THE STATUS OF *CAREX ABORIGINUM* (INDIAN VALLEY SEDGE) IN IDAHO—AN UPDATE

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February 2002

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Prepared for Idaho Department of Parks and Recreation
Through Section 6 Funding From
U. S. Fish and Wildlife Service

SUMMARY

Carex aboriginum (Indian Valley sedge) is endemic to a very narrow area of west-central Idaho. It was first collected in 1899 in Indian Valley, east of Cambridge in Adams County, Idaho. *Carex aboriginum* was not reported again for 100 years until it was re-discovered near Council, Idaho. Prior to this re-discovery, *Carex aboriginum* was presumed globally extinct. *Carex aboriginum* is currently known from only four occurrences, two of which were discovered during field surveys conducted in 2001. Population, habitat, threat, and other information was collected at three of the four occurrences. *Carex aboriginum* grows on ephemerally moist sites, including mesic graminoid meadows and grass-dominated gaps within scrub-shrub riparian zones. It often grows on low alluvial terraces adjacent to intermittent creeks, but it has also been collected along a wet ditch. In general, *Carex aboriginum* habitat is transitional between wet, flooded sites and dry, upland areas. Two occurrences have less than 15 plants each, and both of these occurrences each occupy less than 10 square meters of habitat. One occurrence has approximately 200 plants; it may be the only occurrence viable in the long-term. Cattle grazing was documented at two occurrences and associated impacts, such as trampling and direct grazing of plants, as well as damage to streambanks and soil compaction, may pose a threat to the long-term viability of *Carex aboriginum* populations. Invasive exotic species were present at all three occurrences visited in 2001. Some of these exotic species are highly competitive and their invasion may be detrimental to *Carex aboriginum*. Information collected in 2001 indicates that *Carex aboriginum* remains one of Idaho's rarest and most imperiled plant species. Without actions to conserve and expand current populations, this species may qualify for listing under the Endangered Species Act.

ACKNOWLEDGEMENTS

Section 6 funding for this project was provided by the U. S. Fish and Wildlife Service, Region 1, through the Idaho Department of Parks and Recreation. Mering Hurd, with the U. S. Forest Service Rocky Mountain Research Station, provided valuable insights on the biology of *Carex aboriginum*. Ann DeBolt and Jack Larocco, with the Lower Snake River District of the Bureau of Land Management, gave additional assistance. Special thanks go to the landowner for granting us permission to conduct surveys on his land, and for his interest in the conservation of natural resources. Shelley Cooke, with the Idaho Conservation Data Center, entered and managed data for this project. Michael Mancuso, of the Idaho Conservation Data Center, and Terry Vernholm, of the Idaho Department of Fish and Game, reviewed the report.

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INTRODUCTION

Carex aboriginum (Indian Valley sedge) is an easily identified sedge species endemic to a very narrow area of west-central Idaho. It was first collected by Marcus E. Jones in 1899 in Indian Valley, east of Cambridge in Adams County, Idaho. *Carex aboriginum* was not reported again for 100 years until it was re-discovered near Council, Idaho. Prior to its re-discovery, *Carex aboriginum* was presumed globally extinct because numerous surveys had failed to re-locate the species and most of Indian Valley's moist bottomland habitat had been converted to agriculture (Moseley 1990). Currently, *Carex aboriginum* is known from only four occurrences in the world. All occurrences are relatively small and potentially threatened by current land uses and/or exotic weed species invasion. Three occurrences are located on private land, only one of which is protected. Three of the occurrences are clustered between Mesa and Council, Idaho. The fourth occurrence is disjunct from the other three, located in Washington County, about 25 miles south of Council.

Carex aboriginum grows on ephemerally moist sites, including mesic graminoid meadows, as well as grass-dominated gaps within scrub-shrub riparian zones. *Carex aboriginum* often grows on low alluvial terraces adjacent to intermittent creeks, but it has also been collected along a wet ditch. In general, *Carex aboriginum* habitat is transitional between wet, flooded sites and dry, upland areas. It is often found on the margins of riparian or wetland areas. These productive habitats are often used for cattle grazing.

Carex aboriginum is one of Idaho's rarest plant species and a species of high conservation concern. It is on the Lower Snake River District Bureau of Land Management (BLM) Special Status Plant List. In 2001, the Idaho Conservation Data Center (CDC) received funding from the U. S. Fish and Wildlife Service (USFWS) to perform field surveys and assess the conservation status of *Carex aboriginum*. Prior to this survey, information regarding the biology, ecology, range, and habitat conditions of *Carex aboriginum* was lacking.

METHODS

Field surveys for *Carex aboriginum* were performed between May 21 and June 6, 2001. At the start of the surveys, only the Mesa (002) occurrence was known. The occurrence at the locality of the original collection of *Carex aboriginum*, east of Salubria in Indian Valley (001), was presumed extirpated. Prior to field surveys, I looked at herbarium specimens of *Carex aboriginum* housed at the U. S. Forest Service Rocky Mountain Research Station in Boise to learn how to identify the species. I then visited the Mesa (002) occurrence and developed a proper field search image for the species and its habitat. Next, topographic maps, National Wetlands Inventory maps, land ownership maps, and field reconnaissance were used to determine areas of potential habitat for surveys. The study area was centered at Indian Valley, with surveys conducted around Council, from Goodrich to Cambridge, around Indian Valley, and in the North Crane Creek basin.

The original Mesa (002) occurrence was thoroughly surveyed on May 30 and May 31. Surveys consisted of meandering, loosely gridded transects through potential habitat. During the first week of surveys, only a few wet meadows were found, and these were often heavily grazed and difficult to survey. Most surveys concentrated along seasonal, intermittent creeks with adjacent moist, grassy banks and terraces. On June 1, I stumbled upon *Carex aboriginum* within the scrub-shrub riparian zone at Lower School Creek (003). With this discovery, the potential habitat for *Carex aboriginum* was redefined to include creeks with scrub-shrub vegetation (e.g., willows and hawthorne). Subsequent surveys included these types of creeks and led to the discovery of an additional occurrence at Sheep Creek/North Crane Creek Confluence (004) on June 5. Although *Carex aboriginum* is a distinctive species in the field, identification was confirmed using "Vascular Plants of the Pacific Northwest" (Cronquist 1969). Flowering heads (present at all occurrences surveyed) are required for positive identification, though vegetative characteristics (e.g., thin blue-green leaves, rhizomatous character) can also be useful. No voucher specimens were collected at the Lower School Creek (003) and Sheep Creek/North Crane Creek Confluence (004) occurrences because of their small population sizes. After field surveys were completed, an additional occurrence was reported at Council (005). I did not visit this site in 2001.

The field survey project had four main goals:

1) To re-locate the previously reported occurrence of *Carex aboriginum*. At this occurrence, and any others discovered during surveys, the following information was documented:
   a) exact locations of occurrence (utilizing a navigation grade GPS unit and topographic maps)
   b) occurrence size and demographic characteristics
   c) physical habitat and substrate features
   d) associated plant communities and species (including other rare species); nomenclature for all species in the report follows the PLANTS Database (National Resources Conservation Service 2001).
   e) current land uses and threats

   This information was entered into the CDC database to generate detailed Element Occurrence Records (Appendix 1). An occurrence is standard database device used throughout the Natural Heritage/Conservation Data Center network for tracking rare species, or "elements." Occurrences represent a specific geographic location and may or may not be equivalent to the biological definition of a population. The three-digit code assigned to each occurrence corresponds to the reference number used by the CDC database. The occurrence locations of *Carex aboriginum* were also mapped (Appendix 2).

2) To document baseline habitat conditions by taking photos and sampling vegetation plots at each occurrence. This information can be used for initiating a systematic monitoring program in the future. Table 1 summarizes information regarding monitoring photos and vegetation plots. Locations of habitat monitoring photos and vegetation plots were not permanently marked with re-bar, but the center of distinct sub-populations and/or vegetation plots were mapped using a GPS unit. Locations are documented in the Element Occurrence Records (Appendix 1). At representative sub-populations, the plant community supporting *Carex aboriginum* was described from vegetation plots. Cover of all species in the vegetation plot was estimated using methods modified from Bourgeron et al. (1992). A 0.1-acre circular plot was used in the meadow at the Mesa (002) occurrence. However, the small patch sizes of habitat at the Lower School Creek (003) and Sheep Creek/North Crane Creek Confluence (004) occurrences required a much reduced plot size (5 x 2 meter rectangle) to avoid sampling adjacent unsuitable *Carex aboriginum* habitat. Photos were taken at each sub-population. At the main sub-population at the Mesa (002) occurrence, photos were taken at 0, 45, 90, 135, 180, 225, 270, and 315 degrees from the center of the vegetation plot. At other sub-populations, close-up photos, mid-range overview photos (about five meters away at oblique angles), and long-range overview photos were taken. An automatic camera with a wide-angle lens was used. Habitat monitoring photos, with descriptions of their locations, and vegetation plot data are on file at the CDC.

Table 1. Summary of information regarding monitoring photos and vegetation plots.

Occurrence (#)	# of Photos	Vegetation Plots (Size)	Location Notes
Mesa (002)	a) 8 b) 2 c) 4	a) 0.1 acre b) no plot c) no plot	a) main sub-population, in meadow at upper end of basin b) middle sub-population, along intermittent stream c) lower sub-population, next to cattle-watering pond
Lower School Creek (003)	a) 2 b) 2 c) 3 d) 3	a) no plot b) 5 x 2 m c) 5 x 2 m d) no plot	a) upper sub-population, at upper end south of trail b) middle sub-population, north channel c) middle sub-population, south channel d) lower sub-population, at lower end near cottonwoods
Sheep Ck./North Crane Ck. Confluence (004)	4	5 x 2 m	below and south of power line pole near confluence

3) To search public land supporting potential habitat for new occurrences. Surveys were performed both at the margins of, and within, the hypothesized range of *Carex aboriginum*. Location, population, habitat, and threat data were also collected at any newly discovered occurrences. Searched areas where no *Carex aboriginum* was found are mapped in Appendix 3.

4) To assess the conservation status of *Carex aboriginum* and make any necessary recommendations regarding conservation management.

RESULTS

Detailed population, habitat, and threat information was collected at the previously known Mesa (002) occurrence. Two new occurrences (Lower School Creek (003) and Sheep Creek/North Crane Creek Confluence (004)) were found during my survey, and population, habitat, and threat information was collected at these sites. I learned of the Council (005) occurrence after this year's field surveys were completed. As a result, I was unable to visit this occurrence in 2001, and no population, habitat, or threat information is available. Only a few other ephemerally wet mesic graminoid meadows with *Carex* species were found in the Indian Valley region. These areas of potential habitat were searched, but no *Carex aboriginum* was found. Thorough, but unsuccessful, searches of intermittent or seasonally flowing stream terraces were also conducted. Importantly, *Carex aboriginum* was found growing within scrub-shrub riparian zones of intermittent creek bottoms. This habitat was not known to support *Carex aboriginum* prior to this survey.

Carex aboriginum remains one of Idaho's rarest and most imperiled plant species. Globally, *Carex aboriginum* is known from only four extant occurrences in Idaho. The Indian Valley (001) occurrence is still presumed extirpated based on current land uses in the Salubria/Indian Valley area. The Lower School Creek (003) and Sheep Creek/North Crane Creek Confluence (004) occurrences have less than 15 plants each, and both of these occurrences each occupy less than 10 square meters of habitat. The Mesa (002) occurrence has approximately 200 plants, although most *Carex aboriginum* occurs in one large sub-population. This occurrence may be the only one viable in the long-term. Cattle grazing was documented at the Mesa (002) and Sheep Creek/North Crane Creek Confluence (004) occurrences, though the season of use was different at each site. Grazing impacts, such as trampling and direct grazing of plants, as well as damage to streambanks and soil compaction, may pose a threat to the long-term viability of *Carex aboriginum* populations. Invasive exotic species were present at all three occurrences visited in 2001. Some of these exotic species are highly competitive and their invasion may be detrimental to *Carex aboriginum*. Additional surveys of potential habitat not visited in 2001, as well as habitat and population monitoring of known occurrences, are needed to better assess the long-term conservation of *Carex aboriginum* in Idaho.

TAXONOMY

Scientific name: *Carex aboriginum* M. E. Jones

Full bibliographic citation: Jones, M. E. 1910. Montana botany notes. Bulletin University of Montana 15: 69-70.

Type specimen: Jones s. n., July 12, 1899, Indian Valley, Southern Idaho, near Salubria. 2300 feet (Lenz 1986). The type specimen is located at Claremont College, Pomona, California (POM). The specimen was annotated by F. J. Hermann in 1964.

Pertinent synonyms: none

Common name: Indian Valley sedge

Size of genus: There are over 1,000 species of *Carex* (sedge), with the greatest species diversity in moister areas of the northern temperate and arctic zones (Cronquist 1969). There are over 500 species known from North America and *Carex* is one of the largest genera in Idaho's flora. In their field guide, Hurd et al. (1998) treated 114 species from the Great Basin, southern Idaho, and adjacent Oregon and Wyoming . Hermann (1970) treated 165 taxa from the Rocky Mountains in his guide.

Family name: Cyperaceae

Common name for family: sedge

History of knowledge of taxon: *Carex aboriginum* was first collected by Marcus E. Jones, a botanist, geologist, and mining engineer, on July 12, 1899 (Lenz 1986). He collected the species during exploration of Indian Valley, at Salubria (east of the current town of Cambridge) in what is now Adams County, Idaho. *Carex aboriginum* was not reported again for 100 years until Curtis Bjork, of Washington State University, collected it on May 28, 1999, south of Council, in Adams County, Idaho (Conservation Data Center 2002). Prior to this collection, *Carex aboriginum* was presumed globally extinct because numerous surveys had failed to re-locate the species and most of Indian Valley's moist bottomland habitat had been converted to agriculture (Moseley 1990). Based in part on this presumption, Hurd et al. (1998) did not include the species in their recent "Field guide to Intermountain sedges." On May 18, 2000, Joy Handley, of University of Wyoming, collected *Carex aboriginum* in a roadside ditch on the south side of Council, Idaho (Handley and Hartman 2001). During my 2001 inventory, I discovered two more *Carex aboriginum* sites and revisited the population Curtis Bjork discovered. One of the new sites was between Bjork's collection site and Handley's site, on lower School Creek (four miles south-southwest of Council). The other site is located about 25 miles south of Council, on lower Sheep Creek in Washington County.

Alternative taxonomic treatments: *Carex aboriginum* is recognized as a distinct species by several taxonomic treatments (e.g., Cronquist 1969; Hermann 1970). No alternative taxonomic treatments have been proposed since its original description. Mackenzie misapplied the name *Carex aboriginum* to a variety of *Carex parryana* (Moseley 1990). Although the two species share the character of variable distribution of male and female flowers, they are otherwise completely different (Cronquist 1969; Hermann 1970).

LEGAL OR OTHER FORMAL STATUS

NATIONAL

U. S. Fish and Wildlife Service: In 1976, *Carex aboriginum* was formally recommended for listing as endangered (Moseley 1990). In 1980, it was designated a Category 1 candidate for listing. Its status was revised to the Category 2 candidate list in 1985 until this list was abolished in 1996. Since 1996, *Carex aboriginum* has had no formal U. S. Fish and Wildlife Service status.

Bureau of Land Management: *Carex aboriginum* is currently on the Lower Snake River District BLM Special Status Plant List (Atwood et al. 2000).

U. S. Forest Service: *Carex aboriginum* was not on the threatened, endangered, proposed/petitioned, and sensitive plant species list for the Boise, Payette, and Sawtooth National Forest plan revision (U. S. Department of Agriculture 2000).

Other current formal status recommendations: NatureServe, representing the network of Natural Heritage Programs and Conservation Data Centers, has assigned a global rank of G1 (critically imperiled because of extreme rarity) to *Carex aboriginum* (Conservation Data Center 2002). Prior to 1999, its rank was GX (believed to be extinct throughout its range).

STATE

Idaho Conservation Data Center: The CDC assigns a state conservation rank of S1 (critically imperiled) to *Carex aboriginum* due to its limited distribution and few known occurrences (Conservation Data Center 2002).

Idaho Native Plant Society: The INPS currently lists *Carex aboriginum* as a Global Priority 1 species (similar to NatureServe's rank) with a threat rank of 2 (a species with imminent, high magnitude threats) (Idaho Native Plant Society 2001).

DESCRIPTION AND IDENTIFICATION

General non-technical description: The following description is adapted from Cronquist (1969). *Carex aboriginum* stems are loosely clustered on short rhizomes. It has blueish-green leaves that are narrow and flat (about 2 to 4 mm wide) and restricted to the lower one-third of the stem. The flowering stems are about 1 m tall, exceeding the leaves by up to 60 cm. There are three or four short, cylindrical spikes (each up to 1.5 cm long) per flowering stem. The spikes are erect or ascending, their weight tending to cause the stems to droop. The terminal spike is staminate, while the lateral spikes are pistillate, staminate, or mixed (staminate above pistillate). The bract subtending the lowest spike equals or clearly exceeds the inflorescence. The pistillate scales are reddish-brown and are narrower and shorter than the perigynia. The perigynia is greenish when immature, but becomes coppery-tinted pale brown when mature. The perigynia is ovate to elliptic, somewhat inflated, about 5 mm long, and has a prominent beak. The perigynia are ascending to spreading, or the lower ones are reflexed. The achene is triangular, with three stigmas.

Technical description: *Carex aboriginum* has been described by Cronquist (1969), Hermann (1970), Davis (1952), and Jones (1910). The full technical description by Cronquist (1969) can also be found in Moseley's status report (1990). Refer to these publications for the full technical description.

Local field characters and identification aids: *Carex aboriginum* resembles *Carex raynoldsii* (Raynold's sedge), to which it is probably related (Cronquist 1969; Moseley 1990). Hermann (1970) believes *Carex aboriginum* is closely related to *Carex serratodens*, a species distributed from southern Oregon, through California, to northeastern Arizona (Moseley 1990). *Carex raynoldsii* differs by having smaller perigynia (3.3 to 4.4 mm long) that are abruptly contracted to a short, scarcely bidentate beak (Cronquist 1969; Hurd et al. 1998). The perigynia appear plump and congested in the spike versus pointy and spreading as in *Carex aboriginum*. *Carex raynoldsii* has stiff, ascending leaves that are often wider than the lax leaves of *Carex aboriginum*. *Carex aboriginum* also resembles *Carex buxbaumii* (Buxbaum's sedge); they both have nearly elliptical perigynia, narrow bluish-green leaves, and short terminal gynacandrous clavate spikes (Cronquist 1969; Hurd et al. 1998). Unlike *Carex aboriginum*, *Carex buxbaumii* grows at higher elevations in wet meadows, fens, and peat bogs. *Carex buxbaumii* is best distinguished from *Carex aboriginum* by having pistillate scales distinctly longer than its perigyina. *Carex aboriginum* is easily distinguished from other *Carex* species with which it might be associated (e.g., *C. athrostachya* (slenderbeak sedge), *C. deweyana* (Dewey's sedge), *C. nebrascensis* (Nebraska sedge), *C. praegracilis* (clustered field sedge), and *C. sheldonii* (Sheldon's sedge)). *Carex sheldonii* differs by having light green leaves and long cylindrical spikes (over 2 cm long) bearing hairy perigynia (Cronquist 1969; Hurd et al. 1998). *Carex athrostachya*, *C. deweyana*, *C. nebrascensis*, and *C. praegracilis* all have lenticular achenes with two stigmas. These four species all have spikes that are distinctly different from *Carex aboriginum*. The bluish-green leaves of *Carex nebrascensis* are thick, firm, and wider than the leaves of *Carex aboriginum*. *Carex deweyana* and *C. praegracilis* resemble *Carex aboriginum* (i.e., they both have soft, narrow leaves born from short rhizomes) in vegetative character. *Carex athrostachya* differs by being densely tufted.

Photos and line drawings: Line drawings of *Carex aboriginum* are found in Jones (1910) and Cronquist (1969). These drawings can also be found in Packard (1979) and Moseley (1990); they are not reproduced in this report. Figure 1 includes photos of *Carex aboriginum*. Other photos are on file at the CDC.

Figure 1. Photos of *Carex aboriginum*. Top-right photo is courtesy of Anne DeBolt, BLM; bottom-right photo is at lowest sub-population at Lower School Creek (003) (taken on June 1, 2001); left photo is courtesy of Mering Hurd, U. S. Forest Service Rocky Mountain Research Station.

DISTRIBUTION

Global distribution and precise occurrences in Idaho: *Carex aboriginum* is known from only four extant occurrences in the world. All occurrences are located in Adams County, and adjacent Washington County, in west-central Idaho. Figure 2 shows the known range of *Carex aboriginum*. Three occurrences (Mesa (002), Lower School Creek (003), and Council (005)) are found along a six-mile long line located between the towns of Mesa and Council, Idaho. The fourth occurrence, Sheep Creek/North Crane Creek Confluence (004), is disjunct from the other three. It is located in Washington County, about 25 miles south of Council. The Indian Valley (001) occurrence is the original Jones type locality. The location information on the herbarium label is very general (i.e., Indian Valley near Salubria, east of the current town site of Cambridge, Idaho). It is presumed the original population has been extirpated due to the conversion of privately-owned moist bottomlands to agriculture in the Indian and Salubria valleys (Moseley 1990). However, with the discovery of *Carex aboriginum* growing in a wet roadside ditch near Council (005), the possibility of *Carex aboriginum* being found on ditch or streambanks within relict habitat in Indian Valley should not be dismissed. Population, location, habitat, threat, and other conservation information is detailed in the Element Occurrence Records (Appendix 1; Conservation Data Center 2002). The precise locations of extant occurrences are mapped in Appendix 2. The four extant occurrences are summarized below:

Mesa (002): This occurrence is located about two miles northwest of the community of Mesa and about 1.5 miles south-southeast of the Middle Fork Weiser and Weiser River confluence on private land. Patches of *Carex aboriginum* are distributed in a broad valley/basin, with the main sub-population at the upper end of this basin in an ephemerally moist meadow. Location: T.15N, R.1W, S. 9 and S. 8.

Lower School Creek (003): This occurrence is comprised of four sub-populations scattered along lower School Creek located 0.3 to 1.0 miles west-southwest of the community of Mesa Siding (about 4 miles south of Council). At least three of the four sub-populations lie within the Weiser River Trail easement managed for recreation and open space protection. Location: T.16N, R.1W, S. 33.

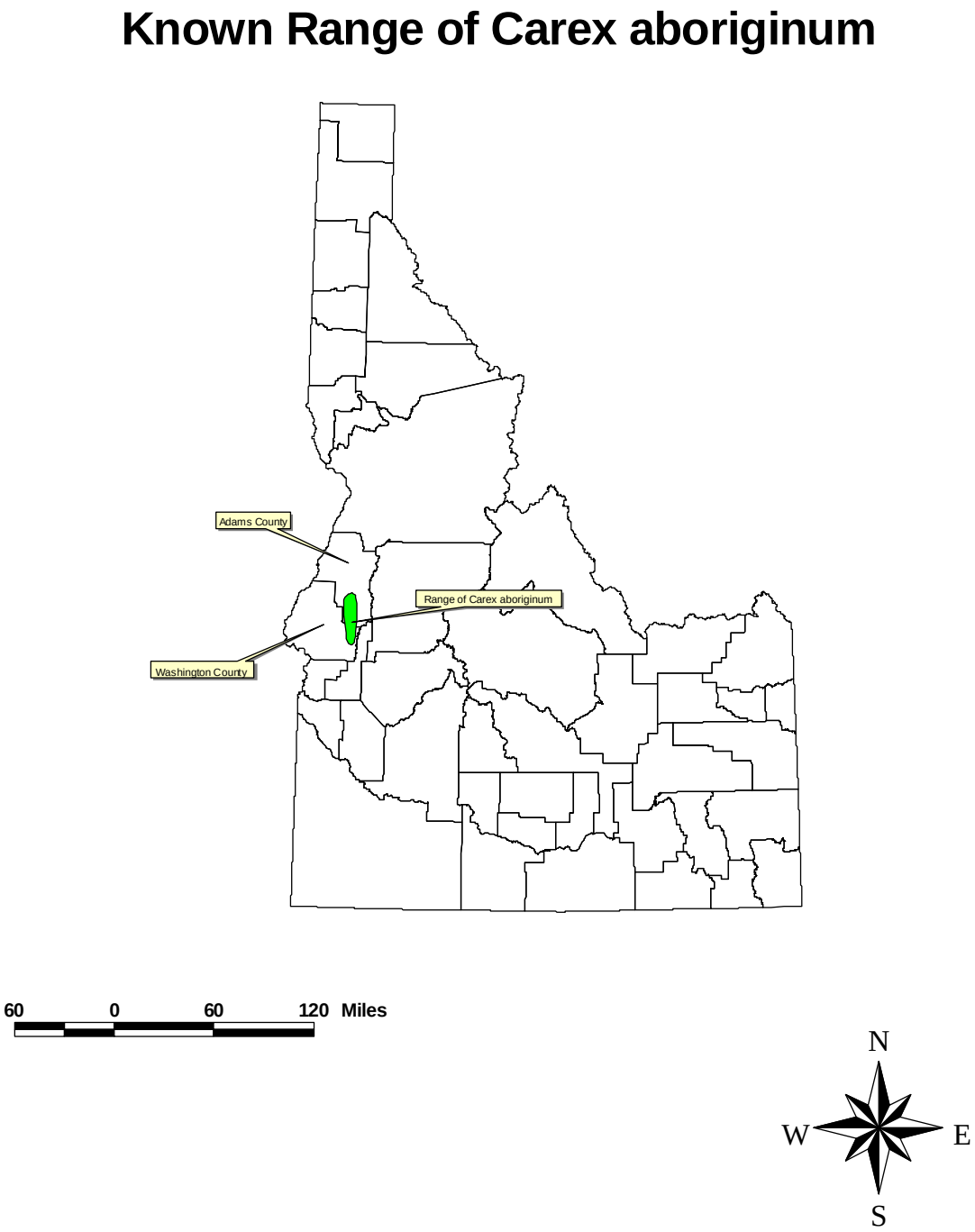
Sheep Creek/North Crane Creek Confluence (004): This occurrence is located near the confluence of Sheep Creek and North Crane Creek. This is the only occurrence in Washington County and is disjunct from the other three occurrences by about 25 miles. Plants are located on the north edge of the riparian zone immediately below a powerline. Location: T.12N, R.1W, S. 36.

Council (005): This occurrence is based on a 2000 herbarium collection by Joy Handley (Handley and Hartman 2001). *Carex aboriginum* was collected in a ditch off South Exeter Road, south of Council. Location: T.16N, R.1W, S. 14.

Unverified/undocumented reports: Collections from Cache County, Utah, Silver Bow County, Montana, and a bog at Stanley Lake in Custer County, Idaho were originally identified as *Carex aboriginum*. These collections are actually *Carex parryana* (Parry's sedge) or other sedge species (Packard 1979; Steele 1981; Moseley 1990).

Synopsis of past and needed inventories in Idaho: Since at least 1970, botanists have unsuccessfully surveyed the Indian Valley area for *Carex aboriginum* (Moseley 1990). Moseley surveyed the Indian and Salubria valleys for *Carex aboriginum* in early July 1989 and "saw no native habitat remaining in the valley bottom." He postulated that agricultural conversion and intensive grazing, especially on the privately-owned bottomland floodplain habitats in the Little Weiser River valley, have probably led to the species' extinction. In Indian Valley and surrounding areas, extensive private land, with no public access, curtailed the extent of both past and this year's surveys. Some blocks of public land could not be accessed due to roads with locked or posted gates. Time constraints prevented finding the landowners and getting permission to access these areas. Unfortunately, no maps or habitat descriptions of areas previously searched by Moseley or others are known. These investigators most likely focused on gumbo soil habitats near Indian Valley using information from Jones's original collection. Moseley surveyed during the summer (when most sedge species are blooming and visible). Based on recent discoveries, prior surveys mis-targeted not only the geographic range of the species (actually

Figure 2. Map showing the known range of *Carex aboriginum*.



north and south of Indian Valley), but also the habitat (actually clay-loam alluvial soils in riparian scrub-shrub and meadows) and the peak phenologic period of *Carex aboriginum* (actually mid-May to mid-June). We now have a basic understanding of the potential habitat supporting *Carex aboriginum*. Since the species is extremely rare and vulnerable, more inventories are needed in areas immediately surrounding Council, in the Shoe Peg Valley area northwest of Midvale, and in the North Crane Creek drainage. I initially limited searches to meadow environments, based on habitat data from the only known occurrence at Mesa (002). By the time I found *Carex aboriginum* in gaps of riparian scrub-shrub habitat at Lower School Creek (003), several promising riparian scrub-shrub habitats had been passed by, especially around North Crane Creek, Shoe Peg Valley, and from east Indian Valley to southeast of Council.

HABITAT

General habitat description: Detailed descriptions of *Carex aboriginum* habitat were made at the Mesa (002), Lower School Creek (003), and Sheep Creek/North Crane Creek Confluence (004) occurrences. Other than the simple description of "wet ditch," habitat data were not available for the Council (005) occurrence. Table 2 summarizes the environmental characteristics of habitat supporting *Carex aboriginum*. Figure 3 shows photos of habitat at each occurrence visited in 2001.

Carex aboriginum grows on ephemerally moist sites in partial to full sun. At Mesa (002), *Carex aboriginum* grows in a moist meadow located within a broad, shallow basin. The basin and seeps are drained by a narrow and incised, intermittently flooded stream channel. *Carex aboriginum* also grows on the low terraces and banks of this channel. Another *Carex aboriginum* patch was observed on the margin of a seep, about 10 meters away from a dugout cattle-watering pond. These wetlands are sub-irrigated by seasonal seeps and springs. Soils are ephemerally moist to seasonally saturated, but the soil dries by late spring or early summer. At this occurrence, there are no associated shrubs to shade *Carex aboriginum*, although tall grass, sedge, and forb species may prevent some sun from reaching the basal leaves. *Carex aboriginum* grows on ground that is wetter than adjacent *Danthonia californica* (California oatgrass) meadow, but drier than adjacent saturated sites.

In contrast to the meadow habitat at Mesa (002), *Carex aboriginum* grows in small gaps (less than 5 to 10 square meters in size) within the mixed scrub-shrub riparian zone at the Lower School Creek (003) and Sheep Creek/North Crane Creek Confluence (004) occurrences. These gaps are dominated by *Poa pratensis* (Kentucky bluegrass), but they also support a diverse mix of other mesic graminoid and forb species. *Carex aboriginum* seems to require at least partial sun. It was not observed within the dense shrub thickets adjacent to these gaps, although it may grow on the edges of shrub thickets. At all occurrences, aspects are variable and terrace slopes are typically less than 3 percent.

At Lower School Creek (003), *Carex aboriginum* grows on low alluvial terraces of an intermittent to temporarily flooded creek that forms a canyon through a basaltic plateau. Multiple narrow channels (1.5 to 3 meters wide) are present in portions of the floodplain that occupies most of the 30 to 40 m wide canyon bottom. These channels are entrenched 0.2 to 0.75 meters deep, reflecting both historical impacts from livestock grazing and down-cutting from occasional large flood events. *Carex aboriginum* grows on sites immediately adjacent to water carrying channels, but also up to 10 meters away on the floodplain. *Carex aboriginum* grows about 0.1 to 0.75 meters above the average high water line of the creek on stable sites that are flooded only during high flow runoff events. *Carex aboriginum* is also occasionally perched on steep undercut banks. The soil is ephemerally moist during spring runoff. *Carex aboriginum* does not grow within the rocky stream channel or on the margins of vernal pools found within the stream channels below high water line.

The habitat at Sheep Creek/North Crane Creek Confluence (004) was similar to that at Lower School Creek (003). The occurrence is found within a small valley on the 30 meters wide floodplain of an intermittent, seasonally flooded, low gradient creek. Multiple flood channels are present in portions of the floodplain. *Carex aboriginum* is located on a low terrace of one of these shallow, 1 m wide, flood overflow channels. This overflow channel is about 4 meters from the main channel and slightly entrenched (about 0.2 to 0.3 meters

deep). *Carex aboriginum* is perched above the average high water line of the creek on a relatively stable appearing terrace. The soil is ephemerally moist, sub-irrigated by seasonal and intermittent flood flows, but is not apparently wet for long periods and is rarely flooded. Small vernal pools are occasionally present in the creek channel and both cattle-watering reservoirs and beaver ponds are present 100 meters upstream. *Carex aboriginum* does not grow in adjacent rocky channels or on the margins of these ponds or vernal pools.

The landscape including and surrounding the range of *Carex aboriginum* generally falls within the sagebrush-steppe (*Artemisia tridentata* (big sagebrush)/*Pseudoroegnaria spicata* (bluebunch wheatgrass)) zone, with *Artemisia rigida* (rigid sagebrush)-*Eriogonum* (buckwheat)/*Poa secunda* (Sandberg's bluegrass) vegetation on shallow soil scabland sites, and mountain shrub communities on northerly canyon slopes. *Carex aboriginum* is known from elevations ranging from 2,875 to 3,415 feet. Since settlement, large areas of sagebrush-steppe vegetation in this area have been converted to exotic grasses through the combined effects of intensive grazing and wildfire. The broad and flat floodplain bottomlands of the Weiser and Little Weiser Rivers once supported a mosaic of *Populus trichocarpa* (black cottonwood), *Salix* (willow) species, *Crataegus douglasii* (black hawthorne), and mesic graminoid meadow plant communities. Remnants of this wetland vegetation remain, especially along the Weiser River. Prior to agriculture and livestock grazing, these moist bottomlands probably supported much more potential *Carex aboriginum* habitat than they do today. Prior to settlement, some bottomland was also sagebrush-steppe, but these areas have since been converted to irrigated agriculture. Within about five miles of all known *Carex aboriginum* sites, the sagebrush-steppe abuts the lower timberline typified by *Pinus ponderosa* (ponderosa pine) and/or *Pseudotsuga menziesii* (Douglas fir) woodland.

Table 2. Summary of environmental characteristics at occurrences visited in 2001.

Occurrence (#)	Elevation (feet)	Alluvial Landform & Moisture Regime	Soil Depth & Texture[1]	Plant Communities
Mesa (002)	3,000 to 3,035	*depressional wetland meadows; seasonally sub-irrigated *low terraces & banks of narrow & incised stream channel; intermittent, seasonally flooded	*moderate *mottled silty clay loam	*mesic graminoid meadow (*Danthonia californica, Hordeum brachyantherum, Poa pratensis, Carex* spp., & *Camassia quamash*)
Lower School Creek (003)	2,875 to 2,910	*low terraces, undercut banks, & floodplain of moderately entrenched stream channel & flood overflow channels *intermittent, temporarily flooded with occasional vernal pools	*shallow to moderate *sandy to silty loam, with gravel	**Salix lasiolepis*/Bench **Crataegus douglasii/Rosa woodsii* **Populus trichocarpa/Crataegus douglasii*
Sheep Creek/ North Crane Creek Confluence (004)	3,415	*low terrace of shallowly entrenched flood overflow channel *intermittent, seasonally flooded with occasional vernal pools	*shallow to moderate *silty clay loam, with trace rock & gravel	**Salix lasiolepis/Rosa woodsii*

[1] all soils are derived from gravelly alluvium of weathered basalt origin

Climate, geology, and soils: The climate within the range of *Carex aboriginum* is moister than adjacent sagebrush-steppe areas to the south (e.g., Weiser) and milder than montane areas to the north (e.g., New Meadows). The following climate data for the range of *Carex aboriginum* is from stations at Cambridge, Ola, and Council (Abramovich et al. 1998). These weather stations receive 19.9 to 25.7 inches of precipitation per year on average. Precipitation peaks during the winter, with about two-thirds of the annual total falling from November through March. Precipitation falls mostly as snow in December, January, and February. July and August are dry, averaging 0.9 to 1.3 inches of rain that often originates from thunderstorms. The coldest month is January, with average temperatures ranging from 22.0 to 25.3 degrees F. The daily minimum averages 13.1 to 16.1 degrees F during January. The hottest month is July, with average temperatures of 70.5 to 73.0 degrees F. The daily maximum is 91 degrees F during July. The frost-free growing season is typically between mid-May and late September in the region (about 140 days).

Figure 3. Photos showing *Carex aboriginum* habitat. Upper-left: grassy gap on alluvial terrace within scrub-shrub riparian zone at Lower School Creek (003) (taken on June 1, 2001 at middle sub-population); upper right: ephemerally moist mesic graminoid meadow habitat of lowest sub-population at Mesa (002) (taken on May 31, 2001, looking south toward upper basin); bottom: overview of riparian zone at Sheep Creek/North Crane Creek Confluence (004)—*Carex aboriginum* grows next to riparian shrubs in lower center of photo (taken on June 5, 2001).

The underlying geology within the range of *Carex aboriginum* is Miocene-age basalt of the Weiser embayment (Fitzgerald 1982). Specifically, the Mesa (002), Lower School Creek (003), and Sheep Creek/North Crane Creek Confluence (004) occurrences are each underlain by circa 15 million-year-old Grande Ronde Basalt flows capped by thin surface layers of recent (Quaternary-age) alluvium. These basalt flows are generally rich in SiO^2 and iron oxides and they form light reddish brown soil upon weathering (Fitzgerald 1982). The Council (005) occurrence is underlain by thicker Quaternary-age alluvium of the Weiser River Valley.

Soils supporting *Carex aboriginum* range from sandy or silty loams to clay loams derived from weathered basaltic rock. Soils are often gravelly, reflecting their alluvial origin. Soil is moderately deep (over 0.75 meters) in the meadow at Mesa (002) and on alluvial terraces in Lower School Creek (003). However, on the floodplain of Lower School Creek (003), the soil was only about 0.1 to 0.2 meters thick over alluvial cobble and gravel. The soil is about 0.5 to 0.75 meters deep at the Sheep Creek/North Crane Creek Confluence (004) occurrence. At Mesa (002), the soil is mottled, indicating seasonal saturation followed by summer drying. The clay-rich soil hardens upon drying. The loamy alluvial soils at Lower School Creek (003) and Sheep Creek/North Crane Creek Confluence (004) have less clay content that do not noticeably harden when dry.

Plant communities: The plant community supporting *Carex aboriginum* at the Mesa (002) occurrence is a mixed mesic graminoid meadow dominated by *Danthonia californica*, *Hordeum brachyantherum* (meadow barley), *Poa pratensis*, *Carex* species, and *Camassia quamash* (camas). This community was difficult to classify due to its heterogeneous composition. The species composition is most similar to the *Hordeum brachyantherum* community type described for southwestern Idaho (Jankovsky-Jones et al. 2001). The co-dominance by *Danthonia californica* may reflect grazing disturbance or a transitional moisture regime between wetter *Carex* dominated vegetation and drier meadow. Patches dominated by *Carex sheldonii*, *Carex athrostachya*, or *Carex nebrascensis*, with *Eleocharis palustris* (common spikerush) and *Juncus* (rush) species, are found on adjacent saturated soil and seeps. The *Danthonia californica* community type dominates adjacent ephemerally moist soil that is drier than soils supporting *Carex aboriginum*.

At Lower School Creek (003), *Carex aboriginum* occurs in gaps dominated by *Poa pratensis* within a *Salix lasiolepis* (arroyo willow)/bench community. This community is similar to the *Salix lasiolepis* dominance type described for southwestern Idaho (Jankovsky-Jones et al. 2001), but includes the "bench" modifier to indicate the terrace position (as in Manning and Padgett 1995). In addition, *Carex aboriginum* was found in a gap within a *Crataegus douglasii/Rosa woodsii* (Wood's rose) community. This habitat is very similar to the *Crataegus douglasii/Rosa woodsii* described for southwestern Idaho (Jankovsky-Jones et al. 2001). *Carex aboriginum* was also found on the periphery of an open *Populus trichocarpa/Crataegus douglasii* stand at Lower School Creek (003). This forested riparian community is poorly documented in southwestern Idaho (Jankovsky-Jones et al. 2001).

At Sheep Creek/North Crane Creek Confluence (004), *Carex aboriginum* grows on the margin of a *Salix lasiolepis*/*Rosa woodsii* community in a microsite dominated by *Poa pratensis*. This community is most similar to the *Salix lasiolepis/Rosa woodsii* community type described by Manning and Padgett (1995) for Nevada, but also similar to the *Salix lasiolepis* dominance type described for southwestern Idaho (Jankovsky-Jones et al. 2001).

Associated species: The following species were associated with *Carex aboriginum* at all three occurrences visited in 2001 (the '?' denotes tentative identification): *Juncus howelii*? (Howell's rush), *Poa pratensis*, *Camassia quamash*, and *Potentilla gracilis* (slender cinquefoil). The following species were associated at two of the three occurrences visited: *Ribes aureum* (golden currant), *Rosa woodsii*, *Salix lasiolepis*, *Carex deweyana*, *Danthonia californica*, *Elymus glaucus* (blue wildrye), *Eleocharis palustris*, *Hordeum brachyantherum*, *Phleum pratense* (timothy), *Achillea millefolium* (yarrow), *Galium aparine* (annual cleavers), *Montia* species (*M. linearis*, *M. perfoliata* (narrowleaf and littleleaf minerslettuce), *Rumex* species (e.g., *R. crispus* (curly dock)), and *Senecio hydrophiloides* (tall grounsel). Other associated species, documented at one occurrence each, included: *Crataegus douglasii*, *Prunus virginiana* (chokecherry), *Salix geyeriana* (Geyer's willow), *Symphoricarpos albus* (common snowbery), *Bromus japonicus* (Japanese brome), *Carex athrostachya*, *Carex*

nebrascensis, *Carex praegracilis*, *Carex sheldonii*, *Carex vulpinoidea* (fox sedge), *Deschampsia danthonioides* (annual hairgrass), *Eleocharis bolanderi* (Bolander's spikerush), *Juncus tenuis* (poverty rush), *Poa bulbosa* (bulbous bluegrass), *Artemisia* species (annual/biennial wormwood), *Castilleja tenuis* (hairy Indian paintbrush), *Cichorium intybus* (chicory), *Epilobium brachycarpum* (tall annual willowherb), *Epilobium densiflorum* (denseflower willowherb), *Erigeron annuus*? (eastern daisy), *Geranium carolinianum*? (Carolina geranium), *Hypericum perforatum* (St. Johnswort), *Lactuca serriola* (prickly lettuce), *Navarretia intertexta* (needleleaf navarretia), *Perideridia* species (yampah), *Potentilla recta* (sulphur cinquefoil), *Ranunculus uncinatus* (woodland buttercup), *Sidalcea oregana* (Oregon checkerbloom), *Taraxacum officinale* (dandelion), *Trifolium longipes*? (longstalk clover), *Triteleia hyacinthina* (white brodiaea), *Verbascum blatteria* (moth mullein), and *Xanthium strumarium* (rough cockleburr).

Associated rare species: Curtis Bjork reported *Trifolium douglasii* (Douglas' clover), a globally rare regional endemic species, as an associated species at the Mesa (002) occurrence. I observed a densely rhizomatous *Trifolium* species that has some characteristics of both *Trifolium douglasii* and *Trifolium longipes* on ephemerally moist soils near all occurrences. This *Trifolium* species was very common within the range of *Carex aboriginum*, but it could not be positively identified as *Trifolium douglasii*. It may actually be *Trifolium longipes*, a common species. *Allium madidum* (swamp onion) and *Downingia bacigalupii* (Bach's calicoflower), two other species on the Idaho Native Plant Society rare plant list, have been reported in the Indian Valley area. I did not observe them during *Carex aboriginum* surveys.

POPULATION BIOLOGY

Population size and condition: *Carex aboriginum* is known from four extant occurrences. The species has not been re-located in the Salubria/Indian Valley area, the site of the original collection of *Carex aboriginum*. *Carex aboriginum* is a short rhizomatous species that both spreads and forms loose clusters. Distinguishing clusters from each other is sometimes difficult. In order to assess population size and condition, the area occupied, numbers of flowering stems, and numbers of loose clusters were estimated for the Mesa (002), Lower School Creek (003), and Sheep Creek/North Crane Creek Confluence (004) occurrences. Totals are probably an underestimate of the true population size. No population data are available for the Council (005) occurrence, which was not known until after my field survey was completed. Approximately 225 *Carex aboriginum* clusters, with slightly over 300 flowering stems, were observed in 2001. About eight sub-populations covering a total of 0.5 to 0.75 acre were found. Density within the scattered and discontinuous sub-populations was generally high. Much potential habitat was unoccupied by *Carex aboriginum* adjacent to, and within the occurrence areas.

"Element Occurrence Ranks" (EORs) were assigned for each occurrence visited in 2001. EORs are used by the network of Natural Heritage Programs and Conservation Data Centers to help prioritize occurrences for conservation planning (The Nature Conservancy 1999). The ranks represent the estimated viability, or probability of persistence, of occurrences based on current habitat condition, population size, and landscape context. An 'A' rank equals excellent estimated viability, a 'B' rank equals good, a 'C' rank equals fair, and a 'D' rank equals poor. Below is a summary of the population size, population condition, and EORs at each occurrence visited in 2001. The EORs should be considered tentative and subject to revision as more information becomes available (as indicated by the '?' following the ranks). See also the "Land Use and Threats" section for additional information.

<u>*Mesa (002):*</u> This occurrence supported the largest known population of *Carex aboriginum*. It had approximately 190 to 200 plant clusters and over 220 flowering stems. The occurrence was discontinuously distributed and comprised of three sub-populations. Over 135 clusters were counted in the main sub-population in the meadow at the upper end of the basin, over 50 clusters grew in the middle sub-population along the intermittent channel, and about 5 clusters were found in the lower sub-population adjacent to the seep near the cattle pond. The middle sub-population was composed of several discontinuously distributed patches. The total number of clusters and flowering heads was probably a low estimate because some stems had been grazed or

trampled, making them difficult to see. Over 90 percent of the *Carex aboriginum* clusters had flowering stems and the peryginia were immature to near mature. The total occupied habitat was over 0.5 acre. The largest sub-population, in the meadow of the upper basin, was about 1,300 square meters in size, while each of the other sub-populations were approximately 400 square meters in size. The entire occurrence was grazed by cattle; however, the lowest and middle sub-populations were most impacted (e.g., trampling and trailing, soil compaction, bank erosion). The lowest sub-population was only about 10 meters from a watering pond that concentrates large numbers of cattle. As a result, this sub-population was heavily trampled and its estimated viability is low. Some potential *Carex aboriginum* habitat has been made unsuitable due to soil compaction and construction of the pond. The upper sub-population was the most viable, at least in the short-term. EOR = B?

Lower School Creek (003): The total number of *Carex aboriginum* clusters was approximately 13, with at least 63 flowering stems. Plants were found in four distinct sub-populations distributed along about one-half mile of the creek bottom. One plant cluster was observed at the lowest sub-population, located adjacent to a *Populus trichocarpa* stand. The middle two sub-populations had six clusters, as did the upper sub-population. The middle two sub-populations were separated by about 10 to 15 meters of thick shrubs. All the flowering *Carex aboriginum* plants observed were in the late flowering/seed development phase; the peryginia were still green and immature. The plants were mostly mature and robust, bearing multiple flower heads per stem, and only a few did not have flowering stems. Each sub-population was less than 10 square meters in size and each individual plant cluster averaged about one square meter of foliar cover. Although the population size was small, the overall habitat condition was fair to good. At least the upper three sub-populations are protected within the Weiser River Trail right-of-way easement managed for recreation and open space. The area is no longer grazed, but evidence of occasional cattle trespass was observed. EOR = C?

Sheep Creek/North Crane Creek Confluence (004): Approximately 11 *Carex aboriginum* clusters with about 19 flowering stems were observed in one patch. All flowering plants observed were in the late flowering phase and had immature peryginia. The total size of the population was only four square meters. The area is grazed during the summer and fall by cattle and an occasionally used cattle trail is located only one to two meters from the population. A small rocky flood overflow channel separates the trail from the population and may deter some grazing of *Carex aboriginum* habitat. Overall, this was the smallest and least viable population observed in 2001. EOR = D?

Phenology: Compared to many other *Carex* species in Idaho, *Carex aboriginum* completes its reproductive cycle early in the growing season. The leaves and flowering stems grow rapidly and plants reach full vegetative height by late May. It flowers from mid-May to early June and the peryginia and achenes mature during June. A few nearly mature peryginia were observed on some plants by early June. Mature achenes were observed on the type specimen collected by Jones on July 12, 1899 (Moseley 1990). The best period to survey for *Carex aboriginum* is about late May through mid-June, when the blue-green leaves and tall flowering stems are most visible.

Reproductive biology: *Carex aboriginum* reproduces by both sexual and vegetative means. Like other *Carex* species, it is most likely wind pollinated. The species has been propagated from seed by Mering Hurd with methods used for other *Carex* species (M. Hurd, U. S. Forest Service, Rocky Mountain Research Station, pers. comm.). *Carex aboriginum* plants propagated from seed grow rapidly under ideal conditions and appear easy to transplant into suitably moist soils. Seeds are probably dispersed by gravity, wind (Moseley 1990), and seasonal floods. *Carex aboriginum* vegetative propagation is by short rhizomes or rootstocks (Cronquist 1969; Hermann 1970). Both dispersed ramets and loose clusters of ramets were observed in the field.

Biological interactions: No unique or special biological interactions affecting *Carex aboriginum* are known.

Competition and exotic species: *Carex aboriginum* was usually observed growing in full to partial sunlight. When in scrub-shrub riparian zones, it typically grew in grassy gaps between tall shrubs or on the edges of shrub patches. At Lower School Creek (003), a few *Carex aboriginum* stems were also observed under the shrub canopy. *Poa pratensis*, an exotic sod-forming perennial grass, was present at all three *Carex aboriginum*

occurrences visited in 2001. Total vegetative cover was high (e.g., 70 to 100 percent graminoid cover) in areas occupied by *Carex aboriginum*. It appears that *Carex aboriginum* can effectively compete with *Poa pratensis* (as well as other vigorous riparian and wetland species)—at least where *Poa pratensis* does not form dense, nearly monoculture, stands.

In addition to *Poa pratensis*, the following exotic weed species were observed growing either within or immediately adjacent to *Carex aboriginum* population areas: *Arctium minus* (burdock), *Bromus japonicus*, *Chondrilla juncea* (rush skeletonweed), *Cichorium intybus*, *Conium maculatum* (poison hemlock), *Cynoglossum officinale* (hound's tongue), *Euphorbia esula* (leafy spurge), *Geranium carolinianum*, *Hypericum perforatum*, *Lactuca serriola*, *Onopordum acanthium* (Scotch thistle), *Poa bulbosa*, *Phleum pratense*, *Potentilla recta*, *Rumex crispus*, *Taeniatherum caput-medusae* (medusahead), *Tanacetum vulgare* (common tansy), *Taraxacum officinale*, *Verbascum blatteria*, and *Xanthium strumarium*. Of these species, *Chondrilla juncea*, *Conium maculatum*, *Onopordum acanthium*, and *Euphorbia esula* are legally designated as "noxious" by the Idaho Department of Agriculture. These four noxious weeds do not currently have high cover or density within habitat occupied by *Carex aboriginum*. However, they have completely shaded native plants and taken over many drainages within the range of *Carex aboriginum*. Other highly competitive/invasive weeds (e.g., *Arctium minus*, *Cynoglossum officinale*, *Hypericum perforatum*, *Potentilla recta*, and *Tanacetum vulgare*) also can replace native species in riparian and wetland areas.

Exotic weedy species are also very common in the uplands adjacent to *Carex aboriginum* occurrences. This situation often results from the combined effects of soil disturbance (e.g., from cattle grazing) and wildfires (Belsky et al. 1999; Interior Columbia Basin Ecosystem Management Project 1997). Many of the xeric or less productive sites, formerly sagebrush and bitterbrush steppe, are now dominated by *Poa bulbosa*, *Bromus japonicus*, *Bromus tectorum* (cheatgrass), and/or *Taeniatherum caput-medusae*. Other invasive and noxious weeds observed in uplands adjacent to *Carex aboriginum* occurrences included: *Chondrilla juncea*, *Cichorium intybus*, *Euphorbia esula*, *Hypericum perforatum*, *Lactuca serriola*, *Potentilla recta*, *Onopordum acanthium*, and *Salvia* species (European sage). *Onopordum acanthium* dominated drier alluvial terraces at the Sheep Creek/North Crane Creek Confluence (004) occurrence.

Herbivory: I observed cattle eating *Carex aboriginum* plants at the Mesa (002) occurrence. However, cattle appeared to first concentrate on the leaves of other *Carex* species and grasses before eating *Carex aboriginum*. It may be slightly less palatable than other *Carex* species. Herbivory by wildlife species was not observed.

LAND OWNERSHIP AND THREATS

Land ownership and management responsibility: Three of the four extant occurrences of *Carex aboriginum* are located on private land. The land ownership pattern within the range of *Carex aboriginum* is characterized by large blocks of private land with scattered in-holdings of BLM and Idaho state endowment lands. Much of the private land in the area is posted no trespass and numerous roads through these properties are blocked with locked or clearly posted gates. This prevented access for surveys of public land on numerous occasions. Larger blocks of BLM land are found north of Goodrich, west of Cambridge, and in the North Crane Creek basin, but these lands are predominantly dry uplands with only marginal potential habitat for *Carex aboriginum*. Payette National Forest Service land forms a higher elevation border on the western, northern, and eastern sides of the Weiser River basin, but probably supports only minor amounts of potential *Carex aboriginum* habitat. In general, the majority of land within the range of *Carex aboriginum* is managed for livestock grazing. For example, numerous livestock-watering reservoirs have been dug in ephemerally moist drainages and at springs throughout the area. The bottomlands of the Weiser and Little Weiser River valleys are more intensively farmed (e.g., irrigated hay pasture and cropland). Numerous parcels of private land between Cambridge and Council are currently being sub-divided for housing developments. The land ownership and management for each occurrence visited in 2001 is described below. Detailed land ownership and management information were not available for the Council (005) occurrence, but this occurrence is also probably located on private land.

Mesa (002): This occurrence is located on private land managed for livestock grazing. The landowner granted permission for us to access his land for this year's survey.

Lower School Creek (003): The upper three sub-populations of *Carex aboriginum* at the Lower School Creek (003) occurrence are within the Weiser River Trail easement. The easement is 100 feet on each side of the old railroad causeway in this area. This easement is owned by a private non-profit organization that manages the land for recreation use and open space protection. The lowest sub-population probably occurs on private land immediately adjacent to the Weiser River Trail easement. Livestock grazing is mostly excluded from the lower School Creek area.

Sheep Creek/North Crane Creek Confluence (004): This occurrence is located on a section of Idaho state endowment land about 40 meters from a border with private land. This area is managed for livestock grazing, but occasional recreation use also occurs.

Land use and threats: Threats to the integrity of occupied *Carex aboriginum* habitat were observed at each occurrence visited in 2001. Livestock grazing impacts (e.g., streambank degradation, soil compaction, etc.) and noxious weed invasion are high magnitude, imminent threats to all *Carex aboriginum* occurrences surveyed this year. Details are described below for each occurrence visited in 2001. Table 3 summarizes the threats and land use at all four extant occurrences.

Table 3. Threats and impacts in occupied habitat at all *Carex aboriginum* occurrences.

Occurrence (#)	Livestock Activity and Impacts	Invasive and Noxious Weeds	Other Potential Threats
Mesa (002)	*short duration, moderately intensive, spring cattle grazing *trampling around stock-watering pond & on streambanks	*Chondrilla juncea*, *Potentilla recta*, *Salvia* sp., & others	*expansion of cattle trampling zone around stock watering pond *depletion of groundwater from adjacent housing development
Lower School Creek (003)	*occasional trespass cattle grazing *minor trailing	*Arctium minus*, *Cynoglossum officinale*, *Euphorbia esula*, *Hypericum perforatum*, *Tanacetum vulgare*, & others	*over-spraying of noxious weed herbicides along trail right-of-way *erosion of alluvial terraces
Sheep Creek/ North Crane Creek Confluence (004)	*moderate to heavy summer and/or fall cattle grazing *trailing & trampling of stream banks	*Conium maculatum*, *Hypericum perforatum*, *Onopordum acanthium*, & others	*alteration of stream hydrology *erosion of alluvial terraces
Council (005)	unknown	unknown	*herbicide spraying, ditch digging, & ditch maintenance

Mesa (002): According to the landowner, the mesic meadow supporting *Carex aboriginum* at Mesa (002) is grazed by a moderate-sized cattle herd for a short period (about three weeks) in the spring each year. A cattle herd was released into the Mesa (002) occurrence on the weekend of May 26. By May 31, effects were noticeable. After about five days on the site, cattle apparently preferred *Carex sheldonii*, *Carex praegracilis*, *Danthonia californica*, and *Hordeum brachyantherum* before choosing *Carex aboriginum* as forage. However, some *Carex aboriginum* plants were trampled and grazed (with flowering stems removed on some plants). Cattle were observed bedding directly on flowering *Carex aboriginum* plants. Evidence of deer use was minimal at the site.

Carex aboriginum grows in habitats where the soils are susceptible to compaction. As the summer progresses, the clay rich soils supporting *Carex aboriginum* become dry, hard, and less impacted by cattle hooves. Summer drought probably limits the re-growth and reproduction of *Carex aboriginum* after June. Thus, short duration, intensive spring cattle grazing while *Carex aboriginum* is growing and flowering will likely limit its reproduction and promote compaction of the moist soils. The long-term effects of short duration, intensive spring cattle grazing on *Carex aboriginum* populations are not known. Prolonged, excessive cattle grazing can cause a decrease in many *Carex* species, especially if soils are compacted, streambanks trampled, and

reproduction not allowed (Manning and Padgett 1995; Jankovsky-Jones et al. 2001). *Poa pratensis* often replaces *Carex* species under such conditions.

A livestock-watering pond was dug in the seep about 10 meters from the lower sub-population. The digging of the pond and associated trampling from congregated cattle have eliminated potential *Carex aboriginum* habitat. Cattle have compacted and disturbed the wet soils around the pond. Figure 4 is a photo of this cattle pond and associated soil impacts. Water pools on the soil surface and appears to run off faster than in adjacent, less disturbed areas. *Carex* species were not observed on compacted soil around the pond. Cattle were also observed shearing the banks of the intermittent stream channel at the middle sub-population. Excessive runoff from compacted soils, combined with decreased streambank vegetation, may accelerate channel down-cutting and lead to erosion of the terraces (Leonard et al. 1997) supporting *Carex aboriginum*. Expansion of the trampled zone around the cattle pond is a threat to the lower sub-population.

Although native mesic graminoid species still dominate the site, weedy exotic species, such as *Poa pratensis*, *Poa bulbosa*, *Cichorium intybus*, *Verbascum blatteria*, *Lactuca serriola*, and *Xanthium strumarium*, are also common within the meadow supporting *Carex aboriginum*. The abundance of these weeds indicates colonization of disturbed soils (Interior Columbia Basin Ecosystem Management Project 1997). The adjacent degraded uplands also support several weeds that can invade moister soil, including *Chondrilla juncea*, *Potentilla recta*, weedy *Salvia* species, and *Bromus japonicus*. Control of noxious and invasive weeds should be done with a spot spray method to prevent accidental spraying of *Carex aboriginum*.

The landscape surrounding this occurrence has a long history of cattle grazing and other disturbances. As a result, the uplands are dominated by exotic grasses and only remnants of the sagebrush-steppe and rigid sagebrush mosaic exist. Several ranch houses, the county dump, and a busy gravel road are located within one mile of the occurrence. No off-highway vehicle (OHV) travel into the occurrence area was observed; fences limit travel in the area. In addition, a housing development is underway on adjacent sections of land to the west. The potential of these developments for decreasing groundwater feeding the seeps and ephemerally moist meadow habitats of *Carex aboriginum* is not known.

Figure 4. Photo of cattle-watering pond dug into a seep about 10 meters from the lowest sub-population at Mesa (002). Taken on May 31, 2001 from the occupied *Carex aboriginum* habitat.

Lower School Creek (003): Currently, the land at this occurrence is used for recreation and open space protection. A biking and hiking trail follows the old railroad right-of-way adjacent to lower School Creek. Other than for maintenance purposes, motorized vehicle use is prohibited from the trail. According to the Friends of the Weiser River Trail organization, the canyon bottom is excluded from livestock grazing. However, a few cattle may trespass into the riparian zone from adjacent uplands. Past maintenance and construction of the railroad causeway filled portions of the riparian area with rocks and confined the floodplain in some areas. Restriction of the floodplain can accelerate seasonal flood flows causing increased erosion of terraces supporting *Carex aboriginum*. Historic livestock grazing created trails and probably resulted in the loss of some woody vegetation in the creek bottom. At this time, the riparian vegetation around the occurrence appears vigorous. Light amounts of native ungulate browsing and rodent digging were observed in the creek bottom, but they are currently not significant threats to *Carex aboriginum*.

Weedy exotic species, including *Bromus japonicus*, *Phleum pratense*, *Poa pratensis*, *Poa bulbosa*, *Arctium minus*, *Cynoglossum officinale*, *Euphorbia esula*, *Hypericum perforatum*, *Tanacetum vulgare*, *Verbascum blatteria*, and *Xanthium strumarium*, are common at Lower School Creek (003). *Euphorbia esula* occurs only 5 meters from *Carex aboriginum* plants in the middle sub-populations and poses a serious threat unless immediately controlled. *Euphorbia esula* has thoroughly choked some disturbed drainages in nearby areas. Control of noxious weeds should be done with a spot spray method to prevent accidental spraying of *Carex aboriginum*. Herbicide spraying occurs along the railroad causeway and trail. Herbicide spraying was observed only 3 to 4 meters from *Carex aboriginum* plants at the upper sub-population. The risk of over-spraying is high.

Although numerous invasive exotic species are present, native species still dominate the riparian habitat supporting *Carex aboriginum*. The surrounding area has a long history of cattle grazing and other disturbances, including on-going housing development on adjacent ridge-tops. Remnants of native vegetation are still observed on canyon slopes.

Sheep Creek/North Crane Creek Confluence (004): Livestock grazing is the predominant land use in this area. No cattle were observed at the site during surveys in early June. In early November, during a drive-by visit, cattle were observed adjacent to the population area; grazing apparently occurs during the summer and/or fall. About 100 to 150 meters upstream from the *Carex aboriginum* population, several large cattle-watering ponds (located on both sides of the road) have been dug into springs. These ponds have likely removed potential *Carex aboriginum* habitat in the past and altered the hydrology of the area. Cattle concentrate around these ponds, as well as along adjacent beaver ponds in the creek bottom, located about 100 meters upstream. The congregation of cattle around the ponds and on adjacent terraces has caused shearing of banks, trampling and trailing, loss of native shrub and graminoid riparian vegetation, and invasion of disturbed soil by noxious weeds (e.g., *Onopordum acanthium*). Within the occurrence, there has been some *Crataegus douglasii* and *Rosa woodsii* have died, possibly indicating a change in hydrologic conditions. In addition, a minor cattle trail is located only 1 to 2 meters from the population. A small, rocky flood overflow channel separates the trail from the population and may deter some grazing of *Carex aboriginum* habitat. Soil compaction from livestock may accelerate runoff in this channel resulting in erosion of the low terrace (Leonard et al. 1997) supporting *Carex aboriginum*. Upstream of the cattle ponds and above the road is a large exclosure for restoring riparian and wetland habitat. Within the exclosure, the riparian shrub and mesic graminoid vegetation is thick, beavers are active, and water retention is high. This habitat may actually be too wet and densely vegetated to support *Carex aboriginum*. In contrast, heavy grazing above the exclosure and on adjacent terraces has eliminated nearly all of the riparian shrub and mesic graminoid cover; these areas are also unsuitable for *Carex aboriginum*.

Numerous invasive, weedy exotic species, such as *Bromus japonicus*, *Phleum pratense*, *Poa pratensis*, *Poa bulbosa*, *Conium maculatum*, *Hypericum perforatum*, *Onopordum acanthium*, *Rumex crispus*, *Taeniatherum caput-medusae*, and *Verbascum blatteria*, are common within the floodplain of lower Sheep Creek. *Conium maculatum*, a highly invasive noxious weed, occurs within 5 meters of *Carex aboriginum* plants and poses a threat unless controlled. Control of noxious weeds should be done by a spot spray method to prevent accidental spraying of *Carex aboriginum*.

The surrounding landscape has a long history of cattle grazing and other disturbances, including road building and water developments. Only remnants of the former sagebrush-steppe were observed on slopes and benches. Degraded *Crataegus douglasii/Symphoricarpos albus* communities are present on toeslopes in the area. A jeep road, ending at an occasionally used campsite about 200 meters above the occupied habitat, poses no current threat to *Carex aboriginum*. However, this road allows OHV access to the population area.

ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

General assessment of conservation status: Globally, *Carex aboriginum* is known from only four extant occurrences in Idaho. All occurrences are potentially threatened by exotic weed species and/or current land uses. The Indian Valley (001) occurrence is presumed extirpated based on current land uses in the Indian Valley area. Two of the four occurrences (Lower School Creek (003) and Sheep Creek/North Crane Creek (004)) are very small. The Council (005) occurrence was not known until after I completed this year's survey; no population or threat information is available. Based on data collected this year it is clear that *Carex aboriginum* remains one of Idaho's rarest and most imperiled plant species. It is unknown if any occurrence other than Mesa (002) is viable in the long-term. Without actions to conserve and expand current populations, this species may qualify for listing under the Endangered Species Act. The following are recommendations to the USFWS and other land managers regarding the conservation and recovery of *Carex aboriginum*.

Recommendations:

1. *Carex aboriginum* should remain on the Lower Snake River District BLM Special Status Plant List. In addition, due to its proximity to U. S. Forest Service lands, it should be added to the Boise and Payette National Forest sensitive species lists. Due to its rarity (especially on public land) and threats to its habitat, the USFWS could propose *Carex aboriginum* as a candidate for listing under the Endangered Species Act (if future surveys fail to find additional populations). In addition, federal and state land managers should avoid planning any ground disturbing projects (e.g., roads, hydrologic alterations, livestock water developments, etc.) in, or adjacent to, occupied *Carex aboriginum* habitat.

2. No broadcast herbicide spraying should occur within 50 meters of *Carex aboriginum* habitat. Any spraying within 50 meters should be done with a spot spray method. Chemicals targeting graminoid species should not be used within 50 meters of *Carex aboriginum* habitat. Noxious weed control in *Carex aboriginum* habitat needs to occur, but should be done carefully. At Lower School Creek (003), the Friends of the Weiser River Trail should work closely with county weed control agencies to follow these guidelines.

3. Mesa (002) is the largest and healthiest known *Carex aboriginum* occurrence. We do not know the long-term effects of the current short duration, moderately intensive, spring grazing regime on the viability of this population. While *Carex aboriginum* probably tolerates some cattle grazing, limited biologic information suggests that experimental changes to the grazing regime may benefit the species. For example, cattle grazing at this occurrence could be conducted after *Carex aboriginum* drops its seeds (e.g., summer) or prior to the growing season (e.g., winter). Alternatively, exclosures could be erected around the seeps and wetland habitat supporting *Carex aborignum*, while still allowing use of the watering pond and adjacent meadows. At the larger upper sub-population, exclosures could be used to compare population trends in areas open to cattle grazing with those closed to grazing. The USFWS should work with the landowner to develop a conservation agreement. Federal or other habitat restoration funds could pay for exclosures or other conservation actions. The USFWS or Natural Resources Conservation Service could also provide other incentives for the landowner at Mesa (002) to conserve *Carex aboriginum*. For example, the parcel of land may be suitable for conservation through the Wetlands Reserve Program. Under the Wetlands Reserve Program, private property owners can receive financial incentives to restore and protect wetland habitat in exchange for retiring marginal agricultural land. Rangelands and pastures, where the hydrology has been significantly altered but can still be restored, may qualify. Landowners can request permission to cut hay, graze livestock, or perform other activities if these uses are fully compatible with the protection and enhancement of the wetland.

4. The Sheep Creek/North Crane Creek Confluence (004) occurrence should be monitored to prevent further impacts to streambanks, vegetation, and soils from cattle grazing. An additional exclosure or other management action may be needed to protect *Carex aboriginum* habitat.

5. *Carex aboriginum* has been successfully propagated from seeds. In addition, seedlings have been successfully transplanted into properly moist garden settings. An experimental propagation and re-introduction program may be a useful conservation tool for this species. It is possible that the disjunct occurrence in Washington County is genetically different from the Council area occurrences. Until the genetic diversity across all known sub-populations has been studied, care should be taken to prevent crosses that may decrease the inherent adaptive fitness of the species.

6. Surveys should be conducted in areas of potential habitat on public land not surveyed in 2001. Unsurveyed potential habitat may exist in Shoe Peg Valley, areas north of Council, and elsewhere adjacent to the range of *Carex aboriginum*. Additionally, a monitoring program should be initiated. Baseline population and habitat data should be collected at the Council (005) occurrence in 2002.

7. BLM, U. S. Forest Service, Idaho Department of Lands, and Friends of the Weiser River Trail field personnel should be made aware of known populations and the potential for other *Carex aboriginum* occurrences around Council, North Crane Creek, and elsewhere. Personnel should be trained on how to identify *Carex aboriginum* in the field.

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Appendix 1

Element Occurrence Records for *Carex aboriginum*

Appendix 2

Maps of the locations of *Carex aboriginum*

Appendix 3

Maps of searched areas where no *Carex aboriginum* was found in 2001

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