ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract **Element Code:** PMCYP03CQ0
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Carex specuicola* Howell
COMMON NAME: Navajo Sedge
SYNONYMS:
FAMILY: Cyperaceae

AUTHOR, PLACE OF PUBLICATION: J.T. Howell, Leaflets of Western Botany 5(9): 148-149. 1949.

TYPE LOCALITY: USA, Arizona, Coconino County, near Inscription House.

TYPE SPECIMEN: HT: CAS-342553. J.T. Howell 24609, 23 June 1948. IT: GH, LL, NY, US.

TAXONOMIC UNIQUENESS: There are approximately 2000 species in the genus *Carex*, with about 480 in North America and 65-70 species in Arizona (Ball and Reznicek 2002, Rink and Licher, in prep.) *Carex specuicola* may have its closest affinities to sedges more commonly associated with higher elevations. It is most commonly confused with *Carex hassei*, *C. aurea* and *C. utahensis*.

DESCRIPTION: Perennial, grass-like, with a persistent, dried leaf base. Bunch-forming (i.e., in clumps), often forming extensive mats. RHIZOMES 0.7-1.9 millimeters (mm) thick. CULMS 15-50 centimeters (cm) tall, shorter or longer than the leaves, glabrous to glandular and smooth below the inflorescence, often arching. LEAVES 0.6-3.0 (-4.2) mm wide, glabrous or glandular dorsally, green; basal sheaths dark reddish brown, green or brown, distally triangular in cross section and scabrous. INFLORESCENCE elongate, 1.5-8.0 cm long, 0.2-1.0 cm wide, composed of 2-5 cylindric to elliptic spikes; gynecandrous terminal spike (with female flowers at the summit, above male flowers) or rarely entirely male or entirely female, 8-19 mm long, 3-5 mm wide, the lateral spikes entirely female, 3-15 [-24] mm long, 2-5 mm wide, with the lower spikes increasingly separated and on progressively longer peduncles up to 8 cm long; proximal bract awn-like, shorter than the inflorescence, with a sheath 0-2 mm long, scabrous-margined. PISTILLATE SCALES shorter (rarely slightly longer) and narrower than perigynia, allowing the perigynia edges to be easily visible, ovate to broadly elliptic, blunt to acute to acuminate, rarely short-awned, brown with a lighter tan or bright green mid-vein, usually with hyaline margins. PERIGYNIA ascending, flat, with a light green margin and white translucent center, sometimes with black mottling, smooth or papillate with papillae to as tall as wide, 1.6-2.9 (-3.5) mm long, 1.4-2.0 mm wide;

beak well-defined and entire (0.3) 0.4 mm long. ANTHERS 1.3-2.4 mm long. STIGMAS 2 (3). ACHENES lenticular (trigonous), light tan, 0.9-1.5 (-2) mm long, 0.7-1.2 mm wide, not filling perigynia, smooth to minutely papillate, rarely bristled. (Rink and Licher, 2015)

AIDS TO IDENTIFICATION: *Carex specuicola* usually has a gynecandrous terminal spike, with flat, translucent perigynia. These characters separate it from *C. hassei*, and *C. aurea*, which have thicker, inflated perigynia and from *Carex utahensis*, which also has flat perigynia, but the walls of *C. utahensis* perigynia are opaque. *Carex utahensis* A. A. Reznicek & D. F. Murray (in prep), Utah sedge, is probably the most closely related to *Carex specuicola*, and has also been found on the northern Navajo Nation portion of AZ. *Carex utahensis* has mostly 3 stigmas with up to 40% of the flowers with 2 stigmas, whereas *C. specuicola* has mostly 2 stigmas with up to 5% of the flowers having 3 stigmas. *Carex specuicola* has smaller perigynia that are always translucent in the middle whereas mature *Carex utahensis* perigynia are larger and are always opaque. For other minor differences, see Rink and Licher (2015).

ILLUSTRATIONS:

Photo of plant and habitat (Utah Native Plant Society 2003-2005, *in* http://www.utahrareplants.org)
Line drawing (Utah Native Plant Society 2003-2005, *in* http://www.utahrareplants.org)
Line drawing of habit, perigynia, terminal spike (USFWS 1987)
Line drawing (*in* Falk & Jenkins et al., 2001)
Color photos of plant and habitat (Sue Rutman *in* Falk & Jenkins et al., 2001)
Color photo of flower spike (B. Hevron *in* Falk & Jenkins et al., 2001)
Color photo of Isotype specimen (NY-11337, NYBG, *in* http://sweetgum.nybg.org/vh/specimen.php?irn=535241)
Color photo of Isotype specimen (US-2006386, *in* http://collections.mnh.si.edu/search/botany/?irn=2066805)
Color photo: (http://www.fws.gov/southwest/es/arizona/navajo.htm)
Color photos of spike and plant (Joyce Maschinski, *in* CPC at http://www.centerforplantconservation.org/collection/cpc_viewprofile.asp?CPCNum=789)
Color photos of plant and habitat (in Roth 2004).
Line drawing (in FNA 1993+, http://www.efloras.org)
Color photos on the southwestern environmental information network, seinet, http://swbiodiversity.org/seinet/index.php

TOTAL RANGE: Endemic to the south central Colorado Plateau. Only known from Coconino, Navajo, and Apache counties, Arizona, and San Juan County, Utah; most common on the Navajo Nation. Potential distribution on the Navajo Nation includes northeastern Arizona and southeastern Utah, especially in hanging gardens of the San Juan River drainage (Roth 2001, revised 2005).

RANGE WITHIN ARIZONA: Northern Arizona from the Moenkopi Wash drainage near Begashibito Wash north to the Navajo Creek drainage in Coconino County, east through northern Navajo County in the Tsegi Canyon watershed and across and south in Apache County to Canyon de Chelly National Monument.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Perennial graminoid.

PHENOLOGY: Flowering and fruit set occur from spring to summer, but most of the reproduction appears to be vegetative. Although suitable habitat can be identified year round, positive identification is only possible during the flowering/fruiting season from late June through September (Roth 2001, revised 2005).

BIOLOGY: Locally common within highly restricted habitat. Typically forms dense rhizomatous clumps so that determining individual plants is usually not possible (Phillips et al. 1981).

HABITAT: Hanging gardens in alcoves of aeolian sandstone cliffs; rarely along streams. Originally found on Navajo Sandstone, but now also known from Kayenta, DeChelly and Cedar Mesa sandstone formations. Found within Pinyon-Juniper woodland. (Phillips et al. 1981).

ELEVATION: 1280-2300 m (4200-7600 ft.) (Rink and Licher, in prep., and SEINet)

EXPOSURE: 80-90° slope, or greater; all aspects, but generally in alcoves with aspects to the southwest. Sites range from those that receive full sun most days all year long to sites that never experience direct sun.

SUBSTRATE: Moist sandy to silty soils of aeolean sandstones of the southern Colorado Plateau, including Navajo, Kayenta, Wingate, DeChelly, and Cedar Mesa Sandstones. Soil development in these alcove environments is limited. Any soil present is derived from sandstone bedrock and remnants of hanging garden vegetation.

PLANT COMMUNITY: Navajo sedge occurs in hanging garden and riparian microhabitats within the Colorado Plateau Great Basin Desertscrub and Great Basin Conifer Woodland, including pinyon-juniper woodland. Dominant associated species include *Aquilegia micrantha* (Bluff City columbine), *Epipactis gigantea* (giant helleborine), and *Mimulus eastwoodiae* (Eastwood monkeyflower), and *Platanthera zothecina* (Alcove bog-orchid). Associated sensitive and rare species include: *Cirsium rydbergii* (Rydberg's thistle), *Platanthera zothecina* (Alcove bog-orchid), *Primula specuicola* (cave primrose), and *Zigadenus vaginatus* (sheathed deathcamas) (Roth 2001, 2005). Other species that may be associated with this plant include: *Abies concolor* (white fir), *Adiantum capillus-veneris* (southern maidenhair-fern), *Amelanchier utahensis* (Utah serviceberry), *Astragalus sesquiflorus* (sandstone milk-vetch), *Calamagrostis scopulorum* (ditch reedgrass), *Castilleja*

exilis (=*C. minor ssp. minor*), *Cirsium* sp. (thistle), *Clematis* sp. (Virgin's-bower), *Coleogyne ramosissima* (blackbrush), *Cornus sericea* (silky dogwood), *Equisetum hyemale* (rough horsetail), *Heterotheca villosa* (hairy false golden-aster), *Hordeum jubatum* (foxtail barley), *Juniperus* (juniper), *Mimulus guttatus* (common large monkeyflower), *Phragmites australis* (common reed), *Pinus edulis* (two-needle pinyon pine), *Pinus ponderosa* (Ponderosa Pine), *Pseudotsuga menziesii* (Douglas-fir), *Quercus gambelii* (gambel oak), *Q. turbinella* (shrub live oak), *Rhus trilobata* (sumac), *Rosa* sp. (rose), *Solidago velutina* (= *S. sparsiflora*, sparse goldenrod), *Symphoricarpos* sp. (snowberry), and *Yucca* (Roth 2001, revised 2005; SEINet accessed 2005). Exotic species known to be associated with these sites are *Agrostis semiverticillata* (water bentgrass),*Bromus rubens* (red brome), *Bromus tectorum* (cheatgrass), *Poa pratensis* (Kentucky bluegrass), *Elaeagnus angustifolia* (Russian olive), *Tamarix* sp., and *Taraxacum officinale* (dandelion). These exotics are not thought to be present in numbers that threaten the native plants (Rink and Hazelton 2014).

POPULATION TRENDS: It is difficult to reliably assess population trends for this species for two reasons. First, it is tricky to quantify population size for Navajo sedge. Because of the species' rhizomatous habit, it is impossible to count the number of individuals in a population, and because of the complex, vertical, and often inaccessible nature of hanging garden habitats, it is also a challenge to measure population size based on the area covered by the plants. Second, trends are difficult to assess because it has not always possible to determine whether a given garden or alcove is exactly the same garden or alcove visited by a previous surveyor. Many of the Navajo Sedge sites were first mapped and recorded in the 1980's and 1990's, without the aid of accurate GPS units. Subsequent surveys failed to re-locate several of these gardens. It is not possible to determine whether these missing gardens represent extirpated populations, or if they were mapped inaccurately or imprecisely when they were first discovered. In some cases, populations were found by climbing up steep, rotten, loose sandstone that subsequent surveyors were unwilling to climb.

In 2004, Navajo Natural Heritage Program botanist Daniela Roth completed a status assessment for Navajo Sedge within the Navajo Nation, where the vast majority of populations are found. Prior to writing the 2004 status assessment, Roth spent three years surveying all known locations for the species on the Navajo Nation, and searching for new populations. By 2004, Roth had located and confirmed that 17 of the 21 previously known populations were extant. It is possible that the four populations that she was unable to re-locate had been extirpated. However, it is also possible that they were simply mis-mapped, or mapped imprecisely, such that subsequent surveys were unable to locate them. At one of the missing populations, a different species of *Carex* was found. This site may have been originally based on a misidentified *Carex*. In addition to confirming 17 previously known populations, Roth found 16 new populations in time to write the 2004 status assessment, greatly expanding our understanding of the species' geographic range.

Since the 2004 status report, nine new Navajo Sedge populations have been discovered. Between 2010 and 2014, 15 previously known populations were surveyed and confirmed extant. No populations have been recorded as extirpated since 2004.

Although very few populations are suspected of having been extirpated since this species was Listed threatened, it is important to note that some populations consist of multiple hanging gardens, and there are cases of possible extirpation from individual gardens.

Specifically, Roth recorded Navajo sedge as missing from at least one garden within four different multi-garden populations. These four populations are still considered extant, however, because Navajo Sedge remains in at least one garden within each complex.

Roth reported low vigor for almost half of her populations, due to livestock impacts or drought. The poor state of so many of the populations in 2004 can be attributed to the effects of the extreme drought years of 2002 and 2003. Based on field work done since then, it does not appear that Navajo Sedge is on a continued decline. The majority of populations appear to be stable. A few populations have increased vigor, and a few have decreased vigor, but no populations (or even subpopulations in individual gardens) have been extirpated since 2004. In her 2012 Status report, Hazelton reported one missing garden. However, that garden was located later in 2012, confirming that Navajo Sedge population as extant.

In 2013, a USFWS contractor set up a long-term monitoring program, which includes measurements of permanent plots throughout the species' range. The protocol for this study is more rigorous than previous monitoring work, with the expectation that this work will record population trends and the impact of threats at a higher resolution than previous efforts (Rink and Hazelton 2014).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: LT with critical habitat (USDI, FWS 1985)
[C1 USDI, FWS 1980]
[PE USDI, FWS 1976]
[PTN-E, 1975 Notice of Review]

STATE STATUS: Highly Safeguarded (ARS, ANPL 1999)
[Highly Safeguarded (ARS, ANPL 1993)]

OTHER STATUS: Category 3 (NNDFW, NESL 2005)
[Category 3 (NNDFW, NESL 2001)]
[Category 3 (NNDFW, NESL 1994)]

MANAGEMENT FACTORS: Due to the restricted habitat of this species, it is vulnerable to water diversion projects, groundwater pumping, capping of well sites, and over-grazing of accessible sites (USFWS 1985, Falk & Jenkins et al. 2001, and CPC 2003). Water development within hanging garden habitat for domestic livestock, which not only diverts water from the garden but concentrates trampling and grazing within the garden, was present at two of the three gardens occupied by Navajo sedge at the time of listing and cited as a threat. However, of the 41 Navajo sedge occurrences recorded since listing on the Navajo Nation, only one has a livestock trough (Hazelton 2012). Over eighty percent of the known Navajo sedge locations on the Navajo Nation have hanging gardens accessible to livestock. Of sites visited from 2000 to 2003, about 23% had medium to heavy livestock impact (Roth 2004). These numbers are biased, however, because surveys of Navajo sedge frequently involve only hanging gardens that are accessible to humans (Hazelton 2012). Many hanging gardens that may be occupied by Navajo sedge are inaccessible to both livestock and humans.

Potential drought, global climate changes, and associated drying of seep and spring areas may represent the primary threat to populations of this species.

PROTECTIVE MEASURES TAKEN: Some populations are naturally protected from livestock impacts and other physical damage by the inhabitance of sheer cliff habitats.

Navajo Sedge is listed as G3 on the Navajo Endangered Species List, which means it is a species whose prospects of survival or recruitment are likely to be in jeopardy in the foreseeable future on the Navajo Nation. Because of this status, project sponsors who propose development in Navajo Sedge habitat are required to analyze the impacts that the proposed development might have to the Navajo Sedge. In general, the Navajo Nation Department of Fish and Wildlife does not recommend approval for projects with potential to adversely affect NESL species. Similarly, the threatened status of Navajo sedge with designated critical habitat under the Endangered Species Act means that any project authorized, funded or carried out by a federal agency that may affect Navajo sedge is subject to Section 7 consultation to ensure the action does not jeopardize the continued existence of the species or result in adverse modification of designated critical habitat.

SUGGESTED PROJECTS: Additional surveys of potential habitat in southeastern Utah should be undertaken, in order to establish the northern range limit of this species. Sites without sedge should be documented and monitored so that we can determine cases of dispersal. A hydrologic analysis of the aquifers supporting hanging gardens with Navajo sedge should be undertaken to document natural fluctuations in water quantity and impacts from existing and future ground water development. Long-term monitoring of population status, including the impacts of perceived threats should be continued in order to determine whether this species is declining or stable. The recovery plan should be updated to reflect our current understanding of Navajo Sedge's range and status.

LAND MANAGEMENT/OWNERSHIP: Navajo Nation, BIA - Navajo Reservation; Hopi Tribe, BIA – Hopi Reservation; NPS – Canyon de Chelly National Monument, Natural Bridges National Monument, and Glen Canyon National Recreation Area; BLM lands in southeastern Utah.

SOURCES OF FURTHER INFORMATION

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ADDITIONAL INFORMATION:

Revised: 1995-05-23 (DBI)
1998-12-15(DJG)
2003-09-18 (SMS)
2005-09-29 (SMS)
2015-11-22
(Rink and Hazelton)

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