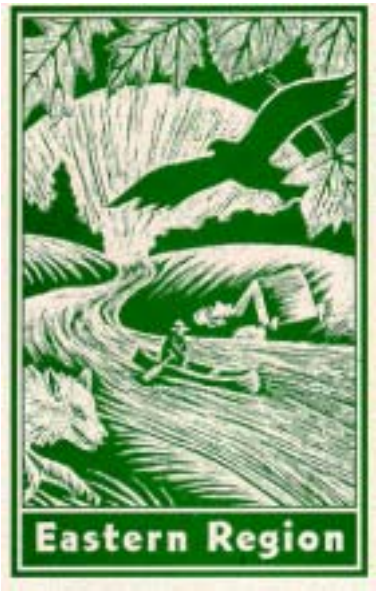
Conservation Assessment

For

Hall's bulrush (Schoenoplectus hallii) (Gray) S.G. Smith



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This document is undergoing peer review, comments welcome

This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

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EXCEUTIVE SUMMARY

Schoenoplectus hallii (Hall's bulrush) is designated as a Regional Forester Sensitive Species on the Huron-Manistee and Mark Twain National Forests in the Eastern Region of the Forest

Service. This species is not documented to occur on any other National Forests. The purpose of this document is to provide background information necessary to prepare Conservation Approaches and a Conservation Strategy that will include management actions to conserve this species.

Hall's bulrush is wetland species that typically grows along sandy shorelines in areas free of perennial and woody vegetation. *S. hallii* has an unusual life cycle, rarely appearing in consecutive years. The achenes subsist in the seedbank for many years, germinating only when conditions are appropriate. Extant populations occur in only nine mid-western states; the species is considered historical or extirpated in several others. The most significant threats to the species are destruction and alteration of its wetland habitats.

ACKNOWLEDGEMENTS

Thanks to the following individuals who kindly responded to my requests for information: Craig Anderson, Carol Baskin, Allison Cusick, Craig Freeman, Ron Hellmich, Julie Holling, Mike Homoya, Paul Kores, Paul McKenzie, Bert Pittman, Marian Smith, Tim Smith, and Deborah White.

NOMENCLATURE AND TAXONOMY

Order:	Cyperales
Family:	Cyperaceae
Common names:	Hall's bulrush Hall's club-rush Hall's twine-bulrush
Scientific name:	*Schoenoplectus hallii* (Gray) S.G. Smith
Synonyms:	*Scirpus hallii* Gray *Scirpus supinus* L. var. *hallii* (Gray) Gray *Scirpus unioides* (Delile) Boiss. var. *hallii* Gray (Beetle)
PLANTS database symbol:	SCHA9

DESCRIPTION OF SPECIES

Schoenoplectus hallii is usually characterized as an annual (Mohlenbrock 1963; Voss 1972). However, Gleason and Cronquist (1991) describe it as an "annual (or seeming annual)", and the National PLANTS Database (2001) classifies it as both an annual and a perennial. In his 1998 Status Assessment for the Fish & Wildlife Service, McKenzie describes Hall's bulrush as an annual, "with short rhizomes that are hidden by the aerial stem bases." The slender, wiry culms are terete and grow in tufts up to 80 cm tall. Often several shorter culms are clustered around the base of the plant. The basal sheaths sometimes bear an expanded terminal blade, but not always (Mohlenbrock 1963).

There is only one bract below the inflorescence, an involucral leaf that is acute-tipped and nearly half as long as the culms (Mohlenbrock 1963). The involucral leaf typically surpasses the spikelets, or flower-clusters, by at least 15 mm (Voss 1972). Hall's bulrush plants have 1-7 greenish-brownish spikelets, which are ovoid-cylindric in shape with a pointed tip. Each spikelet is 5-15 mm long and 2.5-3.5 mm wide, and subtended by a scale, or small bract (Mohlenbrock 1963). Anthers are 0.3-0.7 mm long (Voss 1972).

The ovate scales are greenish-brown, tan, or brown with a green or straw-colored midrib that projects as a short cusp past the body of the scale. Including the acuminate tip, they measure just 2.5-4.0 mm in length (McKenzie 1998). Because they persist longer than the scales, the achenes tend to be rather conspicuous (Voss 1972). The achenes are obovoid in general shape, widest above the middle. They are plano-convex, range from 1.5 to 2.0 mm long, and are black in color at maturity (Mohlenbrock 1963). *Schoenoplectus hallii* is completely lacking perianth bristles, an important identifying feature. However, the prominent corrugated ridges that horizontally transverse the achene are perhaps the most distinctive characteristic of this species (Mohlenbrock 1963; Voss 1972; McKenzie 1998).

In the field, *S. hallii* is often confused with several closely related species from which it cannot be distinguished vegatatively (Mohlenbrock 1963; Ostlie 1990; McKenzie 1998). In the eastern part of its range, *Schoenoplectus purshianus* and *Schoenoplectus smithii* are both similar enough to warrant frequent confusion. Mohlenbrock (1963) outlined the following characteristics that can be used to separate the three species: *S. purshianus* has pitted biconvex achenes with obtuse scales and stout bristles; *S. smithii* has smooth plano-convex achenes with obtuse scales and slender or no bristles; and *S. hallii* has transversely ridged plano-convex achenes with awned scales and no bristles. In the western part of its range, *S. hallii* is often confused with *Schoenoplectus saximontanus* (McKenzie 1998). At one time these two species were both classified as separate varieties of the same species, *S. supinus* (Gleason & Cronquist 1991; National PLANTS Database 2001). However, the two can be readily distinguished by close scrutiny of mature achenes: *S. saximontanus* is tricarpellate, while *S. hallii* is merely bicarpellate (Gleason & Cronquist 1991; McKenzie 1998). In the deep south, most of the reported *S. hallii* occurrences have turned out to be misdeterminations of *Schoenoplectus erectus* (McKenzie 1998). This species is the most closely related to *S. hallii*, and perhaps most difficult to distinguish. *S. erectus* has reddish scales, while *S. hallii* has brownish scales; and *S. erectus* has a flat or even bulged appearance to the ventral surface of the achene, which is concave in *S. hallii* (McKenzie 1998).

LIFE HISTORY

Hall's bulrush has a highly irregular and unpredictable cycle of growth. Although it has been observed annually at several sites in Missouri (McKenzie 1998), the species is not typically found at the same site in successive years (Ostlie 1990). When conditions are favorable for germination and plants develop, population numbers vary widely from year to year (McKenzie 1998). It has been well documented that *S. hallii* generally grows in exposed wet soils, but the exact mechanisms that trigger seed germination remain unknown.

After being visited in 1960, and despite years of active searching, plants did not reappear again at a Muskegon County site in Michigan until 1980 (Ostlie 1990). Plants were collected at a Dane County site in Wisconsin in 1950, but again, despite frequent re-visits, were not observed again until 1996 (WI DNR 2002). Such long intervals without apparent development are not uncommon for this species, evidence that the achenes of *S. hallii* remain viable in the seed bank for many years. Due to this long-term persistence of the achenes, The Nature Conservancy deems any site where Hall's bulrush has been observed within the last 25 years to be extant (Oslie & Gottlieb 1992).

Seed dispersal mechanisms remain largely unknown, although waterfowl may play a role in their consumption of both the vegetation and achenes of bulrushes (Martin et. al. 1951). Colonization of new sites is unlikely, however, due to the very slight odds of achenes being transported to a site meeting *S. hallii*'s strict germination requirements. Most populations of *S. hallii* occur on small patches of very specialized habitat, surrounded by enormous areas of thoroughly inappropriate habitat (McKenzie 1998).

HABITAT

S. hallii is a wetland species, found primarily in situations where widely fluctuating water levels eliminate competition by keeping the area free of other vegetation (Ostlie 1990). Such habitat occurs in coastal plain marshes, sandy swales, ephemeral pools, sinkhole ponds, sand prairies, ditches, lake shores, and even agricultural sites (Ostlie 1990; McKenzie 1998). While typical sites have an exposed sandy substrate, *S. hallii* is occasionally found along rocky or cobbled shorelines (McKenzie 1998; WI DNR 2002).

DISTRIBUTION AND ABUNDANCE

S. hallii has a large range spanning much of the central and midwestern United States, but populations are few and far between. Hall's bulrush has been attributed to an even larger range than that which it actually occupies, primarily due to confusion over taxonomy and identification. Errors such as the misdetermination of specimens and the misreading of herbarium labels have led to false reports of the species from Alabama, Colorado, Florida, South Carolina, South Dakota, and Texas (McKenzie 1998).

Expert-confirmed extant populations occur in Illinois, Indiana, Kansas, Kentucky, Michigan, Missouri, Nebraska, Oklahoma, and Wisconsin (McKenzie 1998; Steinauer 2001). Historical populations of Hall's bulrush have been confirmed from specimens collected in Georgia, Iowa, and Massachusetts. The species is thought to be extirpated from Massachusetts, where all suitable habitat within the previously known location has been destroyed (Ostlie 1990;

McKenzie 1998). Its exact status in Georgia and Iowa is unclear, as appropriate habitat remains available and no active searches have been conducted recently (McKenzie 1998).

In 1998 there were only 46 extant populations of *S. hallii* rangewide, mostly in Illinois (McKenzie 1998). Recent surveys have discovered many new occurrences in Nebraska and Oklahoma (Steinauer 2001; Waldstein 2002), bringing the total number of range-wide occurrences to approximately 100.

There are approximately 30 extant populations of Hall's bulrush in Illinois in Alexander, Cass, Kankakee, Mason, and Morgan counties (McKenzie 1998). The Indiana Natural Heritage Data Center is currently tracking five populations in Lake and Porter counties (Homoya 2002; IN DNR 2002). The Kansas Biological survey is tracking seven populations of *S. hallii* in Harper, Harvey and Reno Counties, three of which are considered extant by the Nature Conservancy 25-year standard (Kansas Biological Survey 2002). The Kentucky Natural Heritage Program tracks two occurrences of *S. hallii* in Christian county (Kentucky Nature Preserves Commission 1999), although the two populations are close enough so as to be considered just one occurrence by the US Fish and Wildlife Service (McKenzie 1998). There are five populations of Hall's bulrush tracked by Michigan Natural Features Inventory in Allegan and Muskegon counties (MNFI 2000). In Missouri, there are four extant populations of *S. hallii*, in Howell and Scott counties (Missouri Department of Conservation 2002). In Nebraska, *S. hallii* was only known from three historical sites until just recently. In 1999 and 2000, while surveying for western prairie fringed orchid (*Platanthera praeclara*) in the Sandhills, Robert Steinauer found 20 new populations of Hall's bulrush in Holt, Brown, Rock, Loup, Garfield, and Wheeler counties (Steinauer 2001). Similar discoveries were made in recent surveys on the Wichita Mountains Wildlife Refuge in Comanche County Oklahoma, where in 2000 and 2001 *S. hallii* was found in 39 new locations on 18 ponds (Waldstein 2002). Hall's bulrush had previously been known from only three sites in Oklahoma, in Atoka, Comanche and Johnston counties (McKenzie 1998). There is only one documented population of *S. hallii* in Wisconsin, in Dane County (WI DNR 2002).

RANGE WIDE STATUS

Hall's bulrush has a Nature Conservancy ranking of G2, indicating that it is globally imperiled and very vulnerable to extinction (Ostlie & Gottlieb 1992; NatureServe Explorer 2001). Most of the states within the species range have a heritage status of S1, including Nebraska, Kansas, Oklahoma, Missouri, Iowa, Wisconsin, Illinois, Kentucky, and Indiana. In Michigan, *S. hallii* is ranked S2; and the species is considered extirpated in Massachusetts (NatureServe Explorer 2001).

POTENTIAL THREATS

The most serious threats to populations of *S. hallii* are the destruction and alteration of its wetland habitat (Ostlie 1992; McKenzie 1998). Many sites have been partially or entirely destroyed by various types of development, including residential, commercial, agricultural, and recreational. A large portion of a site in Kentucky was recently obliterated by the construction of a new truck stop (McKenzie 1998). The dredging and filling that makes residential development possible in wet areas has damaged habitat in Michigan and Kansas

(Ostlie 1990). Several populations of Hall's bulrush in Illinois were eliminated by agricultural activities, such as the plowing and tillage of wetland habitat in dry years, and the deliberate application of post-emergent herbicides (McKenzie 1998).

There are many other sites where habitat has not been destroyed outright, but rather altered to such a degree that they were no longer suitable for populations of *S. hallii*. Habitat at a historical site in Massachusetts was irrevocably altered by an influx of storm water runoff, septic effluent, and herbicides (Ostlie 1990). Four of the five sites in Michigan are threatened by off-road vehicle use (MNFI 2000). While the species requires flooding to maintain its early successional habitat, Hall's bulrush is an not a submergent: inundation has been documented to kill flowering plants if water overtops the plants after germination (McKenzie 1998). Permanent inundation has been suggested as a cause of the loss of a historical site in Massachusetts (McKenzie 1998). Where early successional habitat is not naturally maintained or managed for, perennials easily outcompete *S. hallii*, especially non-native invasive species such as purple loosestrife (*Lythrum salicaria)*. Dense populations of purple loosestrife can inhibit the germination of Hall's bulrush, which may have caused the loss of a site in Massachusetts, and currently threatens sites in Indiana and Kansas (Ostlie 1990; McKenzie 1998).

LAND OWNERSHIP AND EXISTING HABITAT PROTECTION

With the exception of the large number of sites recently found on the Wichita Mountains Wildlife Refuge in Oklahoma, most populations of Hall's bulrush are located on private ownership. While populations of *S. hallii* on public land are afforded protection from threats such as residential development and agricultural tillage, other risks such as damage from recreational use and competition from invasive species still exist.

In Illinois, where the type specimen for *S. hallii* was originally collected, there is only one protected population, on the Sand Prairie-Scrub Oak Nature Preserve in Mason County (McKenzie 1998). In Indiana, there are several populations of *S. hallii* on National Park lands in Indiana Dunes National Lakeshore, and another population at the Coulter Nature Preserve (Homoya 2002; IN DNR 2002). All five of Michigan's populations of Hall's bulrush occur at least partially on public land: two sites are on State of Michigan lands managed by the Michigan Department of Natural Resources, two sites are located on Federal lands managed by the Manistee National Forest and one site is partly owned by the Michigan Nature Association (McKenzie 1998; MNFI 2000).

SUMMARY OF EXISTING MANAGEMENT ACTIVITIES

Protecting extant *S. hallii* sites is necessary for the species' long-term survival. McKenzie (1998) suggested that management plans should be developed for sites occurring on public land, and outlined six key elements essential for preserving populations.

"Included in such plans should be recommendations to:
1) protect and maintain the hydrology essential to the species,
2) retard plant succession,
3) control competing perennials, especially such aggressive exotics as purple loosestrife,
4) control off road vehicle use,
5) develop an active outreach and education program, and
6) support the development of long-term monitoring programs and active research on the species."

Other strategies can be used on the many Hall's bulrush sites that are privately-owned. Heritage staff in Missouri, where all four extant sites occur on private property, have been quite successful in working with landowners. Two sites have been registered with The Nature Conservancy's Registry Program (Missouri Department of Conservation 2002). At a third site, the landowner verbally agreed to protect the occurrence by maintaining the sand pond in its current state, preventing woody perennials from encroaching on the site, and allowing researchers access to the area for study (McKenzie 1998; T.E. Smith 2002).

RESEARCH AND MONITORING

Populations of Hall's bulrush are tracked by natural heritage programs in every state in which the species occurs. This usually entails periodic visits by heritage staff to known element occurrence sites; some states are actively searching for new populations. For example, during the summer of 2001, heritage staff in Inidana re-visited all known sites within the state, and discovered one new population (Homoya 2002). Other monitoring activities take place within the bounds of specific management areas, such as the Wichita Mountains Wildlife Refuge in Comanche County, Oklahoma. In the 2000 and 2001 field seasons, refuge-wide surveys were conducted for *S. hallii*, and plans are in place for future monitoring (Waldstein 2002).

Range-wide monitoring also takes place on the federal level by the US Fish and Wildlife Service. In 1993, Hall's bulrush was classified as a Category 2 candidate species on the Plant Candidate Review for Listing as Endangered or Threatened Species. Category 2 candidate species were defined as those for which listing as Federally Endangered or Federally Threatened may be warranted, but conclusive data on biological vulnerability and threats is not available. Category 1 candidate species were defined as those species for which the Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to support the issuance of a proposed rule to list as endangered or threatened, but issuance of the proposed rule is precluded by other listing actions (McKenzie 1998).

In 1994, shortly after Hall's bulrush was listed as a Category 2 species, federal policy changed the definition of candidate species. The Fish and Wildlife Service no longer maintains an official list for species such as Hall's bulrush that are rare enough to merit concern over species viability, but lack concrete evidence to rule upon. Only those species

formerly classified as Category 1 species are still considered candidates. However, the agency works closely with state heritage programs and species experts to help determine when sufficient information is available to warrant their addition to the list of candidate species. As part of that effort, the Fish and wildlife Service's Columbia, Missouri Field Office began a range-wide status review of Hall's bulrush in 1995, and an official Status Assessment was published in 1998 (McKenzie 1998).

The range-wide monitoring by the Fish and Wildlife Service is a continual, ongoing process. Paul McKenzie is currently updating the 1998 Status Assessment to include new information, and also collaborating with Galen Smith to publish data in a peer-reviewed journal later this year (McKenzie 2002). There are research programs currently focused on *S. hallii* at several universities, so more information about the species is forthcoming.

At the University of Kentucky, Carol and Jerry Baskin have been investigating germination requirements since 1991, funded partially through the US Fish and Wildlife Service (McKenzie 1998). In their attempt to break dormancy in achenes of *S. hallii*, the Baskins have tried various combinations of flooded vs. non-flooded conditions, cold stratifications vs. constant temperatures, and treatments with various chemicals (McKenzie 1998). The Baskins are currently working on a paper to be submitted for peer-review in the summer of 2002; preliminary results indicate that Hall's bulrush requires cold stratification followed by flooding to break dormancy and germinate (Baskin 2002).

Marian Smith from Southern Illinois University at Edwardsville has been studying the basic biology and ecology of *S. hallii* for the last 18 months, funded partially by the Missouri Department of Conservation. Dr. Smith and her students are investigating populations of Hall's bulrush at field sites in Missouri, Illinois, Oklahoma, and Kentucky. No data has been published yet. Research topics include number and viability of achenes in soil seed banks; surface characteristics and shape of achenes; flotation of achenes and potential of dispersal on floodwaters; stem and culm structure; achene germination and early seedling development; gas exchange physiology; population demography; site characteristics and vegetative community; and possible hybridization with *S. saximontanus* (M. Smith 2002).

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