated that noxious weeds are commonly scattered and noticeable, but only small colonies were present.

Habitat conditions beyond 25 m transect buffer

No evidence of recreation impacts or fire was observed between 25 and 100 m of any transect (Table 5). OHV use occurred between 25 and 100 m of transect 1. All 6 transects received either a 1 or 2 score for noxious weeds, roads, and hydrologic alteration. A score of 1 indicated that trace impacts or disturbance was present and a score of 2 indicated noticeable impacts. Large colonies of noxious weed species were commonly observed between 25 and 100 m of 5 transects. Transect 3 had only scattered noxious weed colonies in the surrounding habitat. An IDFG service road running through upland habitat around the wetland periphery minimally affected all transects except transect 1. Irrigation ditches and water management structures affected the hydrology of all 6 transects.

Biocontrol insects were released for thistle species in 2002, but were not yet effective as of 2004. All transects were given a score of 1 for the conservation attribute both within and beyond the 25 m buffer.

DISCUSSION

Chester Wetlands supports the third largest Ute ladies'-tresses occurrence in the state (Colket et al. 2006). With the exception of high noxious and/or highly invasive exotic species cover at 5 of 6 transects, habitat conditions documented in 2003 and 2004 were suitable for the short-term persistence of Ute ladies'-tresses at Chester Wetlands.

Inventories in 2006 covered the same ground as 2003 and 2004 surveys. The recent inventory documented that several prior known subpopulations were larger (in both area occupied and number of plants) than previously thought (IDCDC 2006). In addition, 2 new subpopulations were found in 2005. As a result, several subpopulations have been merged making 8 for the site. Over 1,600 Ute ladies'-tresses, occupying approximately 22 patches, are now known from Chester Wetlands (IDCDC 2006). These results emphasize the need for additional surveys of unsurveyed potential habitat and the value of repeated inventories. An explanation for large differences in the number of observed

plants between survey years is due to Ute ladies'-tresses' life history. The primary life stages exhibited are seedling, subterranean dormant, above-ground vegetative, and reproductive. The subterranean dormant stage may persist for as long as four or more years before transitioning above-ground stages (Fertig et al. 2005).

Before cattle grazing ended at Chester Wetlands, plant cover and litter was likely lower and the proportion of bare ground and rocks higher. Colonization of formerly bare soil by noxious weeds and exotic species may be a consequence of past cattle grazing at Chester Wetlands. Similarly, browsing of woody vegetation by cattle may have maintained open habitat preferred by Ute ladies'-tresses. Species richness, community structure, and species composition in Ute ladies'-tresses habitat has likely changed since cattle grazing ended. With ground disturbance and hydrologic changes associated with proposed wetland enhancement, increased exotic species invasion can be expected in some areas. Long-term monitoring of these attributes will help us better understand these processes.

MONITORING RECOMMENDATIONS

Monitoring information is useful for making management decisions that are adaptive and responsive to identified threats or habitat changes. Annual monitoring of transects and Ute ladies'-tresses subpopulations is recommended for assessing effects of the wetland enhancement project and implementation of the Ute ladies'-tresses management plan (IDFG 2003). Additional transects should be established at subpopulations likely to be affected by wetlands enhancement. Transects should be long enough to encompass the extent of habitat affected by water level changes. We recommend that Ute ladies'-tresses monitoring be part of an integrated wetland enhancement monitoring program. Monitoring data collected in 2003 and 2004 serve as a baseline to compare future measurements against.

We recommend that the monitoring protocol be slightly modified in order to improve detection of habitat changes using statistical tools. For attributes requiring estimation of cover, we recommend recording absolute cover or a more narrowly defined cover class rather than just a broad cover class. Cover by species or at least by well-defined specific functional groups should also be recorded (e.g. native perennial versus exotic perennial, sedges, rushes, etc.). These and other modifications may also provide valuable information regarding the ecologic effects of wetland enhancement.

Based on monitoring observations, Ute ladies'-tresses habitat at Chester Wetlands currently receives only light recreation activity. Public access for hunting, fishing along the river, and for other wildlife-based recreation is expected to increase. The effects of public access on Ute ladies'-tresses should be monitored and designated trails considered if necessary.

MANAGEMENT IMPLICATIONS

Several issues should be addressed for ensuring the long-term viability of Ute ladies'-tresses at Chester Wetlands. First, of highest immanency and magnitude, is the IDFG/Ducks Unlimited Inc. proposal to install levees and alter hydrology on the Chester

Wetlands for the purpose of wetland enhancement. It is unknown whether the proposed actions will have a net benefit or harm to Ute ladies'-tresses. Much of the Ute ladies'-tresses habitat at the Chester Wetlands was likely artificially created in the first place, so it is possible that the project design could enhance some Ute ladies'-tresses habitat. However, the design will flood a portion of occupied habitat, causing some subpopulations to shrink, shift location, or die out; other subpopulations may establish in new locations. The proposal should be carefully reviewed for its potential impacts on Ute ladies'-tresses habitat. As the proposal moves forward, changes to habitat and subpopulations should be closely monitored.

Noxious weeds and invasive exotic species pose another imminent threat to Ute ladies'-tresses at Chester Wetlands. Large colonies of Canada thistle, field sowthistle, musk thistle, and other noxious weeds found throughout the property threaten Ute ladies'-tresses habitat. This site presents an opportunity to assess effectiveness of various weed controls, such as mowing, additional biocontrol agents, prescribed cattle or goat grazing, burning, or hand pulling. Due to the widespread nature and location of some thistle colonies, broadleaf chemical treatment may be considered, but effects on Ute ladies'-tresses pollinators should be considered and spraying avoided within 25 m of occupied and immediately adjacent potential habitat. Traditional weed management strategies (e.g. herbicides) are detrimental to Ute ladies'-tresses and its pollinators (Sipes and Tepedino 1995, Fertig et al. 2005). It is particularly challenging to manage noxious and invasive weeds because Ute ladies'-tresses' primary pollinator, bumblebees (*Bombus* spp.; Hymenoptera: Apidae), are negatively affected by herbicides throughout the entire growing season (Sipes and Tepedino 1995). Biocontrol agents are one of the best tools available to control weeds without detrimentally affecting Ute ladies'-tresses or its pollinators.

Full implementation of the management plan for Ute ladies'-tresses at Chester Wetlands requires the IDFG to protect known occupied habitat. Any activities adversely affecting Ute ladies'-tresses will be avoided within a 25 meter buffer around occupied and immediately adjacent potential habitat. Habitat monitoring conducted during 2003 and 2004 documented only light trampling of vegetation resulting from IDFG management within the 25 m transect buffer. Current motorized routes for site management are mostly outside the 25 m buffer. Future route selection and OHV use should only occur outside the 25 m buffer of occupied habitat. Sand Creek WMA personnel should be knowledgeable about where Ute ladies'-tresses occurs in Chester Wetlands and familiar with the requirements of the management plan for Ute ladies'-tresses (IDFG 2003).

The Chester Wetlands Ute ladies'-tresses occurrence has important conservation implications, being one of the largest in Idaho. In addition, the Chester Wetlands occurrence is the only one located in a different drainage from other Ute ladies'-tresses in the state Guidelines for Chester Wetlands management protect Ute ladies'-tresses from livestock grazing, public OHV and vehicle use, and overnight camping disturbance, all of which are of concern on the South Fork Snake River populations (IDFG 2002). These guidelines give IDFG an opportunity to manage Chester Wetlands as a Ute ladies'-tresses conservation site important for recovery and delisting of the species in conjunction with other goals (IDFG 2002). The Chester Wetlands has great potential for

Ute ladies'-tresses population and habitat biology research, including studying the effects of wetland enhancement on subpopulation establishment.

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Table 1. Mean values for attributes indicating direct changes or threats to habitat measured at the transect scale (see Appendix 1).

Transect	Transect length (m) (n = # of sample blocks)	Direct Changes / Threats								
		Hydrologic and Fluvial Geomorphic Change	Off-highway Vehicle Use	Trails		Recreation	Other Human-caused Ground Disturbance	Fire	Confirmed Mortality	Wildlife Activity
		Deposition	Tracking and trailing	Origin not determined	Human trails	Campsite impacts	Roads, houses, excavation, filling, heavy equipment, firefighting, etc.	Wildfire, human or natural	Human harvest, disease, or other mortality	Bedding, trampling, trails, browsing, burrowing
1	50 (n = 20)	0	0	0	0	0	0	0	0	0.1
2	30 (n =12)	0	0	0	0	0	0	0	0	0.1
3	40 (n = 16)	0	0	0	0	0	0	0	0	1.4
4	30 (n = 12)	0	0	0	0	0	0	0	0	0.8
5	30 (n = 12)	0	0	0	0	0	0	0	0	0.3
6	25 (n = 10)	0	0	0	0.3	0	0	0	0	0.4

Table 2. Mean values for attributes indicating indirect changes or threats to habitat and total of all attributes measured at the transect scale (see Appendix 1).

Transect	Indirect Changes / Threats								Conservation Information	Total (excluding litter depth and vegetation height)
	Vegetation Structure and Composition								Population Information	
	Invasive and noxious weeds	Bare ground, rocks, and litter	Litter depth (cm)	Vegetation height (cm)	Graminoids	Forbs	Woody species	Species Richness (index)	Population tally	
1	0.6	2.0	7.4	23.0	0	0.1	0	0.1	2.8	5.7
2	2.0	2.0	7.0	23.8	0.4	0	0	0.5	2.8	7.8
3	1.5	2.0	4.6	13.8	0.3	0.5	0.2	not recorded	3.0	8.9*
4	1.8	2.0	5.4	17.2	0	0.5	0.3	0	1.5	6.9
5	2.0	2.0	7.0	16.4	0	0.3	0.4	not recorded	2.6	7.6*
6	1.7	1.0	6.6	27.8	0	0	0.3	0	2.8	6.5

Table 3. Line intercept data (m), species present, and total woody cover (%) for each transect.

Transect	Start Side	Right Side	Left Side	End Side	% Cover
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	0.01 Pacific willow	3.36 Pacific willow, Wood's rose	0.0	0.0	1.9
4	0.0	0.0	0.0	0.0	0.0
5	0.01	4.45 willow spp.	0.0	0.0	5.6
6	0.93 Geyer's and Bebb's willows	0.01 willow spp.	1.26 willow spp.	0.57 Bebb's willow	4.0

Table 4. Values for habitat attributes measured within 25 m buffer of transect (Appendix 1).

Transect	Direct Changes / Threats					Indirect Changes / Threats			Conservation Information	Total
	Off-highway Vehicle Use	Trails		Recreation	Other Human-Caused Ground Disturbance	Fire	Noxious Weeds	Hydrologic Alteration	Population Information	
	Tracking and trailing	Origin not determined	Human trails	Campsite impacts	Roads, houses, excavation, filling, heavy equipment, firefighting, etc.	Wildfire, human or naturally caused	Invasion and colonization by noxious weed species	Levees, rip-rapping, culverts, bridges, causeways, diversions, other developments	Exclosures, fences, biocontrol, or other protective measures	
1	0	0	0	0	0	0	2	0	1	3
2	0	0	0	0	1	0	2	0	1	4
3	0	0	0	0	0	0	2	0	1	3
4	0	0	0	0	0	0	2	0	1	3
5	0	0	0	0	0	0	1	0	1	2
6	0	0	1	0	0	0	2	1	1	5

Table 5. Values for habitat attributes measured between 25 m and radius specified (100 to 400 m) for attribute of transect.

Transect	Direct Changes / Threats						Indirect Changes / Threats		Conservation Information	Total
	Off-highway Vehicle Use	Trails		Recreation	Other Human-Caused Ground Disturbance	Fire	Noxious Weeds	Hydrologic Alteration	Population Information	
	Tracking and Trailing	Origin not determined	Human trails	Campsite impacts	Roads, houses, excavation, filling, heavy equipment, firefighting, etc.	Wildfire, human or naturally caused	Invasion and colonization by noxious weed species	Levees, rip-rapping, culverts, bridges, causeways, diversions, other developments	Exclosures, fences, biocontrol, or other protective measures	
1	1	0	0	0	0	0	2	1	1	5
2	0	0	0	0	1	0	2	1	1	5
3	0	0	0	0	2	0	1	1	1	5
4	0	0	1	0	1	0	2	1	1	6
5	0	0	0	0	1	0	2	2	1	6
6	0	0	0	0	2	0	2	1	1	6

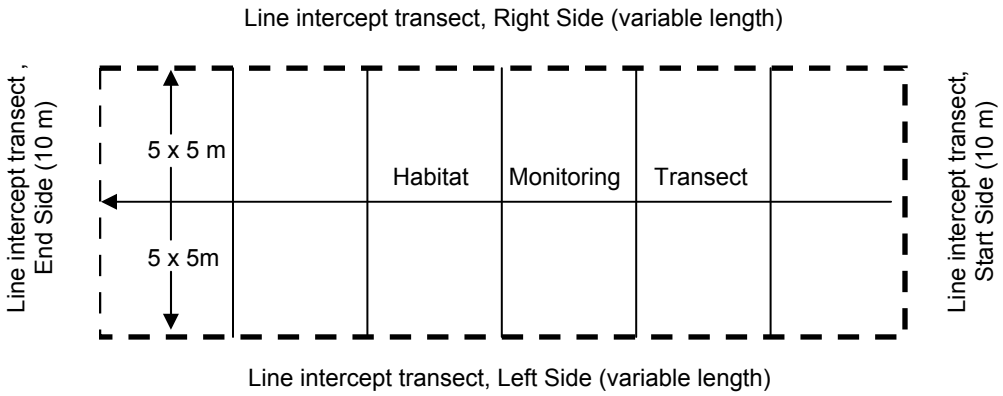

Figure 1. Illustration of habitat monitoring and line-intercept transect layout. The dotted lines represent the line-intercept transects. Each square represents the 5 m^2 sample block for evaluating habitat attributes.

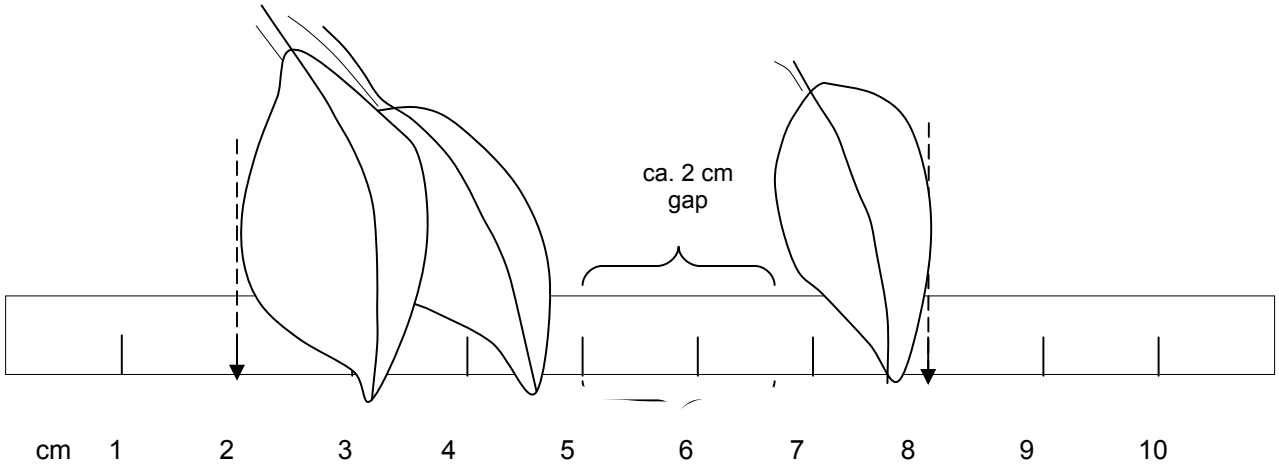

Figure 2. Illustration of line intercept protocol for measuring woody vegetation. A closed canopy should be assumed until the gap exceeds 10 cm. Here, the gap between foliage is only about 2 cm. The correct cover reading in this example is 6 cm.

APPENDIX 1

Instruction key for Ute ladies'-tresses (*Spiranthes diluvialis*) habitat monitoring

Instruction Key for Ute ladies'-tresses (*Spiranthes diluvialis*) Habitat Monitoring				
Threats / Changes to Habitat	**Attribute Type**	**Indicator or Surrogate Measured**	**"A" Transect Scale Indicator Values** ***Evaluation within each 5 x 5 m sample block; Recorded in Table "A" of Tally Sheet***	**"B" Landscape Scale Indicator Values** ***Evaluation within a specified radius of the midpoint of transect; Recorded in Table "B" of Tally Sheet***
Direct Threats and Changes to Habitat				
Hydrologic and Fluvial Geomorphic	1) Deposition (e.g., recent sand, woody debris, or other alluvium)	Depth of recent alluvial deposits (e.g., unconsolidated silt, sand, gravel, cobble, or woody debris) deposited in the last 10 years (date estimated). Must be more than a trace present.	0=0 to 5 cm (trace amounts in block) 1=5 to 15 cm 2=16 or more cm	Not measured
Off-Highway Vehicle Use	2) Tracking and trailing	Number of recent track sets/trails through the sample block caused by OHVs (including, but not limited to, all-terrain vehicles, motorcycles, mountain bikes, and 4 x 4 vehicles). This doesn't include heavy equipment.	0=none 1=one track set 2=more than one track set	Within 100 m radius: 0=none visible 1=one to three track sets 2=more than three track sets
Trails	3) Trail(s) where origin is uncertain (animal vs. human-caused)	Number of obviously recent trails through the sample block.	0= none 1=one trail with trampled vegetation, minimal bare ground 2=more than one trail; or one trail with much bare soil	Within 100 m radius: 0=none 1=one to three trails visible 2=more than three trails
	4) Human-caused trails	Number of obviously recent human foot trails through the sample block (can be difficult to distinguish from other trails).	0= none 1=one trail with trampled vegetation, minimal bare ground 2=more than one trail; or one trail with much bare soil	Within 100 m radius: 0=none 1=one to three trails visible 2=more than three trails
Recreation	5) Campsite impacts (e.g., tent sites, kitchens, fire rings, wood cutting)	Trampled vegetation and bare ground (soil and gravel, not generally rocks) obviously recently exposed by human recreation activities (including, but not limited to, tent sites, kitchens, campfire rings, wood cutting).	0=zero impacts 1=one distinct campsite impact, with or without bare ground (trampled vegetation) 2=more than one campsite impact, or one camp impact with much bare soil exposed	Within 100 m radius: 0=no impacts (zero campsites and associated impacts) 1=one to two campsites, or associated impacts visible 2=more than two campsites, or associated impacts widespread and noticeable

Other Human-Caused Ground Disturbance	6) Roads, houses, excavation, filling, heavy equipment, firefighting, etc. Flood control activities not considered here (see "Hydrologic Alteration").	Bare ground (soil and gravel, not generally rocks) obviously recently exposed or deposited by human activities, or presence/absence in the landscape. The number of ground disturbing impacts is measured. **Note type and extent in comments.**	0=no sign 1=one distinct human impact 2=more than one	Within 400 m radius: 0=no impacts (zero impacts related to excavation, filling, and/or heavy equipment operation visible) 1=trace impacts visible (minimal or peripheral disturbance) 2=impacts noticeable (e.g., one or more)
Fire	7) Wildfire, human or naturally caused	Burn intensity of recent, noticeable burns. Look for charred stumps of trees and shrubs and blackened, ashy soil surface. Herbaceous growth can mask burns quickly in riparian settings.	0=unburned 1=light burn of herbaceous understory present; minimal impact to shrubs and no "sterilized" soil 2=heavy burning of herbaceous understory and/or woody overstory	Within 100 m radius: 0=unburned 1=majority of the area burned is a light burn of herbaceous understory with minimal impact to woody vegetation 2=majority of area is heavily burned, woody vegetation and herbaceous layer mostly removed
Confirmed Direct Loss of *Spiranthes diluvialis* Individuals	8) Herbicide spraying, human harvest, disease or other mortality causes.	Dead *Spiranthes diluvialis* are difficult, or impossible, to observe; the cause of death may be unknown. Herbicide spraying is the most obvious cause. Note any mortality in "comments."	0=no mortality 1=up to 3% of herbaceous cover sprayed with herbicides 2=more than 3% of herb cover sprayed	Not measured
Wildlife Activity	9) Bedding, trampling, trails, browsing, burrowing.	Wildlife trampling, trailing, bedding, and grazing is most noticeable in areas ungrazed by livestock. The number of wildlife trails and beds and the amount of browsing are measured. **Note wildlife species (if known) in comments.**	0=no noticeable wildlife use; trace shrub browsing may be evident 1=one to two wildlife beds and/or trails visible with trampled vegetation and/or bare ground; moderate browsing 2=more than two trails and/or beds; trampling and grazing is heavy; heavy browsing	Not measured

Indirect Changes/Threats				
Vegetation Succession: Structure, Composition	10) Noxious weeds and highly invasive exotic species	Total cover of all highly invasive and noxious weed species typically associated with *Spiranthes diluvialis*. These species include, but are not limited to: *Agropyron repens, Bromus inermis, Carduus nutans, Centaurea diffusa, C. maculosa, Cirsium arvense, C. vulgare, Euphorbia esula, Phalaris arundinacea, Sonchus arvensis, Tanacetum vulgare*. Do **not** consider *Agrostis stolonifera* and *Poa pratensis* here. **Indicate the species present in the comments.**	0=zero 1=less than 10% cover 2=10% or more cover	0=none, or only widely scattered noxious weeds within 100 m radius; colonies not noticeable (only consider noxious weeds; don't include *Phalaris arundinacea*) 1=noxious weeds commonly scattered and noticeable; only small colonies, but no large colonies present 2=noxious weeds common and widespread, usually large colonies
	11) Bare ground, rocks, and litter	Estimate total cover of these elements.	0=less than 30% total cover 1=30-50% cover 2=over 50% cover	Not measured
	12) Litter depth	At the center of the sample block, hold a ruler vertically and visually average the litter depth at the center area (about an arm's length radius from the center).	Record average in centimeters.	Not measured
	13) Vegetation height	At the center of the sample block, hold a ruler vertically and visually average the vegetation height at the center area (about an arm's length radius from the center).	Record average in centimeters.	Not measured
	14) Graminoids (but not *Phalaris*)	Total cover of all mesic graminoid species typically associated with *Spiranthes diluvialis*. These species include, but are not limited to: *Agrostis stolonifera, Carex lanuginosa, C. nebrascensis, Eleocharis palustris, Juncus balticus, J. ensifolius, Muhlenbergia* spp., *Phalaris arundinacea,* and *Poa pratensis*.	0=40% or more cover 1=3 to 39% cover 2=less than 3% cover	Not measured
	15) Forbs (minus highly invasive and noxious weeds).	Total cover of all forb species in the sample block, **other than** noxious weeds (but including other weedy spp.) (*Equisetum* spp. are often associated with *Spiranthes diluvialis* and do not pose long-term detrimental competitive threat).	0=less than 30% total cover 1=30 to 50% cover 2=over 50% cover	Not measured
	16) Woody species	Total cover of all woody species (individuals do not have to be rooted within the sample block), including all shrubs and trees).	0=less than 1% cover 1=1 to 10% cover 2=10-29% cover 3=30% cover or more	Not measured

	17) Species Richness	Number of plant species present. List the three most dominant species in the comments.	0=6 or more species present 1=3-5 species present 2=1-2 species present	Not measured
Hydrologic Alteration	18) Levees, riprapping, culverts, bridges, causeways, diversions, or other development that alters the hydrology or fluvial geomorphology of the river/wetland	Number of hydrologic alterations within the landscape	Not measured	Within 400 m radius: 0=none present 1=one alteration causing minimal impact to river flow within floodplain or wetland hydrology 2=more than one alteration, or a single large one causing noticeable alteration
Conservation Information				
Population Information	19) Population tally	Is *Spiranthes diluvialis* present?	0=25 or more plants 1=11 to 14 plants 2=1 to 10 plants 3=0 plants	Not measured
Conservation	20) Exclosures, fences, or other measures (including biocontrol insects on noxious weeds) present that protect *Spiranthes diluvialis* from livestock, OHVs, weeds, recreation, or other potential impacts.	Presence or absence along and adjacent to transect and the effectiveness of the protective measure	Not measured.	Within 100 m radius: 0=exclosure or other measure present protecting the majority of the subpopulation; biocontrol insects effectively controlling noxious weeds 1=exclosure or other measure present but does not protect the majority of the sub-population (impacts not fully excluded); noxious weed biocontrol insects released, but are not yet effective 2=no exclosures or other measure present

APPENDIX 2

Field-usable data sheets for Ute ladies'-tresses (*Spiranthes diluvialis*) habitat monitoring

Data Sheet for Ute ladies'-tresses (*Spiranthes diluvialis*) Habitat Monitoring—Transect-scale Assessment

Date: _____ **EO #:** **Chester** **Subpopulation #:** _____ **Transect:** _____ **Observer(s):** _____

Table "A"

Attribute Types at the Transect Scale		2.5 m		7.5 m		12.5 m		17.5 m		22.5 m		27.5 m		32.5 m		37.5 m		42.5 m		47.5 m	
		L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R
Direct Changes/Threats																					
Hydrologic and Fluvial Geomorphic Change	1) Deposition																				
Off-Highway Vehicle Use	2) Tracking and trailing																				
Trails	3) Origin not determined (human vs. wildlife)																				
	4) Human trails																				
Recreation	5) Campsite impacts																				
Other Human-Caused Ground Disturbance	6) Roads, houses, excavation, filling, heavy equipment, firefighting, etc.																				
Fire	7) Wildfire, human or natural																				
Confirmed Mortality	8) Human harvest, disease, or other mortality																				
Wildlife Activity	9) Bedding, trampling, trails, browsing, burrowing																				
Indirect Changes/Threats																					
Vegetation Succession: Structure, Composition	10) Noxious weeds and invasive exotic species																				
	11) Bare ground, rocks, and litter																				
	12) Litter Depth																				
	13) Vegetation Height																				
	14) Graminoids (but not Phalaris)																				
	15) Forbs (minus invasive and noxious weeds)																				
	16) Woody species																				
Competition	17) Species richness																				
Conservation Information																					
Population information	19) Population tally																				

(Reminder: the lower the number the better the habitat. The higher the number, the less ideal the habitat.)

Comments for Table A (before each write attribute type and sample block (#, L or R) to which it refers):

Data Sheet for Ute ladies'-tresses (*Spiranthes diluvialis*) Habitat Monitoring—Broad-scale Assessment

Date: _____ **EO #:** **Chester** **Subpopulation #:** _____ **Transect:** _____ **Observer(s):** _____

Table "B"

Attribute Types at the Landscape Scale		**Measured at Mid-point of Transect**		**Comments**
Direct Changes/Threats		*0 to 25 m*	*25 m – (Given radius)*	
Off-Highway Vehicle Use	2) Tracking and trailing		(to 100 m)	
Trails	3) Trail, origin uncertain		(to 100 m)	
	4) Human trails		(to 100 m)	
Recreation	5) Campsite impacts		(to 100 m)	
Other Human-Caused Ground Disturbance	6) Roads, houses, excavation, filling, heavy equipment, firefighting, etc.		(to 400 m)	
Fire	7) Wildfire, human or naturally caused		(to 100 m)	
Indirect Changes/Threats				
Invasive & Noxious Weeds	10) Invasion and colonization by noxious and invasive weedy species		(to 100 m)	
Hydrologic Alteration	18) Levees, rip-rapping, culverts, bridges, causeways, diversions, other developments		(to 400 m)	
Conservation Information				
Population / Conservation Information	20) Exclosures, fences, biocontrol, or other protective measures		(to 100 m)	

(Reminder: the lower the number, the better the habitat. The higher the number, the less ideal the habitat.)

Pollinators observed? Y / N Collected? Y / N Notes:

_____

_____

Comments for Table B (before each, write attribute type (#) to which it refers:

_____

_____

_____

_____

_____

_____

_____

Photos taken:

Roll/Frame	From	Toward	Description

Line intercept data (cover in m for each side of the polygon):

Transect Length (m) _____

Transect, ending side: _____ m

Transect, side L: _____ m

Transect, side R: _____ m

Transect, start side: _____m

APPENDIX 3

Locations of habitat monitoring transects

Table 1. Locations of habitat monitoring transects. SPATIAL DATA NOT SHOWN.

Transect	2004 Subpopulation Number	Easting*	Northing*	± m	Dominant Associated Plant Species
1	4			4.9	not available
2	5			5.2	Baltic rush, cinquefoil spp., field sowthistle, creeping bentgrass
3	6			4.6	field horsetail, mat muhly, Nebraska sedge, field sowthistle, creeping bentgrass, thistle spp.
4	7			<1	mat muhly, Nebraska sedge, field sowthistle, creeping bentgrass, smooth horsetail, white clover
5	8			<1	Baltic rush, Kentucky bluegrass, creeping bentgrass, sedge spp., variegated horsetail
6	9			<1	Baltic rush, Kentucky bluegrass, Nebraska sedge, field sowthistle, creeping bentgrass, swordleaf rush

* GPS coordinates of transect start in UTM NAD 27, Zone 12T