MONITORING THE HABITAT OF UTE LADIES' TRESSES (*SPIRANTHES DILUVIALIS*) ON THE SOUTH FORK SNAKE RIVER, IDAHO— SECOND YEAR RESULTS

by

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ABSTRACT

Spiranthes diluvialis (Ute ladies' tresses) is an orchid listed as Threatened under the Endangered Species Act. It is known from 23 occurrences in eastern Idaho. From 1997 to 2002, we monitored the population and habitat of *Spiranthes diluvialis* occurrences on public land along the South Fork Snake River. In 2001, we developed, tested, and implemented easily repeatable and objective monitoring methods for measuring changes and threats to *Spiranthes diluvialis* habitat. These monitoring methods use an index of habitat change, incorporating what we have learned about *Spiranthes diluvialis* habitat characteristics and the effects of disturbance from past monitoring and floodplain dynamics research. The index consists of a checklist of habitat attributes measured at both the population (transect) scale and the landscape scale. The measurements of these habitat attributes use a relative scale, yielding cumulative values representing current habitat conditions at each transect. During 2001, 23 permanently marked habitat monitoring transects, representing 18 *Spiranthes diluvialis* occurrences on the South Fork Snake River, were established and baseline habitat condition data collected. Data was again collected at 22 transects in 2002. One additional transect was established at the island portion of the Annis Island occurrence. This report summarizes data collected in 2002 and compares the results with baseline data collected in 2001.

In 2002, five transects had large decreases in the cumulative mean of all attributes, indicating an overall improvement in habitat conditions. Five transects had large increases in the cumulative mean of all attributes, indicating an overall decline in habitat conditions. Observer error and climatic fluctuation may also be possible factors influencing changes between 2001 and 2002. Repeat photographs proved useful for documenting growth of competing vegetation, browsing by wildlife, and the amount of bare ground exposed by campsite impacts. Positive relationships between population trends and the cumulative mean of all attributes, or any specific habitat attribute, could not be confirmed for any transect. At the transect scale, the index of habitat change is very good at measuring annual changes in grazing impacts (especially late season grazing), as well as human recreation impacts and off-highway vehicle use. In 2003, improvements will be made so that the cover of competing vegetation will be more accurately estimated. At the landscape scale, habitat conditions did not change dramatically from 2001 at the majority of transects.

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INTRODUCTION

Spiranthes diluvialis (Ute ladies' tresses) is an orchid listed as Threatened under the Endangered Species Act. It is currently known from widely dispersed populations in Washington, Montana, Idaho, Utah, Wyoming, Nebraska, and Colorado. In 1996, three occurrences were discovered in riparian and wetland habitats along the floodplain of the South Fork Snake River in eastern Idaho. Subsequent searches from 1997-2002 yielded a total of 23 occurrences in eastern Idaho (22 on the South Fork Snake River and one on the Henrys Fork, northeast of St. Anthony). From 1997 to 2002, the population and habitat of *Spiranthes diluvialis* occurrences on public land along the South Fork Snake River were cooperatively monitored by the Idaho Conservation Data Center (CDC), Bureau of Land Management (BLM), and Caribou-Targhee National Forest.

After habitat and population monitoring in 2000, it was determined that an objective method of monitoring *Spiranthes diluvialis* was needed (Murphy 2000). Annual monitoring of *Spiranthes diluvialis* on the South Fork Snake River prior to 2001 relied on counting the observable population of flowering individuals and making notations regarding threats and habitat conditions at each occurrence (Moseley 1998, 2000). However, the flowering population of *Spiranthes diluvialis* is naturally highly variable year to year and annual climate fluctuations may alter the phenology of *Spiranthes diluvialis*, creating the potential for mis-timed surveys. In addition, within tall grassy habitat observers can easily miss small plants, vegetative plants, and plants in fruit. Thus, counting plants may be insufficient for determining long-term population (and meta-population) trends. Moreover, plant counts alone tell us little about the condition of *Spiranthes diluvialis* habitat. In addition, subjective notations on habitat quality may reflect observer bias and do not provide a good reference point from which to measure changes and threats to *Spiranthes diluvialis* habitat over time.

Research to accurately describe the habitat of *Spiranthes diluvialis* began in 1998. The following year, it expanded to incorporate floodplain research by Mike Merigliano of the University of Montana and BLM (Moseley 1998). The research aims to understand the primary successional pathways and the relationships between fluvial geomorphology, riparian community ecology, and river management in *Spiranthes diluvialis* habitat (Murphy 2001a). As part of this research, soil, vegetation, and floodplain data were collected at the majority of *Spiranthes diluvialis* occurrences on the South Fork Snake River. In 2001, systematic, easily repeatable monitoring methods for measuring changes and threats to the habitat of *Spiranthes diluvialis* were developed, tested, and implemented. These monitoring methods use an index of habitat change, incorporating what we have learned about *Spiranthes diluvialis* habitat characteristics and the effects of disturbance from floodplain dynamics research and past monitoring (Murphy 2001b). The index assumes that *Spiranthes diluvialis* requires riparian and wetland habitat with specific environmental characteristics and disturbance levels for population establishment and persistence (summarized in Moseley 1998, 1999). The index uses a relative scale with numeric values reflecting changes and threats to habitat quality measured at a series of permanent transects. Measurable threats and habitat disturbance factors are assumed to be agents, or indicators, of habitat change. Importantly, such an index is holistic and realizes that populations can respond to the cumulative impacts of habitat disturbance and change.

In 2001, 23 permanent habitat monitoring transects were established at 18 *Spiranthes diluvialis* occurrences on the South Fork Snake River. During late August and early September 2002, 22 of these, at 17 occurrences, were re-sampled. In addition, one new transect was established at Annis Island, to better capture variations in environmental conditions at this large occurrence. The baseline data collected in 2001 and 2002 provide a reference point for annually measuring future environmental change at both the population and landscape scale. Detailed background information, methods, and complete results from 2001 habitat monitoring are reported in "Monitoring Ute ladies' tresses (*Spiranthes diluvialis*) habitat on the South Fork Snake River, Idaho—First year results" (Murphy 2001b). This report summarizes data collected in 2002 and compares the results with 2001.

METHODS

A complete description of the methods for the index of habitat change is found in last year's report (Murphy 2001b). Detailed steps for transect establishment, photo-point monitoring, and habitat monitoring are also listed in Appendix 1 of this report. The equipment required for these procedures is also listed. Appendix 1 can be reproduced for use in the field. A field useable copy of the "*Spiranthes diluvialis* Transect Establishment and Environmental Description Data Form" is located in Appendix 2. A field useable copy of the "*Spiranthes diluvialis* Habitat Monitoring Checklist" is found in Appendix 3. A field useable copy of the "*Spiranthes diluvialis* Habitat Monitoring Tally Sheet" is in Appendix 4. No significant changes to the methodology were made in 2002, only some minor edits made for clarification. The following is a summary of the methods used in 2001 and 2002.

Transect Establishment Procedure **-** With the exception of one new transect established in 2002, all other transects were established in 2001. Transect start locations were subjectively chosen, but usually met the following criteria: they were in large *Spiranthes diluvialis* sub-populations; represented the range of plant community types and fluvial landform settings at different occurrences; captured both degraded and high quality habitat; and were adjacent to land uses or impacts likely to cause changes to *Spiranthes diluvialis* habitat. Two or more transects were established at large or heterogeneous occurrences with variable threat levels. Transects were placed to run lengthwise through the center of the sub-population being sampled. There were a few exceptions in meeting the criteria and best judgment was used when establishing transects in these locations.

Transects were rectangular belts, with a tape forming a central baseline. The belt transects were variable length, but limited to between 20 m and 50 m. The width was fixed at 5 m on each side of the baseline (totaling 10 m wide), unless the total width of the habitat allowed for only a belt only 2.5 m on each side of the baseline. The lengths and widths were chosen to create 5 x 5 m sampling blocks on each side of the baseline. The width was designed to capture changes at the edges of the *Spiranthes diluvialis* sub-population's habitat. The start of each transect was permanently marked with a re-bar stake. Semi-permanent points on higher ground (e.g., trees) were tagged to serve as a back-up for future transect re-location. Tree tags and bearings proved very valuable in re-locating re-bar stakes in 2002. All location and environmental setting data were recorded on specially designed forms (Appendix 2). Completed copies of forms for all transects are on file at the CDC.

Photo-point Monitoring Procedure **-** At the half-way point of each transect, a series of four photos were taken in the following order: 1) from the center of the transect toward the end, along the transect bearing; 2) 90 degrees from the transect bearing (right side); 3) 180 degrees from the transect bearing (toward the start); 4) 270 degrees from the transect bearing (left side). Photos were general habitat overviews, not close-ups, and a reference point was included in the foreground, as well as in the background. The annual monitoring photos are on file at the CDC.

Habitat Monitoring Procedure **-** A checklist of habitat changes and threats, both human-caused and natural, was developed for the index of habitat change (Appendix 3). The checklist was developed by utilizing descriptions of habitat conditions at *Spiranthes diluvialis* occurrences on the South Fork Snake River (Moseley 1998, 1999, 2000; Murphy 2000). The conditions at the time of original description are assumed to represent "suitable" habitat. The checklist includes important habitat attributes (i.e., habitat characteristics, changes, threats) that are assumed to affect *Spiranthes diluvialis* populations. These habitat attributes were divided into direct and indirect categories. Measurable indicators, or surrogates, for the habitat attributes were assigned numeric values reflecting different condition classes. For all attributes, the numeric values were zero, one, or two (except the population tally, which included four classes). The zero class represents "suitable" habitat conditions. The higher the number, the less suitable the current habitat conditions. These attributes were evaluated at both the population scale (within the 5 x 5 m sample blocks) and the landscape scale (at the half-way point of the transect). Habitat attribute data values were entered into the appropriate field on the *Spiranthes diluvialis Habitat*

Monitoring Tally Sheet (Appendix 4). These numeric values contributed toward index output values (i.e., means for each attribute and cumulative means for the transects). If the habitat attributes change over time, then the output values should reflect the direction and magnitude of that change. A complete description of the habitat attributes, the indicators measured, and the rationale for their inclusion, is outlined in Murphy (2001b).

RESULTS AND DISCUSSION

Transect Establishment and Environmental Description Information **-** Between August 21 and September 5, 2002, data was collected at 22 of the 23 habitat change monitoring transects established in 2001. Due to time constraints, the Gormer Canyon #4 (013) transect was not re-sampled. Also in 2002, an additional 30 m transect was established on the island portion of Annis Island to better capture the range of environmental conditions at this occurrence. At the Lufkin Bottom (011B), Lower Swan Valley (019), and Black Canyon (022) transects, the re-bar marking the start of the transect was not re-located. At these transects, new re-bar markers were re-established as close as possible (i.e., within one to two meters) of their original GPS location and at the same distance and bearing from the tree tags. Transect GPS locations, bearings, and lengths were not altered and no new *Transect Establishment and Environmental Description Data Forms* were completed. At several other transects established in 2001, missing or damaged tree tags (from wildlife and/or human activity) were replaced and additional direction notes recorded to aid future relocation. Table 1 summarizes the establishment data and environmental setting for all transects established in both 2001 and 2002.

For all transects re-sampled in 2002, there were no changes in the plant communities traversed by the belt transect, nor any changes in the fluvial landforms, soils, hydrologic regimes, or other environmental characteristics of the transects. No large flood events, or other large-scale natural or human-caused floodplain alterations occurred on the South Fork Snake River in 2002. The new Annis Island (006C) transect, like the majority of other transects, traversed a turf-like *Agrostis stolonifera-Poa pratensis* community with several native mesic graminoid species, with *Equisetum laevigatum* and *Gycyrrhiza lepidota* also intermixed (Table 1). The primary transect setting was on a low terrace adjacent to a flood overflow channel. The terrace was ephemerally moist from sub-irrigation and the adjacent channel retained water pools in low spots all year. The transect is flooded only during large flow events (e.g., in June 1997). The surface soil texture along the transect was sand and loamy sand.

Photo-point Monitoring **-** Photographs were re-taken at the midpoints of 21 transects. Very heavy rain and dark sky conditions prevented repeating photos at Warm Springs Bottom (003B) in 2002. Photos were also taken at the new Annis Island (006C) transect. In addition, a permanent photo-point was established on the mainland portion of the Black Canyon occurrence. This photo-point may serve as the mid-point of a habitat change monitoring transect to be established in the future. In general, repeat photographs were useful for documenting the growth of woody vegetation between 2001 and 2002, especially increases in canopy diameter and height. For example, photographs at Twin Bridges (007) and Lower Swan Valley (019) clearly showed an increase in shrub canopy size, especially for *Elaeagnus commutata* (silverberry) and *Salix exigua* (coyote willow). These photos supported data recorded in the sample blocks at these transects. Photographs at Mud Creek Bar (009) showed a decrease in woody vegetation cover between 2001 and 2002, likely due to beaver cutting, which also supported data recorded in the sample blocks. Repeat photographs also captured the increase in mesic graminoid cover recorded at Railroad Island (005) and Mud Creek Bar (009). A slight increase from 2001 in the cover of weedy species and forbs, especially *Cirsium vulgare* (bull thistle), was observed in photographs at Falls Campground (004B). A human-caused trail with trampled vegetation was noticeable in the 2002 photograph at TNC Island (010). Repeat photographs at Lufkin Bottom (011A) indicated an increase in the amount of bare ground exposed by campsite impacts.

Table 1. Summary of transect establishment and environmental setting data of all habitat change monitoring transects.

Occurrence (Transect Number)	Transect Length (m)	Transect Bearing (degrees)	Plant Communities Traversed by Transect	Fluvial Landforms Where Transect is Located
Kelly's Island (001)	25	4	*Elaeagnus commutata; Carex lanuginosa; Eleocharis rostellata*	floodplain wetland; flood overflow channel, without perennial water
Rattlesnake Point (002)	30	135	*Salix exigua/* mesic graminoid*; Agrostis stolonifera-Poa pratensis*	main river channel bank; fluvial terrace
Warm Springs Bottom (003A)	25	27	*Salix exigua/* mesic graminoid*; Carex lanuginosa; Agrostis stolonifera-Poa pratensis*	spring-fed channel; flood overflow channel w/perennial water; fluvial terrace; borrow pit
Warm Springs Bottom (003B)	40	330	*Salix exigua/* mesic graminoid*; Carex lanuginosa; Agrostis stolonifera-Poa pratensis*	abandoned meander, without perennial water; flood overflow channel
Falls Campground (004A)	35	248	*Elaeagnus commutata; Carex lanuginosa*	abandoned meander/oxbow, without perennial water; flood overflow channel
Falls Campground (004B)	20	265	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	flood overflow channel, without perennial water; depositional/aggrading area
Railroad Island (005)	20	126	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	backwater slough; flood overflow channel, with perennial water; fluvial terrace
Annis Island (006A)	40	324	*Populus angustifolia/* mesic graminoid*; Salix exigua/* mesic graminoid*; Carex lanuginosa*	abandoned meander/oxbow, with perennial water; floodplain wetland; borrow pit
Annis Island (006B)	30	283	*Agrostis stolonifera-Poa pratensis; Carex lanuginosa; Equisetum variegatum*	abandoned meander/oxbow, with perennial water; floodplain wetland; borrow pit
Annis Island (006C)*	30	98	*Agrostis stolonifera-Poa pratensis; Equisetum laevigatum*	flood overflow channel, with perennial water; abandoned meander/oxbow; fluvial terrace
Twin Bridges (007)	25	304	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	backwater slough; flood overflow channel, with perennial water; fluvial terrace
Lorenzo Levee (008)	n/a	n/a	n/a	n/a
Mud Creek Bar (009)	20	131	*Agrostis stolonifera-Poa pratensis*	main river channel bank; eroding cutbank; fluvial terrace
TNC Island (010)	25	290	*Agrostis stolonifera-Poa pratensis; Equisetum laevigatum*	backwater slough; flood overflow channel, with perennial water
Lufkin Bottom (011A)	50	294	*Salix exigua/* mesic graminoid*; Equisetum variegatum*	secondary river channel bank; flood overflow channel; fluvial terrace

Table 1 continued. Summary of transect establishment and environmental data setting of all habitat change monitoring transects.

Occurrence (Transect Number)	Transect Length (m)	Transect Bearing (degrees)	Plant Communities Traversed by Transect	Fluvial Landforms Where Transect is Located
Lufkin Bottom (011B)	30	81	*Agrostis stolonifera-Poa pratensis*	backwater slough; fluvial terrace
Gormer Canyon #5 (012)	n/a	n/a	n/a	n/a
Gormer Canyon #4 (013)	20	51	*Salix exigua/* mesic graminoid	main river channel bank; fluvial terrace
Pine Creek #5 (014)	30	180	*Salix exigua/* mesic graminoid*; Salix lutea/* mesic graminoid*; Equisetum variegatum*	flood overflow channel, without perennial water; floodplain wetland
Archer Powerline (015)	n/a	n/a	n/a	n/a
Pine Ck. #3 & #4 (016A)	30	329	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis*	abandoned meander/oxbow, without perennial water; flood overflow channel
Pine Ck. #3 & #4 (016B)	40	90	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis; Equisetum variegatum*	backwater slough; flood overflow channel, with perennial water; floodplain wetland
Lower Conant Valley (017)	25	213	*Elaeagnus commutata; Agrostis stolonifera-Poa pratensis*	abandoned meander/oxbow, without perennial water; flood overflow channel
Upper Conant Valley (018)	20	262	*Elaeagnus commutata*	abandoned meander/oxbow, without perennial water; flood overflow channel
Lower Swan Valley (019)	25	253	*Elaeagnus commutata*	secondary river channel bank; fluvial terrace
Squaw Creek Islands (020)	n/a	n/a	n/a	n/a
Gormer Canyon #3 (021)	25	305	*Salix exigua/* mesic graminoid*; Equisetum variegatum*	spring-fed channel; flood overflow channel, with perennial water; fluvial terrace
Black Canyon (022)	20	211	*Salix exigua/* mesic graminoid*; Equisetum variegatum*	alluvial/point bar; flood overflow channel, with perennial water

* = established in 2002

Habitat Conditions at the Population Scale—A Summary of 2002 Results by Habitat Attributes **-** The following is a summary of 2002 results, including comparisons with 2001 results, by habitat attributes. For detailed information, refer to Table 2 which summarizes the mean values for each habitat attribute measured at the population scale, as well as the cumulative mean of all attributes, for both 2001 and 2002. Transect specific results, with more detailed information, are reported following this discussion.

Hydrologic and Fluvial Geomorphic Change—Deposition and Loss of Soil Moisture (Cover of Mesic Graminoids): Seven transects had more than trace evidence of recent alluvial deposition (nearly always sand, cobble, or woody debris deposits from June 1997) in 2001, compared to six transects in 2002. Loss of soil moisture, indicated by mesic graminoid cover below 40%, was recorded in sample blocks at 14 transects in 2001, but only 10 transects in 2002. In 2002, no transects averaged less than 40% cover of mesic graminoid species for the whole transect, compared to two in 2001. Deposition and loss of soil moisture are sometimes related. For example, a large amount of sand deposition may decrease mesic graminoid cover. Deposition and loss of soil moisture were inversely related at five transects. However, mesic graminoid cover may also decrease during drought, under competition (from invasive and noxious weeds, forbs, and woody species), and with heavy livestock grazing or recreation impacts. For example, more rainfall occurred during the summer of 2002 than in the same period in 2001, leading to slightly taller and denser mesic graminoids in 2002. In addition, the taller and denser grass made the 1997 flood deposits more difficult to see in 2002. These factors are good explanations for the changes between 2001 and 2002. In addition, visually estimating the difference between 30% and 40% cover of mesic graminoids can be difficult for some observers and bias may be introduced. Future data collected for mesic graminoid cover will be an estimate of cover, instead of gross cover classes. The cover estimation will then be assigned to the appropriate cover class. This will hopefully decrease the amount of error by forcing observers to be more careful in their estimation of cover.

Invasive and Noxious Weeds: In both 2001 and 2002, 22 transects had values over zero for the invasive and noxious weeds attribute. Nineteen transects had noxious weeds (i.e., those designated under Idaho's Noxious Weed Law), often in addition to other invasive species. The other three transects had only invasive weedy species, such as *Cirsium vulgare*, *Phalaris arundinacea* (reed-canary grass), *Tanacetum vulgare* (tansy), and exotic hay grasses. *Cirsium arvense* (Canada thistle) was the most common noxious weed, observed at 17 transects. *Sonchus arvensis* (perennial sowthistle) was also common (especially on moister ground), observed at 10 transects. Ten transects had invasive and noxious weeds at relatively high levels (averaging over 10% cover for the whole transect). Six transects had large increases in the cover of invasive and noxious weeds in 2002. Changes between 2001 and 2002 at several transects may reflect fluctuations in the amount of *Cirsium vulgare*, a common biennial weed on the South Fork Snake River. This species can fluctuate in response to variations in the timing and intensity of cattle grazing. Invasion by weeds are often symptomatic of soil disturbing activities, but the exact causes of increased invasive and noxious weed cover at six transects in 2002 are complex and not explained by disturbance alone.

Livestock Grazing Impacts—Hoof Prints and Scat Piles, Forage Utilization, Trails and Bedding: Ten transects at six occurrences are currently seasonally grazed by cattle. Grazing impacts were lower at six transects in 2002 than in 2001. The most notable exception was at Annis Island in 2002, where late-season trespass cattle grazing resulted in higher impacts. Grazing outside the season of permitted use did not occur at any other transects in 2002. The index of habitat change captures changes in annual grazing impacts (especially late-season grazing) very well.

Late-season grazing presents a direct threat to *Spiranthes diluvialis* due to the increased chance of grazing and trampling of flowering plants. This can result in decreased reproduction. The BLM and the USFS performed grazing allotment inspections in 2002 to ensure compliance with the permitted season of use. If compliance with current livestock management plans continues, grazing is a negligible direct threat to *Spiranthes diluvialis*. In some situations, grazing may reduce competing vegetation to the

benefit of *Spiranthes diluvialis*. However, soil compaction and invasion by weeds and unpalatable forbs, sometimes associated with cattle grazing, are indirect threats to *Spiranthes diluvialis*.

Off-highway Vehicle Use: At Twin Bridges Island and Warm Springs Bottom (003B), 4-wheelers drove through wetlands adjacent to occupied *Spiranthes diluvialis* habitat. OHV travel was also reported at Annis Island. However, no transects at these three sites were affected. Warm Springs Bottom (003A) was the only transect impacted by OHV travel in 2002. The BLM planned to re-construct OHV barriers at Warm Springs Bottom and Mud Creek Bar in fall 2002 to prevent future OHV travel.

Recreation—Human Trails and Camping Impacts: In 2002, nine transects had recreation trails through *Spiranthes diluvialis* habitat, but only one of those transects had associated campsite impacts (e.g., other trampling related to tent sites, fire rings, kitchens, boat landings, etc.). In contrast, seven transects had recreation trails in 2001, with campsite impacts recorded at three of those transects. Although human trails and campsites occur very close to *Spiranthes diluvialis* at numerous occurrences, no trampled plants were confirmed in 2002. In 2002, the BLM and USFS conducted river patrols on the upper South Fork Snake River to ensure compliance with regulations and increase education of river users. These patrols will continue in 2003. In addition, an educational kiosk will be established at the Conant Boat Access advising recreationists to avoid *Spiranthes diluvialis*.

Other Human-caused Ground Disturbance: No recent human-caused ground disturbance (e.g., construction, excavation or filling, etc.) was documented at any transect in 2002.

Fire: A human-ignited wildfire burnt a portion of the Annis Island (006A) transect during late spring 2001. A mosaic pattern of intensity, from partial to full removal of the duff layer, was observed within the burned habitat. In general, environmental changes to this transect were minimal in 2002, indicating that this habitat was recovering from the fire. In both 2001 and 2002, similar numbers of *Spiranthes diluvialis* were observed blooming within lightly burnt areas along the transect.

Confirmed Mortality of Spiranthes diluvialis—Herbicide Spraying or Other Causes: No confirmed mortality of *Spiranthes diluvialis* was observed at any transect in either 2001 or 2002. No herbicide spraying in *Spiranthes diluvialis* habitat was observed.

Wildlife Activity: In 2002, 22 transects had measurable disturbances from wildlife (e.g., ungulate bedding, trampling or trails, and shrub browsing). In 2001, 18 transects had measurable impacts from wildlife. Impacts were mostly limited to vegetation trampling, infrequent bedding, and moderate levels of woody vegetation browsing. Importantly, 12 of these 22 transects changed dramatically between 2001 and 2002. Of all attributes, this one varied the most between 2001 and 2002 measurements. This is probably due to difficulties in discerning between different levels of browsing. More precise definitions of wildlife impacts will be developed for 2003.

Vegetation Succession—Competition by Tall and Invasive Forbs: Nineteen transects had measurable tall and invasive forb cover exceeding the zero class (30% or greater cover) in 2002, two less transects than in 2001 (Table 2). In 2002, six transects averaged between 30 and 50% cover for the entire transect each year. This was also two less transects than in 2001. Transects with forb cover averaging 30% or greater usually had high cover of *Glycyrrhiza lepidota* (licoriceroot), *Medicago lupulina* (black medic), and/or *Trifolium* species (red and white clover). The decrease may be related to relationships between cattle grazing and annual climate variation. Soil disturbed by cattle grazing or other activities may facilitate invasion by leguminous forb species. Observer error in estimating forb cover may also be a factor influencing apparent changes between 2001 and 2002. Future data collected for forb cover will be an estimate of cover, instead of gross cover classes. This will hopefully decrease the amount of error by forcing observers to be more careful in their estimation of cover.

Vegetation Succession—Competition by Shrubs and Trees: Measurable shrub and tree cover exceeding the zero class (over 1% cover) was documented at all 23 transects in both years. The cover classes chosen for this habitat attribute may have been too low. In addition, observers may have over-estimated shrub and tree cover in the sample blocks. This is the case if overhanging tree cover is counted (e.g., at Gormer Canyon #3 (021)). Future data collected for woody vegetation cover will be an estimate of cover, instead of gross cover classes, and not include overhanging tall trees. It is also possible that the shrub and tree cover attribute may be less important for determining ideal *Spiranthes diluvialis* habitat than previously thought. For example, *Spiranthes diluvialis* plants have been observed growing below the partially closed canopy of *Salix exigua* stands at several occurrences.

Population Information—Population Tally: The population of *Spiranthes diluvialis* observed along the transect (i.e., typically flowering plants) is not always a direct measure of habitat conditions. Observable population size is related to overall habitat conditions and also reflects annual climate fluctuation, prolonged dormancy, and shifting phenology. It is impossible to identify any correlations between changes in observable *Spiranthes diluvialis* numbers and changes in specific habitat attributes. The apparent population trends at occurrences were included in Table 2, determined from the 2002 status report (Murphy 2002). There was no apparent relationship between population trend and the cumulative mean for the transect. Transects with low cumulative mean values (e.g., under 0.40) did not always have increasing population trends. For example, Twin Bridges (007), TNC Island (010), and Upper Conant Valley (018) all had decreasing population trends. If attributes representing natural, or non-human related, habitat changes and threats (i.e., deposition, cover, fire, wildlife impacts, cover of mesic graminoids, forbs, and woody species, and *Spiranthes diluvialis* population tally) were removed from the analysis, the new cumulative mean values (representing predominantly human-related changes) also did not reveal any relationships with population trend. These results reinforce the fact that the number of *Spiranthes diluvialis* observed each year fluctuates as a result of numerous combined factors, including habitat conditions, climate and hydrologic conditions (not measured with this habitat monitoring method), and demographics (also not measured).

Habitat Conditions at the Population Scale—A Summary of 2002 Results by Transect **-**
Transect specific results, with detailed information, are reported in the following discussion. The focus is mainly on large changes between 2001 and 2002 (i.e., attribute value means that changed by more than 0.30 and cumulative transect means that changed by more than 0.05). Refer to Table 2 for data.

Kelly's Island (001): No major changes in habitat attributes or threats were recorded in 2002. Invasion and colonization by invasive and noxious weeds remained high, mainly due to high cover of *Sonchus arvensis* along the transect. A potential positive relationship between high cover of invasive and noxious weeds and a decreasing population trend was identified in both 2001 and 2002. In 2002, minor vegetation trampling from an infrequently used recreation trail was observed. These trails trampled vegetation, but did not expose or compact soil.

Rattlesnake Point (002): In 2002, this transect had a large decrease in the cover of invasive and noxious weeds from 2001 levels. The main invasive weed was *Cirsium vulgare*, an opportunistic species that can increase after soil disturbance (e.g., heavy grazing) but decrease under competition. Prior to 2002, cattle grazed this transect during the summer and associated livestock impacts were high. Grazing sometimes releases forbs from competition with mesic graminoid species. This may explain moderately high forb cover (mainly *Glycyrrhiza lepidota*) at this transect. Livestock grazing was eliminated in 2002 and associated hoof and scat sign and forage utilization were much lower in 2002 than in 2001. Old livestock trails were still visible in 2002. In addition, many more *Spiranthes diluvialis* were observed along the transect in 2002 than in 2001, probably due to the elimination of late-summer grazing. Overall, decreased grazing impacts and weed levels resulted in a relatively large decrease in the cumulative mean for the transect. This indicates an overall improvement in habitat conditions, but future monitoring is necessary to confirm any persistent trends.

Table 2. Mean values for habitat attribute types* calculated for all sample blocks at each transect. The cumulative mean of all attributes, as well as population trend, for each trasect is also included.

Occurrence (Transect Number)	Year of Monitoring	Apparent Population Trend (at least 3 consecutive years in same direction)	Transect Length (m) (n = # of sample blocks)	Direct Changes/Threats												Indirect Changes			Total Values for Transect (Sum of data for each category)	Cumulative Mean for Transect (tot./16/n)
				Hydrologic & Fluvial Geomorphic Change		Invasive & Noxious Weeds	Livestock Grazing Impacts			OHV Use	Recreation		Other Human Ground Disturbance	Fire	Confirmed Mortality	Wildlife Activity	Vegetation Succession		Population Information		
				Deposition	Loss of soil moisture	Invasion & colonization by weedy species	Hoofprints & scat piles	Forage utilization	Trails & bedding	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire	Herbicide spraying or other mortality	Ungulate bedding, trails, browsing; beaver	Competition by tall & invasive forbs	Competition by shrubs & trees	Population tally		
Kelly's Island (001)	2001	decreasing?	25 (n = 10)	0.00	0.00	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	1.00	2.80	64.00	0.40
Kelly's Island (001)	2002	decreasing		0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.30	0.00	0.90	2.80	65.00	0.41
Rattlesnake Point (002)	2001	unknown	30 (n = 12)	0.50	0.17	1.50	1.00	1.25	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.75	1.00	1.75	2.50	131.00	0.68
Rattlesnake Point (002)	2002	increasing?		0.33	0.08	1.17	0.17	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.83	1.08	1.67	2.17	104.00	0.54
Warm Spgs Bottom (003A)	2001	unknown	25 (n = 10)	0.00	0.00	1.10	0.90	0.80	0.90	0.00	0.50	0.00	0.30	0.00	0.00	0.40	1.20	1.70	2.60	104.00	0.65
Warm Spgs Bottom (003A)	2002	unknown		0.00	0.00	1.00	0.20	0.00	0.30	0.10	0.20	0.00	0.00	0.00	0.00	2.00	0.00	1.70	2.30	78.00	0.49
Warm Spgs Bottom (003B)	2001	unknown	40 (n = 16)	0.00	0.00	0.88	1.00	0.75	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.88	1.63	100.00	0.39
Warm Spgs Bottum (003B)	2002	unknown		0.00	0.00	0.69	1.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	1.25	0.75	1.63	106.00	0.41
Falls Campground (004A)	2001	unknown	35 (n = 14)	0.14	0.21	0.43	0.57	0.21	0.71	0.00	0.07	0.00	0.00	0.00	0.00	0.36	0.43	1.93	2.93	112.00	0.50
Falls Campground (004A)	2002	decreasing?		0.14	0.07	0.64	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.86	1.86	3.00	108.00	0.48
Falls Campground (004B)	2001	unknown	20 (n = 8)	1.00	0.50	1.38	0.25	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.88	0.63	1.38	2.75	78.00	0.61
Falls Campground (004B)	2002	decreasing?		1.00	0.63	1.38	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.88	0.75	1.13	2.75	71.00	0.56
Railroad Island (005)	2001	decreasing?	20 (n = 8)	0.75	0.75	1.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.13	1.50	3.00	60.00	0.47
Railroad Island (005)	2002	decreasing		0.25	0.00	1.63	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	1.00	0.75	1.75	3.00	68.00	0.53
Annis Island (006A)	2001	unknown	40 (n = 16)	0.00	0.00	0.25	1.00	0.13	0.44	0.00	0.00	0.00	0.00	0.75	0.00	0.31	1.25	1.75	2.25	130.00	0.51
Annis Island (006A)	2002	unknown		0.00	0.00	0.19	1.00	0.44	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.75	1.75	2.38	118.00	0.46
Annis Island (006B)	2001	unknown	30 (n = 12)	0.00	0.00	0.92	1.67	0.00	0.08	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.08	0.50	2.17	83.00	0.43
Annis Island (006B)	2002	unknown		0.00	0.00	0.75	1.00	1.33	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.50	0.58	2.92	98.00	0.51
Annis Island (006C)	2001	not established in 2001																			
Annis Island (006C)	2002	unknown	30 (n = 12)	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.75	0.42	2.58	58.00	0.30

Table 2 continued. Mean values for habitat attribute types* calculated for all sample blocks at each transect. The cumulative mean of all attributes, as well as population trend, for each trasect is also included.

Occurrence (Transect Number)	Year of Monitoring	Apparent Population Trend (at least 3 consecutive years in same direction)	Transect Length (m) (n = # of sample blocks)	Direct Changes/Threats												Indirect Changes			Total Values for Transect (Sum of data for each category)	Cumulative Mean for Transect (tot./16/n)
				Hydrologic & Fluvial Geomorphic Change		Invasive & Noxious Weeds	Livestock Grazing Impacts			OHV Use	Recreation		Other Human Ground Disturbance	Fire	Confirmed Mortality	Wildlife Activity	Vegetation Succession		Population Information		
				Deposition	Loss of soil moisture	Invasion & colonization by weedy species	Hoofprints & scat piles	Forage utilization	Trails & bedding	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire	Herbicide spraying or other mortality	Ungulate bedding, trails, browsing; beaver	Competition by tall & invasive forbs	Competition by shrubs & trees	Population tally		
Twin Bridges (007)	2001	decreasing	25 (n = 10)	0.00	0.50	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.30	1.50	2.10	55.00	0.34
Twin Bridges (007)	2002	decreasing		0.00	0.40	0.60	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	1.00	0.00	1.80	2.40	63.00	0.39
Mud Creek Bar (009)	2001	decreasing?	20 (n = 8)**	1.00	0.88	0.25	0.00	0.00	0.00	0.00	1.63	0.38	0.00	0.00	0.00	0.00	0.13	1.38	2.75	67.00	0.53
Mud Creek Bar (009)	2002	unknown		0.75	0.38	0.63	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.63	0.75	0.75	2.75	57.00	0.45
TNC Island (010)	2001	decreasing?	25 (n = 10)	0.00	0.40	1.20	0.00	0.00	0.00	0.00	0.80	0.20	0.00	0.00	0.00	0.00	0.30	0.80	2.70	64.00	0.40
TNC Island (010)	2002	decreasing		0.00	0.10	1.30	0.00	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.60	2.80	54.00	0.34
Lufkin Bottom (011A)	2001	unknown	50 (n = 20)	0.00	0.40	1.45	0.00	0.00	0.00	0.00	0.10	0.15	0.00	0.00	0.00	0.00	0.55	0.65	2.05	107.00	0.33
Lufkin Bottom (011A)	2002	unknown		0.00	0.15	1.50	0.00	0.00	0.00	0.00	0.65	0.30	0.00	0.00	0.00	0.80	0.75	0.90	1.50	131.00	0.41
Lufkin Bottom (011B)	2001	unknown	30 (n = 12)	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.50	0.67	2.58	58.00	0.30
Lufkin Bottom (011B)	2002	unknown		0.17	0.00	0.92	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.42	0.50	0.92	2.67	74.00	0.39
Gormer Canyon #4 (013)	2001	unknown	20 (n = 8)	0.00	0.13	0.50	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.63	0.00	1.75	2.63	46.00	0.36
Gormer Canyon #4 (013)	2002	not monitored in 2002																			
Pine Creek #5 (014)	2001	unknown	30 (n = 12)	0.08	1.00	0.25	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.25	1.42	2.67	78.00	0.41
Pine Creek #5 (014)	2002	unknown		0.00	0.17	0.50	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.50	2.00	2.50	81.00	0.42
Pine Ck. #3 & #4 (016A)	2001	unknown	30 (n = 12)	0.00	0.00	0.25	1.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.17	1.50	1.17	2.83	87.00	0.45
Pine Ck. #3 & #4 (016A)	2002	increasing?		0.00	0.00	0.75	1.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.50	1.00	2.92	94.00	0.49
Pine Ck. #3 & #4 (016B)	2001	unknown	40 (n = 16)	0.00	0.81	0.81	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	1.31	1.06	2.56	121.00	0.48
Pine Ck. #3 & #4 (016B)	2002	increasing?		0.00	0.00	1.06	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	1.94	1.06	2.40	123.00	0.48
Lower Conant Valley (017)	2001	decreasing?	25 (n = 10)	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.70	1.20	2.70	59.00	0.37
Lower Conant Valley (017)	2002	unknown		0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	2.80	44.00	0.28

Table 2 continued. Mean values for habitat attribute types* calculated for all sample blocks at each transect. The cumulative mean of all attributes, as well as population trend, for each trasect is also included.

Occurrence (Transect Number)	Year of Monitoring	Apparent Population Trend (at least 3 consecutive years in same direction)	Transect Length (m) (n = # of sample blocks)	Direct Changes/Threats												Indirect Changes			Total Values for Transect (Sum of data for each category)	Cumulative Mean for Transect (tot./16/n)
				Hydrologic & Fluvial Geomorphic Change		Invasive & Noxious Weeds	Livestock Grazing Impacts			OHV Use	Recreation		Other Human Ground Disturbance	Fire	Confirmed Mortality	Wildlife Activity	Vegetation Succession		Population Information		
				Deposition	Loss of soil moisture	Invasion & colonization by weedy species	Hoofprints & scat piles	Forage utilization	Trails & bedding	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire	Herbicide spraying or other mortality	Ungulate bedding, trails, browsing; beaver	Competition by tall & invasive forbs	Competition by shrubs & trees	Population tally		
Upper Conant Valley (018)	2001	decreasing	20 (n = 8)	0.13	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.63	1.00	2.88	45.00	0.35
Upper Conant Valley (018)	2002	decreasing		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.13	1.00	3.00	41.00	0.32
Lower Swan Valley (019)	2001	increasing?	25 (n = 10)	0.00	0.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.60	1.80	2.60	65.00	0.41
Lower Swan Valley (019)	2002	increasing		0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.20	2.00	2.80	63.00	0.39
Gormer Canyon #3 (021)	2001	unknown	25 (n = 10)**	0.00	1.40	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.10	2.40	79.00	0.49
Gormer Canyon #3 (021)	2002	unknown		0.00	0.20	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	1.20	1.20	2.20	75.00	0.47
Black Canyon (022)	2001	unknown	20 (n = 8)	0.00	0.88	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.38	2.00	1.75	55.00	0.43
Black Canyon (022)	2002	unknown		0.00	0.75	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.25	2.00	2.25	72.00	0.56
Total # of Transects with	2001			7	14	22	11	5	8	0	7	4	1	1	0	18	21	23	23		
Value >0 in Catagory	2002			6	10	22	8	3	6	1	9	1	0	0	0	22	19	23	23		

* attributes correspond with those in the "*Spiranthes diluvialis* Habitat Monitoring Checklist" (Appendix 3); numeric values represent classes (0, 1, or 2, except for population tally which is 0, 1, 2, 3) that reflect different habitat conditions;
**transect width is 5 m instead of 10 m

Warm Springs Bottom (003A): Intensively grazed by cattle in 2001, this transect was only lightly grazed in 2002. As a result, all habitat attributes measuring livestock grazing impacts decreased in 2002. Possibly in response to decreased late-summer grazing, the number of *Spiranthes diluvialis* observed increased in 2002. Decreased livestock grazing impacts best explained the decrease in the cumulative mean from 2001 levels. This transect has a long history of seasonal grazing disturbance that may explain the relatively high cover of invasive and noxious weeds observed in both 2001 and 2002. Recreation impacts occur, but they are relatively minor. For example, Warm Springs Bottom (003A) was the only transect with off-highway vehicle (OHV) tracking in 2002. Travel was light, with vegetation damage at one end of the transect and soil damage limited to a nearby channel bank. In addition, minor vegetation trampling from infrequently used recreation trails were observed in both 2001 and 2002. These trails trampled vegetation, but did not expose or compact soil.

One major wildlife-caused habitat change occurred at Warm Springs Bottom (003A) in 2002. In late summer, beaver dammed a secondary spring channel about 250 m below the old breached dam. Water backed up behind the beaver dam and through a culvert in the old dam, flooding the transect up to 10 cm deep. Forb cover was not easily observed because of beaver-caused flooding, but flowering *Spiranthes diluvialis* plants were observed in the shallow water. During surveys on September 4, 2002, water was draining into the main spring channel behind the old dam, creating a new drainage channel. Beaver had also entered this newly flooded area and were creating a canal through the habitat and cutting woody vegetation. *Spiranthes diluvialis* can tolerate periodic inundation, but the long-term effects of beaver-caused flooding, drainage alteration, and woodcutting are unknown.

Warm Springs Bottom (003B): Like Warm Springs Bottom (003A), Warm Springs (003B) was only lightly grazed in 2002. Associated forage utilization and cattle trailing attributes decreased in 2002. Grazing sometimes releases forbs from competition with mesic graminoid species. This may explain moderately high forb cover recorded at this transect in both 2001 and 2002. This transect had large numbers of *Spiranthes diluvialis* observed, averaging over 10 plants per sample block.

Falls Campground (004A): A livestock grazing exclosure prevents grazing on about one-half of the transect. Cattle usually graze the transect outside the exclosure after the main *Spiranthes diluvialis* growing season. Unauthorized cattle were on the site prior to surveys in 2001, resulting in higher livestock grazing impacts. This did not occur in 2002. This transect had moderate increases in the cover of invasive and noxious weeds, as well as other forbs in 2002. Increased soil moisture over 2001 levels, combined with decreased livestock grazing in 2002, may have facilitated growth of forbs and invasive weedy species in 2002. The average cover of woody species was much higher than 10% in both 2001 and 2002, despite ungulate browsing. Falls Campground (004A) was one of two transects with zero *Spiranthes diluvialis* plants observed in 2002.

Falls Campground (004B): No major changes in habitat attributes or threats were recorded in 2002. A potential positive relationship between high cover of invasive and noxious weeds and a decreasing population trend was identified at Falls Campground (004B) in both 2001 and 2002. This was mainly due to high cover of *Sonchus arvensis* and *Cirsium vulgare*. In 2002, minor vegetation trampling from infrequently used recreation trails were observed along the transect. These trails trampled vegetation, but did not expose or compact soil. No impacts from cattle grazing were observed in 2002.

Railroad Island (005): The attributes for deposition and loss of soil moisture both decreased in 2002. Deposition and loss of soil moisture are sometimes related. For example, a large amount of sand deposition from 1997 probably decreased mesic graminoid cover at this transect. However, annual soil moisture fluctuations, in response to climate variation, may also influence mesic graminoid cover. This was apparent at Railroad Island (005) which appeared very dry in 2001, but was noticeably more green and lush in 2002, making deposition harder to see. In addition, this transect also had noticeable increases in the cover of both invasive weedy species and forbs in 2002. *Phalaris arundinacea* cover is relatively high along the lower margin of the belt transect. Increased soil moisture over 2001 levels

may have also facilitated growth of forbs and *Phalaris arundinacea* in 2002. A potential positive relationship between high cover of invasive and noxious weeds and a decreasing population trend was identified. No *Spiranthes diluvialis* plants were observed along the transect in both 2001 and 2002. The Increase in the cumulative mean for the transect was best explained by increases in the cover of weeds and forbs. No other obvious human-caused habitat changes were recorded.

Annis Island (006A): As evidenced by the means of all attributes measuring livestock grazing impacts, the Annis Island transects were the most intensively grazed of all transects in 2002. This transect received late-season trespass cattle grazing in 2002. Forage utilization and cattle trailing moderately increased from 2001 levels. Forb cover decreased at Annis Island (006A) in 2002, in-part due to cattle utilization of leguminous forbs.

A human-ignited wildfire burnt a portion of the Annis Island (006A) transect during late spring 2001. A mosaic pattern of intensity, from partial to full removal of the duff layer, was observed within the burned habitat. In 2002, cover of mesic graminoids was similar to 2001 and evidence of the fire was difficult to see. There was a slight decrease in the cover of invasive and noxious weeds, as well as a decrease in tall or competitive forbs, possibly in response to the 2001 fire. In general, environmental changes to this transect were minimal in 2002, indicating that this habitat was recovering from the fire. The number of *Spiranthes diluvialis* observed blooming within lightly burnt areas along the transect was similar between 2001 and 2002.

Annis Island (006B): This transect was the most intensively grazed of all transects monitored in 2002. Attributes for forage utilization and trailing and bedding increased from 2001 levels due to late-season trespass cattle grazing. Forb cover decreased in 2002, likely due to livestock utilization of leguminous forbs. In 2002, Annis Island (006B) had the largest decrease of all transects in the number of *Spiranthes diluvialis* observed. This decrease was also probably attributable to late-season cattle grazing that may have decreased the number of flowering stems. The increase in the cumulative mean at Annis Island (006B) was clearly explained by late-season livestock grazing impacts.

Annis Island (006C): This transect was established in 2002. Overall, the habitat conditions at this transect were very good, with only low levels of noxious weeds (*Cirsium arvense*) and competitive forbs (*Glycyrrhiza lepidota*). Unlike the other Annis Island transects, cattle do not currently graze this transect because of its location on an island surrounded by deep channels. The cumulative mean for the transect was the second lowest of all transects.

Twin Bridges (007): Only a few minor changes in habitat attributes or threats were recorded in 2002. In 2002, minor vegetation trampling from infrequently used recreation trails were observed. These trails trampled vegetation, but did not expose or compact soil. Despite moderate levels of shrub browsing by ungulates in 2002, the average cover of woody species increased in 2002 due to annual growth. Repeat photographs clearly documented an increase in shrub canopy size, especially for *Elaeagnus commutata* (silverberry) and *Salix exigua* (coyote willow).

Mud Creek Bar (009): This transect had a large increase in mesic graminoid cover in 2002, due in part, to the recovery of mesic graminoid vegetation from heavy human trampling in 2001. As a result, deposits from 1997 averaging at least 5 cm deep were less noticeable in 2002 than 2001. In 2001, an outfitter camp, was established less than 15 m away from the transect. A trail from the boat landing to the camp went directly across the transect. This camp was eliminated in 2002, habitat was recovering, and both campsite and trail impacts were much lower this year. For example, only minor vegetation trampling was observed from infrequent use of the trails and boat landing. These trails had trampled vegetation, but did not expose or compact soil. There was also an increase in forb cover in 2002. The lack of human trampling in 2002, combined with increased soil moisture, may have allowed for forb invasion into disturbed areas. In addition, higher *Centaurea maculosa* (spotted knapweed) cover was recorded, possibly due to colonization of soils disturbed by human trampling in 2001. In contrast, shrub

and tree cover noticeably decreased in 2002, the result of increased beaver activity at this transect. The net effect of habitat attribute changes was a decrease in the cumulative transect mean for.

TNC Island (010): Only a few minor changes in habitat attributes or threats were recorded in 2002. Portions of the transect annually experience trampling by campers and anglers. These impacts were slightly less in 2002 than in 2001. Although there was relatively high cover of invasive weeds (mostly *Phalaris arundinacea*) in both 2001 and 2002, it is unclear if weed levels are related to recreation impacts. A potential positive relationship between high cover of invasive and noxious weeds and a decreasing population trend was identified at TNC Island (010). The cumulative mean moderately decreased in 2002. The decrease in the cumulative mean was partially explained by slightly lower use of trails and lower campsite impacts.

Lufkin Bottom (011A): Campers, boaters, and anglers trampled habitat in both 2001 and 2002. Overall, the number of recreation trails increased between 2001 and 2002 and campsite impacts increased slightly. Although mostly unchanged from 2001 levels, this transect has relatively high cover of invasive and noxious weeds. Despite recreation disturbances, Lufkin Bottom (011A) had the most *Spiranthes diluvialis* observed of any transect, averaging over 10 plants per sample block. Overall, the cumulative mean increased from 2001. This increase was partially explained by an increase in human recreation impacts. Recognition of moderate ungulate browsing, possibly overlooked in 2001, was also a factor influencing the increase in the cumulative mean.

Lufkin Bottom (011B): Impacts from camping and recreation trails were greater in 2002 than in 2001. The cover of invasive weeds and woody vegetation were also higher in 2002. *Phalaris arundinacea* was the most important invasive species present. The increase in woody vegetation was possibly due to yearly growth, or alternatively, the result of observer error. Increases in these three attributes combined to increase the cumulative mean at Lufkin Bottom (011B) in 2002.

Gormer Canyon #4 (013): This transect was not re-sampled in 2002. See Murphy (2001b) for last year's results.

Pine Creek #5 (014): The cover of mesic graminoids greatly increased in 2002 over 2001 levels. Increases in mesic graminoid cover at Pine Creek #5 (014) might be explained by decreased cattle grazing (shown by decreased cattle trailing in 2002) combined with improved soil moisture conditions. Similar factors may be responsible for the increase in the cover of invasive weeds (mostly *Cirsium vulgare*) and forbs, as well as an increase in the number of *Spiranthes diluvialis* observed. Although this transect had moderate levels of shrub browsing by ungulates in 2002, the average cover of woody species was very high and increased from 2001. Changes in recorded woody vegetation cover at this transect were most likely due to observer error, rather than actual changes due to annual growth.

Pine Ck. #3 & #4 (016A): Only a few minor changes in habitat attributes or threats were recorded in 2002. This transect had an increase in invasive weed cover (mainly *Cirsium vulgare*) in 2002. In addition, the cover of forbs (especially *Trifolium repens*) was high in both 2001 and 2002. The intensity of cattle grazing during the early summer was only slightly higher in 2001 than in 2002 (as evidenced by a decrease in cattle trailing in 2002). It is possible that annual grazing promotes leguminous forbs and releases weeds from competition with mesic graminoid species.

Pine Ck. #3 & #4 (016B): The cover of invasive weeds (especially *Cirsium vulgare*, but also *Phalaris arundinacea*), as well as the cover of forbs (mainly *Trifolium repens*), increased in 2002. Cattle grazing intensity was slightly less in 2002 than in 2001 (evidenced by decreased hoof and scat sign), possibly resulting in a flush of *Cirsium vulgare* at this transect. Grazing also sometimes releases forbs from competition with mesic graminoid species, possibly the cause of elevated *Trifolium repens* cover at this transect. Mesic graminoid cover also increased in 2002. Increases in mesic graminoid cover might be explained by improved soil moisture conditions.

Lower Conant Valley (017): The cover of mesic graminoids increased in 2002. Increases in mesic graminoid cover might be explained by improved soil moisture conditions. This transect had very low cover of invasive weeds, with only a trace amount of *Lactuca serriola* (prickly lettuce) in 2002 and zero weeds in 2001. Lower Conant Valley (017) had a large decrease in the cover of shrubs and trees. Large decreases are probably partly due to observer error, rather than totally the result of wildlife browsing, beaver cutting, or other causes. Increased mesic graminoid cover and decreased woody vegetation cover resulted in a large decrease in the cumulative mean in 2002. The cumulative mean was the lowest of all transects.

Upper Conant Valley (018): No major changes in habitat attributes or threats were recorded in 2002. This was the only transect lacking invasive and noxious weeds in 2002. Although the reason is not obvious, forb cover decreased in 2002. The cumulative mean was the third lowest of all transects.

Lower Swan Valley (019): Only a few minor changes in habitat attributes or threats were recorded in 2002. This transect had decreases in both the cover of invasive and noxious weeds and cover of forbs from 2001 levels. The reasons for these decreases were not obvious. Although Lower Swan Valley (019) had moderate levels of shrub browsing by ungulates, the average cover of woody vegetation remained high and slightly increased in 2002. Repeat photographs clearly showed an increase in shrub canopy size, especially for *Elaeagnus commutata* and *Salix exigua*.

Gormer Canyon #3 (021): Only a few minor changes in habitat attributes or threats were recorded in 2002. One change was an increase in the cover of mesic graminoids and noxious weeds (*Cirsium arvense* and *Sonchus arvensis*). Increases in mesic graminoid cover might be explained by improved soil moisture conditions in 2002. Higher cover of noxious weeds is probably due to invasion of soil disturbed by wildlife. A heavily used wildlife trail runs lengthwise through the middle of this belt transect. This wildlife trail also coincides with relatively high levels of shrub browsing by ungulates. The average cover of woody vegetation was over 10%, but some was attributable to overhanging trees.

Black Canyon (022): The most noticeable change in 2002 was an increase in forb cover over 2001 levels. Increased soil moisture in 2002 may have facilitated growth of forbs. Cover of noxious weeds (especially *Sonchus arvensis*) was high, but unchanged from 2001. Browsing by ungulates also dramatically increased in 2002 (although it is unknown if browsing was overlooked in 2001). This transect also has high cover of shrubs and trees, despite browsing by ungulates. For unknown reasons, this transect had the largest decrease in observed *Spiranthes diluvialis* of any transect in 2002. All of the above factors combined to result in a relatively large increase in the cumulative mean. While increased forb growth probably represents an actual habitat change, other changes may reflect observer error in evaluating attributes requiring cover estimations of vegetation.

***Habitat Conditions at the Landscape Scale—A Summary of 2002 Results by Habitat Attributes* -** Landscape scale habitat measurements are more useful for assessing the risk of impacts to *Spiranthes diluvialis* habitat rather than the magnitude of current or imminent threats. Table 3 summarizes the values measured for landscape scale attributes, as well as the cumulative values, at each transect. The higher the cumulative value of all attributes, the greater the number of threats at the landscape scale and higher the risk of habitat change.

Hydrologic and Fluvial Geomorphic Change—Bank Erosion: No significant bank erosion was observed at any transect in 2002.

Invasive and Noxious Weeds: In 2002, nine transects had small colonies of noxious weeds scattered within 100 m. Ten transects had widespread and/or large colonies of noxious weeds within 100 m. The total number of transects with noxious weed colonies within 100 m increased in 2002. It is difficult to

tell if this result reflects a more accurate assessment by observers, or actual changes in weed levels at the landscape scale.

Off-highway Vehicle Use: OHV use was documented within 100 m of four transects in 2002, two less than in 2001. Natural barriers (e.g., river channels, steep and brushy banks, etc.) or human-constructed barriers were usually sufficient to protect transects from direct OHV travel, except at Warm Springs Bottom and Annis Island (which is adjacent to a levee access road). The OHV barriers at Warm Springs Bottom and Mud Creek Bar were reconstructed in fall 2002 to prevent future problems.

Recreation—Human Trails and Campsite Impacts: In both 2001 and 2002, 15 transects had at least one recreation trail within 100 m. Recreation trails were often (but not always) related to camping areas and boat landings. In 2002, 10 transects were within 100 m of at least one campsite impact. In general, recreation impacts on the landscape level were most noticeable in the canyon stretch of the South Fork Snake River from Lufkin Bottom area upstream to the Pine Creek areas. The large number of transects in proximity to human trails and recreation sites underscores the risk of direct trampling of *Spiranthes diluvialis* and its habitat.

Other Human-caused Ground Disturbance: Nine transects had some ground disturbing activities within 400 m. Four of those transects had noticeable, large impacts or more than one impact. The number of transects with ground disturbances was much less than in 2001. This was due to a more careful analysis of disturbances actually within 400 m, rather than actual improvements in the landscape. No new disturbances were observed in 2002.

Roads and other floodplain development may not always directly impact *Spiranthes diluvialis* habitat, but development is often associated with the increasing risk of other threats (e.g., floodplain alteration, OHV use, weed invasion). In 2001 and 2002, the BLM Upper Snake/South Fork Snake River Land and Water Conservation Fund project acquired conservation easements on private lands along the South Fork Snake River to prevent subdivision and resort development (Murphy 2002). The Land and Water Conservation Fund project is currently negotiating more conservation easements on private lands along the South Fork Snake River.

Fire: A human-ignited wildfire burnt a portion of the landscape around the Annis Island (006A) transect during late spring 2001. By 2002, the herbaceous understory was nearly recovered and some woody vegetation was resprouting. Only some nearby cottonwood trees were apparently killed.

Alteration of the Floodplain: Nine transects had at least one physical structure impacting river hydrology within 400 m. Alteration of the floodplain has effects on the pattern, duration, and intensity of floods and associated erosion and deposition. These fluvial geomorphic changes may affect *Spiranthes diluvialis* populations and habitat. In addition, floodplain alteration is often associated with other development (e.g., roads, housing, recreation sites). No new floodplain alteration structures were observed in 2002.

Population Information—Exclosures, Biological Control, or Other Protections: Nine transects have established measures to protect *Spiranthes diluvialis* populations. To slow or reverse the spread of noxious weeds on the South Fork Snake River, the BLM has released biological control agents for *Cirsium arvense, Centaurea* species, and *Euphorbia esula* (Murphy 2001 and 2002). At least five transects have had noxious weed biological control agents released. The BLM will continue to release biological control agents along the South Fork Snake River in 2003, pending their availability.

Habitat Conditions at the Landscape Scale—A Summary of 2002 Results by Transect **-**
Transect specific results, with detailed information, are reported in the following discussion. The focus is on attributes that changed from 2001 to 2002. Refer to Table 3 for data. Only two transects had major changes in the cumulative value in 2002 (i.e., the cumulative value changed by 5 or more). Also see Murphy (2001b) for 2001 results.

Kelly's Island (001): No changes were observed for any attributes between 2001 and 2002. This transect still has widespread and large colonies of noxious weeds (especially *Sonchus arvensis*) within 100 m. It is also located within 400 m of a developed campground and associated roads. This makes the habitat susceptible to impacts from recreation trails. In addition, flood overflow channels and spring channels adjacent to the transect are forced through culverts under road causeways. Small exclosures at Kelly's Island (001), erected to protect plants from humans or trespass cattle, protect only a portion of the *Spiranthes diluvialis* sub-population in the area.

Rattlesnake Point (002): No major changes on the landscape scale were recorded in 2002. The only notable change from 2001 was the presence of a new campfire ring located about 10 m from the start of the transect (the belt transect itself was not directly affected). No noxious weed colonies were observed within 100 m in 2002. However, this transect had low amounts of other invasive weeds (not noxious weeds) present at the population scale.The distance between the transect and actively eroding cutbank was not measured in 2002. No accelerated erosion was observed.

Warm Springs Bottom (003A): This transect had the highest cumulative value at the landscape scale of any transect. Unchanged from 2001 levels, this transect still has widespread and/or large colonies of noxious weeds within 100 m. It is also located in an area of high recreation use and relatively close to established roads. This makes the habitat susceptible to impacts from OHVs and recreation activities (e.g., mostly trails, but also campsites). More than three angler trails were recorded within 100 m in 2002, an increase from 2001 numbers. In addition, OHVs by-passed the barrier on the access trail at and traveled across the transect margin. No OHV travel was observed in 2001. In fall 2002, the OHV barriers was reconstructed to prevent future access. The transect is also adjacent to an old dam that clearly altered the drainage of water backed up by a downstream beaver dam. Due to increased OHV and recreation use, as well as the influence of the old dam on drainage patterns, the cumulative value for landscape attributes increased in 2002.

Warm Springs Bottom (003B): The only notable change at this transect in 2002 was the presence of OHV use. No OHV travel was observed in 2001. In 2002, OHVs by-passed the barrier on the access trail and nearly traversed this transect.

Falls Campground (004A): No major changes on the landscape scale were recorded in 2002. This transect is located within 400 m of a developed campground and numerous heavily used angler trails are located on the channel bank close to the transect. Recreation use in the area appeared slightly higher in 2002 than in 2001. This transect is partly located within a livestock grazing exclosure that protects the majority of the *Spiranthes diluvialis* sub-population.

Falls Campground (004B): Along with Gormer Canyon #3 (021), this transect had the second lowest cumulative value for landscape scale attributes. This transect is relatively isolated from recreation impacts by its island location (surrounded by a wide channel wadeable only at low flows). This isolation may minimize livestock grazing impacts as well. The transect was heavily impacted by 1997 flood deposits and several populations of noxious weeds have colonized these deposits. OHV travel documented in 2001 (located on the other side of a wide channel from the transect) was determined to be over 100 m away and not recorded in 2002. The transect is located partially within a livestock grazing exclosure that protects the majority of the *Spiranthes diluvialis* sub-population.

Railroad Island (005): No major changes on the landscape scale were recorded in 2002. Large noxious weed colonies were observed within 100 m in 2002. These were probably overlooked in 2001 due to the thick brush around the transect. The riprap near the railroad trestle at this transect was determined to be over 400 m away from the transect and, therefore, not recorded in 2002.

Table 3. Values for habitat attribute types* measured at the landscape scale for each transect.

Occurrence (Transect #)	Year	Direct Changes/Threats							Indirect Changes		Total (excluding Bank Erosion category)
		Hydrologic and Fluvial Geomorphic Change	Invasive & Noxious Weeds	Off-Highway Vehicle Use	Recreation		Other Human Caused Ground Disturbance	Fire	Alteration of Floodplain	Population Information	
		Bank Erosion (m to cutbank)	Invasion by noxious & invasive weeds	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire, human or naturally caused	Levees, rip-rap, culverts, diversions, etc.	Exclosures, biocontrol, other protection	
Kelly's Island (001)	2001	n/a	2	0	1	0	2	0	1	1	7
Kelly's Island (001)	2002	n/a	2	0	1	0	2	0	1	1	7
Rattlesnake Point (002)	2001	12.1	1	0	1	0	1	0	0	2	5
Rattlesnake Point (002)	2002	not measured	0	0	1	1	1	0	0	2	5
Warm Spgs Bottom (003A)	2001	n/a	2	0	1	0	2	0	1	2	8
Warm Spgs Bottom (003A)	2002	n/a	2	1	2	0	2	0	2	2	11
Warm Spgs Bottom (003B)	2001	n/a	1	0	0	0	1	0	1	2	5
Warm Spgs Bottom (003B)	2002	n/a	1	1	0	0	0	0	1	2	5
Falls Campground (004A)	2001	n/a	0	0	2	0	2	0	0	0	4
Falls Campground (004A)	2002	n/a	1	0	2	0	2	0	0	0	5
Falls Campground (004B)	2001	n/a	2	1	1	0	0	0	0	0	4
Falls Campground (004B)	2002	n/a	2	0	1	0	0	0	0	0	3
Railroad Island (005)	2001	n/a	1	0	0	0	0	0	1	2	4
Railroad Island (005)	2002	n/a	2	0	1	0	0	0	0	2	5
Annis Island (006A)	2001	n/a	2	0	0	0	2	1	2	2	9
Annis Island (006A)	2002	n/a	2	0	0	0	1	0	2	1	6
Annis Island (006B)	2001	n/a	2	1	0	1	2	0	2	2	10
Annis Island (006B)	2002	n/a	1	0	0	0	1	0	2	1	5
Annis Island (006C)	2001	Not Established in 2001									
Annis Island (006C)	2002	n/a	2	0	0	0	0	0	2	2	6

Table 3 continued. Values for habitat attribute types* measured at the landscape scale for each transect.

Occurrence (Transect #)	Year	Direct Changes/Threats							Indirect Changes		Total (excluding Bank Erosion category)
		Hydrologic and Fluvial Geomorphic Change	Invasive & Noxious Weeds	Off-Highway Vehicle Use	Recreation		Other Human Caused Ground Disturbance	Fire	Alteration of Floodplain	Population Information	
		Bank Erosion (m to cutbank)	Invasion by noxious & invasive weeds	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire, human or naturally caused	Levees, rip-rap, culverts, diversions, etc.	Exclosures, biocontrol, other protection	
Twin Bridges (007)	2001	n/a	1	1	1	1	2	0	1	1	8
Twin Bridges (007)	2002	n/a	1	1	1	2	2	0	1	1	9
Mud Creek Bar (009)	2001	1.9	1	2	2	2	1	0	0	2	10
Mud Creek Bar (009)	2002	1.6	1	1	1	1	0	0	0	1	5
TNC Island (010)	2001	23.4	0	0	2	2	0	0	0	2	6
TNC Island (010)	2002	23.3	1	0	2	2	0	0	0	2	7
Lufkin Bottom (011A)	2001	n/a	1	0	1	1	1	0	0	2	6
Lufkin Bottom (011A)	2002	n/a	2	0	2	2	0	0	0	2	8
Lufkin Bottom (011B)	2001	n/a	0	0	1	1	1	0	0	2	5
Lufkin Bottom (011B)	2002	n/a	1	0	1	1	0	0	0	2	5
Gormer Canyon #4 (013)	2001	n/a	1	0	1	1	0	0	0	2	5
Gormer Canyon #4 (013)	2002	Not monitored in 2002									
Pine Creek #5 (014)	2001	n/a	0	1	1	1	0	0	0	2	5
Pine Creek #5 (014)	2002	n/a	1	0	1	1	0	0	0	2	5
Pine Creek #3 & #4 (016A)	2001	n/a	2	0	1	1	0	0	0	2	6
Pine Creek #3 & #4 (016A)	2002	n/a	1	0	1	1	0	0	0	1	4
Pine Creek #3 & #4 (016B)	2001	n/a	1	0	1	1	0	0	0	2	5
Pine Creek #3 & #4 (016B)	2002	n/a	2	0	1	1	0	0	0	2	6
Lower Conant Valley (017)	2001	n/a	1	0	0	0	0	0	0	2	3
Lower Conant Valley (017)	2002	n/a	0	0	0	0	0	0	0	2	2

Table 3 continued. Values for habitat attribute types* measured at the landscape scale for each transect.

Occurrence (Transect #)	Year	Direct Changes/Threats							Indirect Changes		Total (excluding Bank Erosion category)
		Hydrologic and Fluvial Geomorphic Change	Invasive & Noxious Weeds	Off-Highway Vehicle Use	Recreation		Other Human Caused Ground Disturbance	Fire	Alteration of Floodplain	Population Information	
		Bank Erosion (m to cutbank)	Invasion by noxious & invasive weeds	Tracking & trailing	Human trails	Campsite impacts	Roads, houses, excavation, filling, etc.	Wildfire, human or naturally caused	Levees, rip-rap, culverts, diversions, etc.	Exclosures, biocontrol, other protection	
Upper Conant Valley (018)	2001	n/a	0	0	0	0	2	0	2	2	6
Upper Conant Valley (018)	2002	n/a	0	0	0	0	1	0	2	2	5
Lower Swan Valley (019)	2001	30.5	0	0	0	0	2	0	2	2	6
Lower Swan Valley (019)	2002	31.2	0	0	1	1	1	0	1	2	6
Gormer Canyon #3 (021)	2001	n/a	2	0	1	0	0	0	0	2	5
Gormer Canyon #3 (021)	2002	n/a	2	0	0	0	0	0	0	1	3
Black Canyon (022)	2001	n/a	1	0	0	0	1	0	1	2	5
Black Canyon (022)	2002	n/a	2	0	0	0	0	0	1	2	5
Total # of Transects with Value >0 in Category	2001	4	16	6	15	10	14	1	10	21	
	2002	4	19	4	15	10	9	0	9	21	

* The attribute types and numeric values correspond with those in the Spiranthes diluvialis Habitat Monitoring Checklist" (Appendix 3). The values represent classes (e.g., 0, 1, or 2, except for the bank erosion attribute which was an actual distance) that reflect different habitat conditions.

Annis Island (006A): A variety of landscape scale threats exist at Annis Island (006A). This transect had widespread and/or large colonies of noxious weeds present within 100 m in both 2001 and 2002. Noxious weed biological control agents have been released at Annis Island. A human-ignited wildfire burnt a portion of the landscape during late spring 2001. By 2002, the herbaceous understory was nearly recovered and some woody vegetation was resprouting. Only some nearby cottonwood trees were apparently killed. The transect is isolated from the active floodplain by levees. A gravel road exists on top of the levee, allowing OHVs access to the area (although none were observed in 2002).

The cumulative value decreased in 2002 at this transect. The decrease was, in part, due to re-evaluations of 2001 data, rather than actual landscape scale habitat changes. Part of the 2002 decrease was attributable to recognizing that noxious weed biological control agents have been released, a fact overlooked in 2001. Recovery from the 2001 wildfire, combined with a re-evaluation of human-caused ground disturbance, also added to the decrease at Annis Island (006A).

Annis Island (006B): This transect also had widespread and/or large colonies of noxious weeds present within 100 m in both 2001 and 2002. Noxious weed biological control agents have been released at Annis Island. The transect is also isolated from the active floodplain by levees. A gravel road exists on top of the levee, allowing OHVs access to the area (although none were observed in 2002).

As with Annis Island (006A), the cumulative value decreased in 2002 at Annis Island (006B). The decreases were, in part, due to re-evaluations of 2001 data, rather than actual landscape scale habitat changes. Part of the 2002 decrease was attributable to recognizing that noxious weed biological control agents have been released, a fact overlooked in 2001. A re-evaluation of human-caused ground disturbance and campsite impacts also added to the decrease.

Annis Island (006C): This transect is relatively isolated from recreation, grazing, and other impacts by its island location (surrounded by a deep channel, only accessible by boat). However, levees are less than 400 m away and may influence the overall hydrologic regime in the area. Widespread noxious weed colonies are present within 100 m.

Twin Bridges (007): No major changes on the landscape scale were recorded in 2002, but a variety of threats exist. This transect had the second highest cumulative values at the landscape scale. Flood overflow channels are forced through culverts under road causeways immediately upstream of the transect. There are widespread and/or large colonies of noxious weeds within 100 m. The transect is also located in an area of high recreation use relatively close to established roads and campgrounds. This makes the habitat susceptible to impacts from OHVs and recreation activities (e.g., mostly trails, but also campsites). For example, a new fire ring was established within 100 m of the transect in 2002. The fence delimiting the campground area at Twin Bridges (007) prevents OHV access and possibly reduces human foot traffic.

Mud Creek Bar (009): The cumulative value for this transect decreased in 2002. This decrease was, in small part, due to a re-evaluation of 2001 data rather than actual landscape scale habitat changes. For example, part of the 2002 decrease was attributable to recognizing that noxious weed biological control agents have been released at this occurrence, a fact overlooked in 2001. Most of the decreases in habitat attributes at the landscape scale were due to the relocation of an outfitter camp that was adjacent to the transect in 2001. As a result of relocating the outfitter camp, recreation trail and campsite impacts, as well as OHV trailing, decreased in 2002. Although heavily used in 2001, the OHV trails located on the island were not used in 2002. However, the OHV barriers at Mud Creek Bar (009) did not prevent all OHV entry to the landscape around the transect (only old tracks from the spring were observed within 100 m). The barriers were reconstructed in fall 2002. Only the Mud Creek Bar (009) transect was at high risk of loss due to bank erosion. The transect center point was only 1.6 m from the active cutbank (0.3 m less than in 2001).

TNC Island (010): No major changes on the landscape scale were recorded in 2002. This transect is predominantly at risk from nearby heavily used campsites and associated recreation activities. In both 2001 and 2002, there were heavy recreation impacts (more than one recreation trail and more than two campsite impacts within 100 m). Active erosion was zero to minimal in 2002.

Lufkin Bottom (011A): This transect is predominantly at risk from nearby heavily used campsites and associated recreation activities. In 2002, it had heavy impacts and/or more than one trail within 100 m, an increase from 2001. Similarly, the number of campsite impacts increased in 2002. These increases in campsite impacts and associated recreation trails caused the cumulative value for landscape attributes to increase. This transect had the third highest cumulative value at the landscape scale of any transect.

Lufkin Bottom (011B): No major changes on the landscape scale were recorded in 2002. Small colonies of noxious weeds were recorded within 100 m in 2002. This may be due to a more careful assessment by observers, rather than an actual change in the landscape.

Gormer Canyon #4 (013): This transect was not re-sampled in 2002. See Murphy (2001b) for last year's results.

Pine Creek #5 (014) No major changes on the landscape scale were recorded in 2002. Small colonies and/or scattered noxious weeds were recorded within 100 m in 2002. This may be due to a more careful assessment by observers, rather than an actual change in the landscape. OHV travel documented in 2001 was determined to be over 100 m from the transects and not recorded in 2002.

Pine Ck. #3 & #4 (016A) No major changes on the landscape scale were recorded in 2002, although the cumulative value slightly decreased at this transect. This decrease was mostly due to re-evaluations of 2001 data, rather than actual landscape scale habitat changes. Part of the 2002 decrease was attributable to recognizing that noxious weed biological control agents have been released at this occurrence, a fact overlooked in 2001. The number and size of noxious weed colonies was also determined to be lower than recorded in 2001.

Pine Ck. #3 & #4 (016B) No major changes on the landscape scale were recorded in 2002. Changes were mostly due to re-evaluations of 2001 data, rather than actual landscape scale habitat changes. The number and size of noxious weed colonies was determined to be higher than recorded in 2001.

Lower Conant Valley (017) No major changes on the landscape scale were recorded in 2002. This transect had the lowest cumulative values for landscape scale attributes of all transects. This site is relatively isolated from recreation impacts by its island location (surrounded by wide channels) position far from the main river channel. This isolation may have minimized historic livestock grazing impacts as well. No noxious weed colonies were observed within 100 m of Lower Conant Valley (017).

Upper Conant Valley (018): No major changes on the landscape scale were recorded in 2002. No noxious weed colonies were observed within 100 m of this transect in both 2001 and 2002. This transect is located within 400 m of a developed recreation area, although it is on the other side of the river channel. Bank stabilizing riprap is also present within 400 m (on the opposite channel bank).

Lower Swan Valley (019): No major changes on the landscape scale were recorded in 2002. No noxious weed colonies were observed within 100 m of the transect in both 2001 and 2002. The only notable change was the establishment of a new campfire ring near the transect. This transect is within 400 m of a housing development in the floodplain. Associated bank stabilizing riprap also occurs within 400 m (upstream, on the opposite channel bank). The impacts of these developments was determined to be minimal, and the corresponding attribute values were decreased from 2001 levels. The measurement of bank erosion at Lower Swan Valley (019) was not repeated in the exact location as in 2001, so the distance to the bank was not accurate. Active erosion was probably minimal in 2002.

Gormer Canyon #3 (021): No major changes on the landscape scale were recorded in 2002. This transect had the second lowest cumulative values for landscape scale attributes. The transect is relatively isolated from recreation impacts by its location far from the main river channel. This isolation may have minimized historic livestock grazing impacts as well. The cumulative value slightly decreased in 2002. This decrease was, in part, due to re-evaluations of 2001 data, rather than actual landscape scale habitat changes. Part of the 2002 decrease was attributable to recognizing that noxious weed biological control agents have been released at this occurrence, a fact overlooked in 2001. Nevertheless, widespread and/or large colonies of noxious weeds were recorded in both 2001 and 2002. A recreation trail recorded in 2001 was determined to be over 100 m away and not recorded.

Black Canyon (022) No major changes on the landscape scale were recorded in 2002. Noxious weed colonies were determined to be large and widespread. This reflects a re-evaluation of 2001 data, rather than an actual change. Bank stabilizing riprap was observed within 400 m of the transect (on the other side of the river channel).

CONCLUSIONS AND RECOMMENDATIONS

Only a few major habitat changes were documented over the one-year monitoring period. At the transect scale, the index of habitat change was very good at measuring annual changes in grazing impacts (especially late-season grazing), as well as recreation impacts and OHV use. In 2002, five transects had large decreases in the cumulative mean of all attributes at the transect scale, possibly indicating an overall improvement in habitat conditions. Five transects had large increases in the cumulative mean of all attributes, possibly indicating an overall decline in habitat conditions. At the landscape scale, habitat conditions changed only minimally between 2001 and 2002 at the majority of transects. Repeat photographs proved useful for documenting growth of competing vegetation, browsing by wildlife, and the amount of bare ground exposed by campsites.

The index of habitat change methods developed for monitoring *Spiranthes diluvialis* habitat were designed to be a relatively quick, easily repeatable, and objective way of measuring current habitat conditions. However, attributes requiring vegetative cover estimation (e.g., mesic graminoid, forb, woody vegetation, and weed cover) changed more than expected at some transects in 2002 (relative to annual growth or climatic fluctuation). This raised the possibility that observer error could be factor and that methods needed adjustment. Similarly, the attribute measuring wildlife activity also fluctuated between 2001 and 2002 at some transects. As a result, some minor changes to the methodology are suggested for next year's habitat monitoring. In 2003, the cover of vegetation will be more accurately estimated. The definitions of classes of wildlife activity will be better defined. In addition, while it is important to document the level of wildlife activity along transects, wildlife activity has both positive and negative effects on *Spiranthes diluvialis* habitat. This attribute may be skewing the calculation of the cumulative transect mean and future calculations may exclude wildlife activity.

It is recommended that the index of habitat change method be utilized for at least the next two to four years of monitoring to assess its effectiveness for measuring habitat change. Transects with imminent habitat threats or changes should be re-sampled in 2003. If possible, transects that experienced large changes (more than +/- 0.05 in the cumulative mean of all attributes at the transect scale) should also be re-sampled in 2003. In addition, Annis Island (006C) and Gormer Canyon #4 (013), both with only one year of baseline habitat data, should be re-sampled in 2003.

Monitoring *Spiranthes diluvialis* is an important task necessary for conservation planning. These habitat monitoring methods aid land managers in systematically documenting the long-term effects of livestock grazing, recreation activities, and other direct and indirect threats to *Spiranthes diluvialis* occurrences on the South Fork Snake River. Unlike information collected with subjective methods, data collected using an

index of habitat change form a numerically determined baseline from which future *Spiranthes diluvialis* habitat changes and threats can be measured. The results provide information useful for assessing:

- the long-term viability of both individual populations and the meta-population
- the status and condition of occupied habitat
- any disturbances or threats to *Spiranthes diluvialis* occurrences
- the effects of current and proposed management and conservation actions in occupied habitat
- conservation actions needed at occurrences

The methods may also be applicable or adaptable for monitoring *Spiranthes diluvialis* on the Henrys Fork River in Idaho, as well as occurrences in other states. However, it must be remembered that transects established in 2001 and 2002 measure only a sub-sample of the entire *Spiranthes diluvialis* habitat on the South Fork Snake River. At large occurrences, currently established transects do not measure the habitat condition of the entire occurrence. New transects may need to be established at additional sub-populations. Unless transects are established at most sub-populations, additional threat and condition observations must continue, in order to meet Section 7 Biological Assessment requirements.

REFERENCES

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Murphy, C. J. 2002. Ute ladies' tresses (*Spiranthes diluvialis*) in Idaho: 2002 status report. Prepared for the Upper Snake River District, BLM and the Caribou-Targhee National Forest by the Conservation Data Center, Idaho Dept. of Fish and Game, Boise. 20 pp.

Appendix 1

Protocol and equipment needed for transect establishment, photo-point monitoring, and habitat monitoring

Transect establishment protocol:

All data (e.g., GPS recordings of re-bar and tree tag, length of transect, and compass bearing from re-bar to end, and text directions to the re-bar location) are recorded on the *Transect Establishment and Environmental Description Data Form* (Appendix 2).

1) Pound in re-bar (preferably a "potato digger" style, with a bent top) at the transect start; make sure it is centered correctly. Record the location of the re-bar with a Global Positioning System (GPS) unit. Include the error estimation given by the GPS unit. Write text direction to the re-bar location.
2) Because re-bar markers are susceptible to covering by alluvium or removal by human users of area, back-up markers are needed. Thus, tree tags, combined with the GPS recordings, are utilized to re-locate the transect for future monitoring if the re-bar cannot be found. Go to the nearest large cottonwood or juniper tree on higher ground, or any other suitable landmark that will most likely remain fixed for a long period of time on higher ground (e.g., fencepost) and put in an aluminum tree tag with an aluminum nail. Mark the following on the tag with a pen or pencil: SPIDIL/Occurrence #/A, B, or C. With tree tags, do not pound completely into bark—leave room for tree growth. This step is not necessary for obvious transect starting points.
3) Record the location of the tree tag with a GPS unit (include error) and record the compass bearing (declination corrected to quad map) and distance from the tree tag to the re-bar. In the text directions, write a brief description of the tagged tree or landmark. This is performed only the first year of monitoring. For second year monitoring, start at the photo-point monitoring procedure.
4) Run the 50 m tape (which forms the center baseline) out from the re-bar for the necessary length, through the center of the sub-population's habitat (parallel, not perpendicular, to the river shoreline, swale edge, or backwater channel edge).
5) Record the length of the transect and the compass bearing (declination corrected to the quad map) of the tape from the re-bar to the end.

Equipment needed for transect establishment:

1) 50 m tape
2) GPS unit (navigation grade is suitable)
3) rebar ("potato digger" (bent top) style preferred)
4) aluminum tree tags and aluminum nails
5) compass, preferably with declination correction on dial, and a clinometer (not necessary for habitat monitoring section)
6) *Transect Establishment and Environmental Description Data Form* (at least one for each transect)

Photo-point monitoring protocol:

1) Go to the halfway point of the transect. Take a series of four photos. Each photo should have a photo label (e.g., on a dry erase board placed in photo) with the date, SPIDIL/Occurrence #/A, B, or C, and an arrow (up arrow = down transect to end; right arrow = right side; down arrow = back to start; left arrow = left side). The photo order should be: 1) taken from the center of the transect toward the end, along the transect bearing; 2) taken 90 degrees from the transect bearing (right side); 3) taken 180 degrees from the transect bearing (toward the start); 4) taken 270 degrees from the transect bearing (left side).
2) Record the roll #, frame #, photographer's name, and any identification comments in the fields located on the *Transect Establishment and Environmental Description Data Form.*

Equipment needed for photo-point monitoring:

1) reliable camera (with batteries and film or memory); preferably a digital camera, but either a high quality, fully automatic, "point and shoot," or a SLR camera are acceptable, preferably with a wide angle lens (28-35 mm)
2) dry-erase board and black dry-erase marker for photo-point label; use paper, clipboard, and black marker as an alternative label method

Habitat monitoring protocol:

1) The tape acts as the baseline from which 5 x 5 m sample blocks on each side of the tape can be placed. For example, a 25 m transect will be sampled with 10 sample blocks, 5 on each side of the tape (Figure 1). To sample the first block on the left, walk 2.5 m along the tape, lay down your reference stick perpendicular and to the left, walk 2.5 m (you are now in the center of sample block 2.5L). Follow the *Spiranthes diluvialis Habitat Monitoring Checklist* for habitat attributes measured at the transect scale (located in column 'A' on the checklist; see Appendix 3). Enter the value for attribute in the appropriate box on the *Spiranthes diluvialis Habitat Monitoring Tally Sheet*. Utilize the comments section when necessary to explain choices or provide important information. Turn around, walk 2.5 m off the right side of the tape (into the middle of sample block 2.5R) and repeat the checklist measurements. Go 5 m down the transect tape (to the 7.5 m mark) and repeat the *Spiranthes diluvialis Habitat Monitoring Checklist* on left (7.5L) and right (7.5R). Continue this process until you reach the transect end.
2) At the transect mid-point, measure the landscape scale attributes (located in column 'B' of the *Spiranthes diluvialis Habitat Monitoring Checklist*) and enter the value for each attribute in the appropriate box on the *Spiranthes diluvialis Habitat Monitoring Tally Sheet*.

Equipment needed for habitat monitoring:

1) A 2.5 m measuring stick for quickly determining sample block boundaries; preferably one that can fold-up or break down (e.g., plastic pvc or "tent-pole" style) that is marked from the bottom at 5 cm, 10 cm, and 15 cm; these markings can be used to quickly measure deposition and stubble height/utilization
2) *Spiranthes diluvialis Habitat Monitoring Checklist* (see Appendix 3; one for each person performing monitoring)
3) *Spiranthes diluvialis Habitat Monitoring Tally Sheet* (see Appendix 4; at least one for each transect)

Appendix 2

Spiranthes diluvialis Transect Establishment and Environmental Description Data Form

Spiranthes diluvialis Transect Establishment and Environmental Description Data Form

Date _____ Observer(s) _____
Element Occurrence #_____ Element Occurrence Name _____
Transect A B C (circle one)

Transect Location

GPS coordinates of re-bar stake (UTM) _____
GPS WP or file name_____ GPS FOM or error (if known) _____

GPS coordinates of tree-tag or other "permanent" landmark (UTM) _____
GPS WP or file name_____ GPS FOM or error (if known) _____
Distance from tree-tag/landmark to re-bar _____
Compass bearing from tree-tag/landmark to re-bar _____

Transect Information

Compass bearing (declination corrected to quad map; *from* re-bar to end of transect) _____
Transect Length (m) _____

Directions (specific):

Sketch a map showing roads/trails, mileages, landmarks, bearings, and other details that will help relocate the transect in the future (if applicable, possible, or necessary):

Photo-point Information

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Photo# (taken from half-way point of transect)	Roll#	Frame#	Photographer	Comments
1 (along transect)	_____	_____	_____	_____
2 (90 degrees from transect bearing)	_____	_____	_____	_____
3 (180 degrees from transect bearing)	_____	_____	_____	_____
4 (270 degrees from transect bearing)	_____	_____	_____	_____
Others (e.g., disturbances, landmarks, etc.)	_____	_____	_____	_____

See next page on back:

Transect Establishment and Environmental Description Data Form continued . . .

Date _____ Observer(s) _____

Element Occurrence #_____ Transect A B C (circle one) Element Occurrence Name _____

Environmental Features

PLANT COMMUNITY: (circle up to 3 best that apply)

Elaeagnus commutata (syn. *E. commutata/A. stolonifera-Poa pratensis*)
Salix exigua/mesic graminoid (syn. *S. exigua/A. stolonifera-Poa pratensis*)
Agrostis stolonifera-Poa pratensis
Carex lanuginosa
Eleocharis rostellata
Equisetum hyemale and/or *E. laevigatum*
Equisetum variegatum

Other (base on currently dominant species): _____

EO DATA: Community Description (e.g., vegetation structure, canopy cover, height, density, spatial distribution, seral status, exotic species, anomalies, etc.)

_____
_____
_____
_____
_____

GENERAL DESCRIPTION: (e.g., environmental factors, water regime, adjacent vegetation, fluvial landform, erosion/deposition, fluvial age of site, etc.)

_____
_____
_____
_____

SOIL DESCRIPTION: (if possible; e.g., surface and A-horizon; circle appropriate descriptors and/or comment)

Organic
Recent Sand Deposits (1997 and after)
Sand
Loamy sand (darker color, some organic matter)
Cobble/pebble/sand mix (cobble dominated)
Mottled (used as a modifier for above classes)

Other/Comments (please describe): _____

FLUVIAL LANDFORM and POSITION OF TRANSECT: (circle one to three most descriptive)

Abandoned meander or oxbow (not linked to main channel; circle: *With* or *Without* perennial water)
Alluvial bar (e.g., developing; not on point)
Backwater slough (e.g., *with* water but little or no flow except during flooding, linked to channel)
Borrow pit/excavated ground (e.g., human caused)
Depositional/aggrading area (e.g., recent sand?)
Eroding cutbank
Floodplain wetland
Flood overflow channel (circle: *With* or *Without* perennial water)
Fluvial terrace
Levee (circle: *Natural* or *Artificial*)
Point bar (e.g., developing)
River channel bank/shore (circle: *Main Channel* or *Secondary Channel*)

Other/Comments/Size (please describe): _____

MICROTOPOGRAPHY: (circle one for each)

Vertical (perpendicular to transect): Concave Convex Flat (<3%) Patterned (microrelief of hummocks and swales) Straight (= or >3%) Undulating (macro-relief)

Horizontal (along transect): Concave Convex Flat Patterned Straight Undulating

ASPECT: (degrees) _____ **SLOPE %:** (usually perpendicular to transect; if greater than 3%) _____

% GROUND COVER: (along transect length) Soil+____Gravel+____Rock/Cobble+____Litter+____Wood+____ Moss/Lichen+____Basal Vegetation (usually about 10%)+____Water+____Other_____ = + or -100%

GROUND COVER DISTURBANCE: (e.g., % of ground surface exposed along transect caused by recent fire, mechanical action, livestock, or wildlife; circle one) Zero-trace 1 to 5% 5 to 20% 20 to 40% Over 40%

DISTURBANCE CAUSE: _____ **ANIMAL EVIDENCE:** _____

DISTURBANCE HISTORY: (type, intensity, frequency, season) _____
_____
_____

RIPARIAN FEATURES ADJACENT TO TRANSECT: **Distance from Transect Line to H_20** (m) _____

Width of Channel (base-flow, measured at lower limits of terrestrial vegetation; circle one) <10 m 10-25 m 25-50 m >50 m

Bed Material in Channel _____ **Channel Depth** (circle one) <50 cm 50-100 cm over 100 cm

Channel Entrenchment (height from lower limit of vegetation to mean high water; circle one) <50 cm 50-100 cm over 100 cm

Surface H_2O (circle one) *Perennial/Present* *Seasonal-Frequent* (almost every year, recent signs) *Seasonal-Infrequent* (only flooded during very large flow events) *Rarely, If Ever* (only flooded during extreme events, e.g., 100 year floods)

Appendix 3

Spiranthes diluvialis Habitat Monitoring Checklist

Spiranthes diluvialis Habitat Monitoring Checklist

Direct Threats and Changes to Habitat	**Attribute Type**	**Indicator or Surrogate Measured**	**"A" Transect Scale Indicator Values** ***Evaluation within 5 x 5 m sample blocks Recorded in Table "A" of Tally Sheet***	**"B" Landscape Scale Indicator Values** ***Evaluation within specific radius of the transect mid-point; Recorded in Table "B" of Tally Sheet***
Hydrologic and Fluvial Geomorphic Change	1) Bank erosion (e.g., cut-banks, meander widening, flood scouring)	Distance (perpendicular) from nearest actively eroding river channel (marked at lower limit line of terrestrial vegetation) to transect mid-point **(if 30 m or less).**	Not measured	Measured distance, per-pendicular from mid-point of transect to nearest active river channel. Describe erosion in comments.
	2) Deposition (e.g., recent sand, woody debris, or other alluvium)	Depth of recent alluvial deposits (e.g., un-consolidated silt, sand, gravel, cobble, or woody debris) deposited in the last 10 years (date estimated). Must be more than trace deposits.	0=0 to 5 cm (trace amounts in block) 1=5 to 15 cm 2=16 or more cm	Not measured
	3) Loss of soil moisture at capillary fringe caused by river down-cutting and subsequent drop in water table	Total cover of all mesic graminoid species typically associated with *Spiranthes diluvialis*. These species include, but are not limited too: *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
Invasive and Noxious Weeds	4) Invasion and colonization by noxious and invasive weedy species	Total cover of all highly invasive and noxious weed species typically associated with *Spiranthes diluvialis*. These species include, but are not limited too: *Agropyron repens*, *Bromus inermis*, *Carduus nutans*, *Centaurea diffusa*, *C. maculosa*, *Cirsium arvense*, *C. vulgare*, *Euphorbia esula*, *Phalaris arundinacea*, *Sonchus arvensis*, and *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	Within 100 m radius: 0=none, or only widely scattered noxious weeds; no colonies present **(only consider noxious weeds, do not include other invasive spp., e.g., *Phalaris arundinacea*)** 1=noxious weeds commonly scattered, but only small colonies present 2=noxious weeds common & widespread, typically large colonies
Livestock Grazing Impacts	5) Hoof prints and scat piles	Number of obvious hoof prints and scat piles from this year.	0=ungrazed 1=less than 10 prints or scat piles 2=more than 10 prints or scat piles	Not measured
	6) Forage Utilization	Stubble height of graminoids (leaves, not inflorescences) in cm (estimated with ruler at center of each 5 x 5 m sample block)	0=over 10 cm or ungrazed 1=5 to 10 cm 2=less than 5 cm	Not measured
	7) Trails and bedding (e.g., trampled or missing vegetation)	Trampled vegetation and/or bare ground (soil and gravel, not generally rocks) obviously exposed by livestock trailing or bedding (if the area is ungrazed, then assume the cause is recreation). The number of trails and beds from this year is measured.	0=ungrazed 1=one trail or bed with trampled vegetation & minimal bare ground 2=one or more trail or bed; or trail/bed with noticeable bare soil	Not measured
Off-Highway Vehicle Use Impacts	8) Tracking and trailing through population areas	Number of 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) during this year. This doesn't include heavy equipment (e.g., dozers).	0=none 1=one track set 2=two or more tracks	Within 100 m radius: 0=none visible 1=one to three track sets 2=more than three track sets

Direct Threats and Changes to Habitat	Attribute Type	Indicator or Surrogate Measured	"A" Transect Scale Indicator Values *Evaluation within 5 x 5 m sample blocks Recorded in Table "A" of Tally Sheet*	"B" Landscape Scale Indicator Values *Evaluation within specific radius of the transect mid-point; Recorded in Table "B" of Tally Sheet*
Recreation	9) Human trails	Number of recent foot trails through the sample block from this year (these can sometimes be difficult to distinguish from cattle trails; look for cattle sign).	0=none 1=one trail with trampled vegetation, minimal bare ground 2=more than one trail; or one trail with noticeable bare soil	Within 100 m radius: 0=none 1=one to three trails visible 2=more than three trails
	10) Campsite impacts (e.g., tent sites, kitchens, fire rings, boat landings, woodcutting etc.) with trampled or missing vegetation	Trampled vegetation and bare ground (soil and gravel, not generally rocks) recently exposed by human recreation activities (including, but not limited to, tent sites, kitchens, campfire rings, wood cutting, and boat landings) from this year. The number of campsites impacts is measured.	0=zero impacts 1=one distinct campsite impact, with or w/out bare ground (trampled vegetation) 2=more than one campsite impact, or one campsite impact with bare soil exposed	Within 100 m radius: 0=no impacts (zero campsites or associated impacts visible) 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	11) Roads, houses, excavation, filling, heavy equipment (e.g., blading, road building, fire fighting, etc.). Flood control activities not considered here (see Alteration of Floodplain section)	Bare ground (soil and gravel, not generally rocks) obviously exposed or deposited by human activities this year, 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, firefighting, and/or heavy equipment visible) 1=trace impacts visible (minimal or peripheral disturbance only) 2=impacts noticeable & large scale (one or more)
Fire	12) 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 & duff layer 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 burned area is a light burn of herbaceous understory with minimal impact to woody vegetation 2=majority of area is heavily burned, woody vegetation & herbaceous & duff layer mostly removed
Confirmed Direct Loss of *Spiranthes diluvialis* Individuals	13) 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, but human or wildlife may also kill plants. **Note any mortality in comments.**	0=no mortality 1=<3% of herb cover sprayed with herbicides; trace mortality 2=≥3% of herb cover sprayed; noticeable mortality of plants	Not measured
Wildlife Activity	14) Ungulate bedding, trampling, trails, grazing, and shrub browsing; beaver wood cutting, trailing, and piling.	Wildlife trampling, trailing, bedding, and grazing are 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, or only trace shrub browsing may be evident 1=one to two wildlife beds and/or trails with trampled vegetation and/or bare ground; moderate browsing 2=more than two trails and/or beds; trampling & grazing is common; heavy browsing	Not measured

Direct Threats and Changes to Habitat	**Attribute Type**	**Indicator or Surrogate Measured**	**"A" Transect Scale Indicator Values** ***Evaluation within 5 x 5 m sample blocks Recorded in Table "A" of Tally Sheet***	**"B" Landscape Scale Indicator Values** ***Evaluation within specific radius of the transect mid-point; Recorded in Table "B" of Tally Sheet***
Vegetation Succession	15) Competition by tall or invasive forbs (other than noxious weeds)	Total cover of all forb species in the sample block, **other than noxious weeds (but including other exotic spp., e.g., *Cirsium vulgare*, *Trifolium* spp., etc.); do not include *Equisetum* spp.** (*Equisetum* spp. are often associated with *Spiranthes diluvialis* and do not pose a long-term detrimental competitive threat).	0=less than 30% total cover 1=30 to 50% cover 2=over 50% cover	Not measured
	16) Competition by shrubs and trees	Total cover of all woody species (individuals do not have to be rooted within the sample block), including all shrubs and *Populus angustifolia* (or other tree species).	0=less than 1% cover 1=1 to 10% cover 2=more than 10% cover	Not measured
Alteration of Floodplain	17) Levees, rip-rapping, culverts, bridges, cause-ways, diversions, or other develop-ment that alters the hydrology or fluvial geomorph-ology of the river	Number of floodplain alterations within the landscape.	Not measured	Within 400 m radius: 0=none present 1=one alteration causing minimal impact to river flow within floodplain 2=more than one alteration, or a single large one causing noticeable alteration
***Spiranthes diluvialis* Conservation Information**				
Population Information	18) Population tally	Is *Spiranthes diluvialis* present?	0=25 or more plants 1=11 to 24 plants 2=1 to 10 plants 3=0 plants	Not measured
	19) Exclosures, fences, or other measures (including bio-control insects for noxious weed control) 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 sub-population; biocontrol insects effectively controlling noxious weeds 1=exclosure or other measure present, but it does not protect the majority of the sub-population (impacts not fully excluded); noxious weed biocontrol insects released, but not yet effective 2=no exclosures or other measures present

Appendix 4

Spiranthes diluvialis Habitat Monitoring Tally Sheet

***Spiranthes diluvialis* Habitat Monitoring Tally Sheet**

Date _____ Observer(s) _____

Element Occurrence #_____ Transect A B C (circle one) Element Occurrence Name _____

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	2) Deposition																				
	3) Loss of soil moisture																				
Invasive & Noxious Weeds	4) Invasion & colonization by invasive & noxious weeds																				
Livestock Grazing Impacts	5) Hoof prints & scat piles																				
	6) Forage utilization																				
	7) Trails & bedding																				
OHV Use	8) Tracking & trailing																				
Recreation	9) Human trails																				
	10) Campsite impacts																				
Other Human Ground Disturbance	11) Roads, houses, excavation, filling, heavy equipment, firefighting, etc.																				
Fire	12) Wildfire																				
Confirmed Mortality	13) Herbicide spraying or other mortality																				
Wildlife Activity	14) Ungulate bedding, trails, trampling, brows-ing; beaver activity																				
Indirect Changes/Threats																					
Vegetation Succession	15) Competition by tall or invasive forbs																				
	16) Competition by shrubs & trees																				
Conservation Information																					
Population Information	18) Population tally																				

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

_____

_____

_____

_____

_____

_____

Table "B" on back . . .

Table "B"

Attribute Types at the Landscape Scale		Measured at Mid-point of Transect	Comments
Direct Changes/Threats			
Hydrologic and Fluvial Geomorphic Change	1) Bank erosion		
Invasive & Noxious Weeds	4) Invasion and colonization by noxious and invasive weedy species		
Off-Highway Vehicle Use	8) Tracking and trailing		
Recreation	9) Human trails		
	10) Campsite impacts		
Other Human Caused Ground Disturbance	11) Roads, houses, excavation, filling, heavy equipment, firefighting, etc.		
Fire	12) Wildfire, human or naturally caused		
Indirect Changes			
Alteration of Floodplain	17) Levees, rip-rapping, culverts, bridges, causeways, diversions, other development		
Conservation Information			
Population Information	19) Exclosures, fences, biocontrol, or other protective measures		

Additional comments (before each write attribute type (#) and sample block (#, L or R) to which it refers):

Submitted by:

_____

Chris Murphy
Botanist
Conservation Data Center
Idaho Department of Fish and Game

Approved by:

_____

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