Schizachne purpurascens

Purple Oat

Poaceae

Schizachne purpurascens by Peter M. Dziuk, 2013

Schizachne purpurascens Rare Plant Profile

New Jersey Department of Environmental Protection
State Parks, Forests & Historic Sites
State Forest Fire Service & Forestry
Office of Natural Lands Management
New Jersey Natural Heritage Program

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Life History

Schizachne purpurascens (Purple Oat) is a perennial grass that grows in loose tufts. The genus *Schizachne* is monotypic. The culms are usually between 40 cm and 1 meter tall, often making a slight bend at the base before becoming upright. The stem nodes are smooth and darken with age, and the leaves are mostly erect and about 2–4 mm wide. The leaf sheaths are fused nearly all the way to the top and the ligules are membranous. The average inflorescence is approximately 10 cm long and somewhat sparsely flowered, with one or two branches at each node that can remain erect but are often spreading or drooping. The glumes at the base of the several-flowered spikelets are purplish and unequal in length. Each papery lemma has a tuft of hair at the base, 7–9 distinct veins, and a long (8–15 mm) awn that equals or exceeds the length of its 8–10 mm body. (See Swallen 1928, Britton and Brown 1913, Fernald 1950, Hitchcock 1950, Gleason and Cronquist 1991, Mittelhauser et al. 2019, Cayouette and Darbyshire 2021). *Schizachne purpurascens* typically flowers in May and June, and the fruits mature during July or sometimes in August (Morin and Payette 1988, Rhoads and Block 2007, Smreciu et al. 2014, Weakley et al. 2022).

Left: Britton and Brown 1913, courtesy USDA NRCS 2022a. Right: Peter M. Dziuk, 2015.

Schizachne purpurascens can obtain nitrogen from invertebrates by forming associations with endophytic insect-pathogenic fungi (EIPF). Behie et al. (2015) isolated several EIPF from *S. purpurascens* plants, including *Metarhizium brunneum*, *Beauveria bassiana* and *Pochonia chlamydosporium*. Spores of EIPF can adhere to the surface of an invertebrate then penetrate the living tissue and proliferate internally, killing the host (Branine et al. 2019). While *Metarhizium* and *Beauveria* primarily utilize insect hosts, *Pochonia* species generally infect nematodes (Moonjely and Bidochka 2019). The fungal mycelia develop in the soil and associate with plants, mostly colonizing root tissue but also sometimes extending into shoots, leaves, or stems (Behie et al. 2015). EIPF translocate nitrogen from the invertebrates to the plants and in turn receive carbon from their floral associates (Behie at al. 2012, 2015, 2017). In addition to enhancing growth and productivity, colonization by *Metarhizium* or *Beauveria* can confer additional benefits on host plants by providing some protection from insect herbivores and other plant pathogens (Branine et al. 2019, Hu and Bidochka 2019).

Pollinator Dynamics

Wind pollination prevails in the grass family (Culley et al. 2002, Garcia-Mozo 2017) and *Schizachne purpurascens* flowers are pollinated by wind (Friedman and Barrett 2009). Some characteristics that facilitate wind pollination in the family include smooth, round pollen grains, a reduced perianth, and a limited number of ovules (Geisler 1945, Friedman and Barrett 2009). Self-incompatibility is common in wind-pollinated plants such as those in the Poaceae (Friedman and Barrett 2009) and is particularly frequent in perennial grasses (Baumann et al 2000). However, no specific information was found regarding the potential for self-fertilization in *S. purpurascens*.

Seed Dispersal

The fruit of a grass, known as a grain or caryopsis, is dry, indehiscent, and single-seeded. The grains of *Schizachne purpurascens* are smooth, dark, and shiny, and at maturity they typically fall free of the palea and lemma (Cayouette and Darbyshire 2021). Wiegmann and Waller (2006) cited abiotic dispersal for the species, which could include both gravity and wind. Smreciu et al. (2014) indicated that the awned lemmas might adhere to mammal fur if the florets were released as a unit but listed wind as the primary dispersal mechanism.

Most grass seeds require a period of dormancy (Deno 1993, Baskin and Baskin 1998), and the propagules of *Schizachne purpurascens* can persist in the soil for some time. *S. purpurascens* was recorded in the seed banks of Wisconsin woodlots that had a variety of canopy covers and land use histories (Gunterspergen and Kunowski 1985), and seeds of the species that were collected from the organic layer of an Ontario woodland were successfully germinated (Qi and Scarratt 1998). Some Purple Oat seeds were also recovered from the upper layer of soil in a subalpine region of Quebec where the grass comprised 2.7% of the aboveground vegetation, although only 3 out of the 103 seeds collected proved to be viable (Morin and Payette 1988).

Habitat

In North America, *Schizachne purpurascens* is usually found in hardwood, mixed, or coniferous forests with substrates that range from moist to dry (Rhoads and Block 2007, Smreciu et al.

2014, Cayouette and Darbyshire 2021, Weakley et al. 2022). The ground is sometimes fairly rocky (Weakley et al. 2022): In New Jersey *S. purpurascens* plants were growing on a ledge near the base of a cliff (NJNHP 2022) and in Indiana the species was located on a limestone slope (Aldrich et al. 1986). In West Virginia, Purple Oat was discovered in a moist forest next to a beaver-impacted site (Bartgis et al. 2015).

Although typical *S. purpurascens* habitat is lightly to moderately shaded (Kashian et al. 2003) the species has been documented growing in an unshaded site on the summit of a high outcrop ridge (Ritchie 1956). Good (1963) examined the responses of woodland herbs to varying light intensities and found that *Schizachne purpurascens* became dominant in sites that received moderately high levels of light in comparison to other parts of the forest floor (available sunlight 14.5–16.3%).

Data from British Columbia was used to calculate Purple Oat's microsite preferences such as elevation (59–1970 meters, average = 940 m) and slope gradient (0–103 percent, average = 13%) (Klinkenberg 2020). Klinkenberg also quantified the most favorable moisture regime as 4 (mesic) on a scale of 0 (very xeric) to 8 (hydric) and identified the nutrient regime as C (medium). A more comprehensive description of the soil and moisture regimes is provided by the B. C. Ministry of Forests (1998). In a mesic water regime the primary water source is precipitation in moderate to fine-textured soils or limited seepage in coarse textured soils. Water is removed somewhat slowly relative to the supply, and moisture availability generally reflects climatic input. A medium nutrient regime, in which an average amount of nutrients are available, is associated with sites at which the water pH generally falls between 5.5 and 6.5.

Wetland Indicator Status

Schizachne purpurascens is a facultative upland species, meaning that it usually occurs in nonwetlands but may occur in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2022b)

SCPU

Coefficient of Conservatism (Walz et al. 2018)

CoC = 10. Criteria for a value of 9 to 10: Native with a narrow range of ecological tolerances, high fidelity to particular habitat conditions, and sensitive to anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The global range of *Schizachne purpurascens* includes much of Asia, eastern Europe, Canada, and the United States (POWO 2022). The map in Figure 1 depicts the extent of Purple Oat in North America.

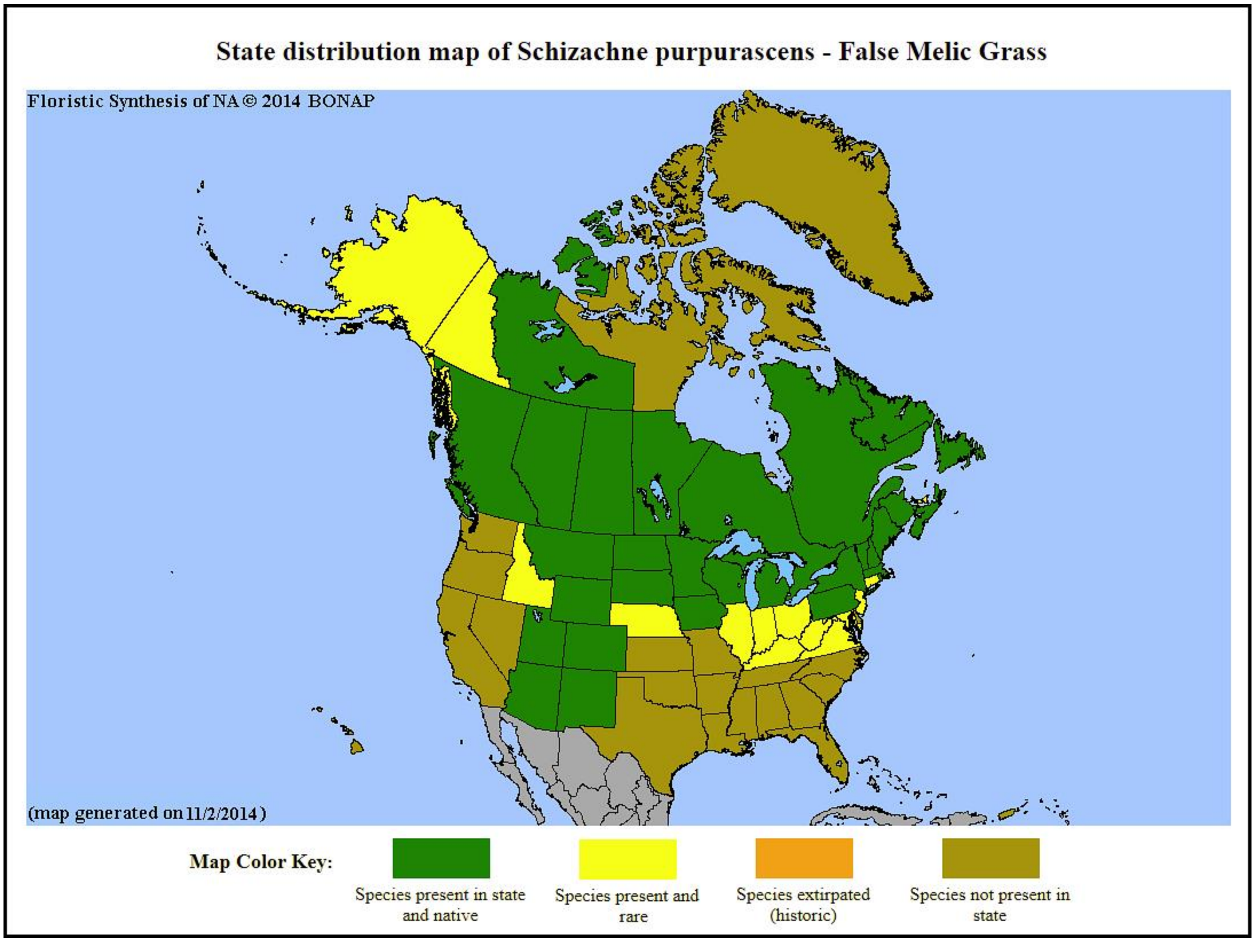

Figure 1. Distribution of S. purpurascens in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2022b) shows records of *Schizachne purpurascens* in only one New Jersey county: Sussex County (Figure 2 below). Although Britton (1889) cited a report of the species from Bergen County the occurrence was apparently never documented (Snyder 1989).

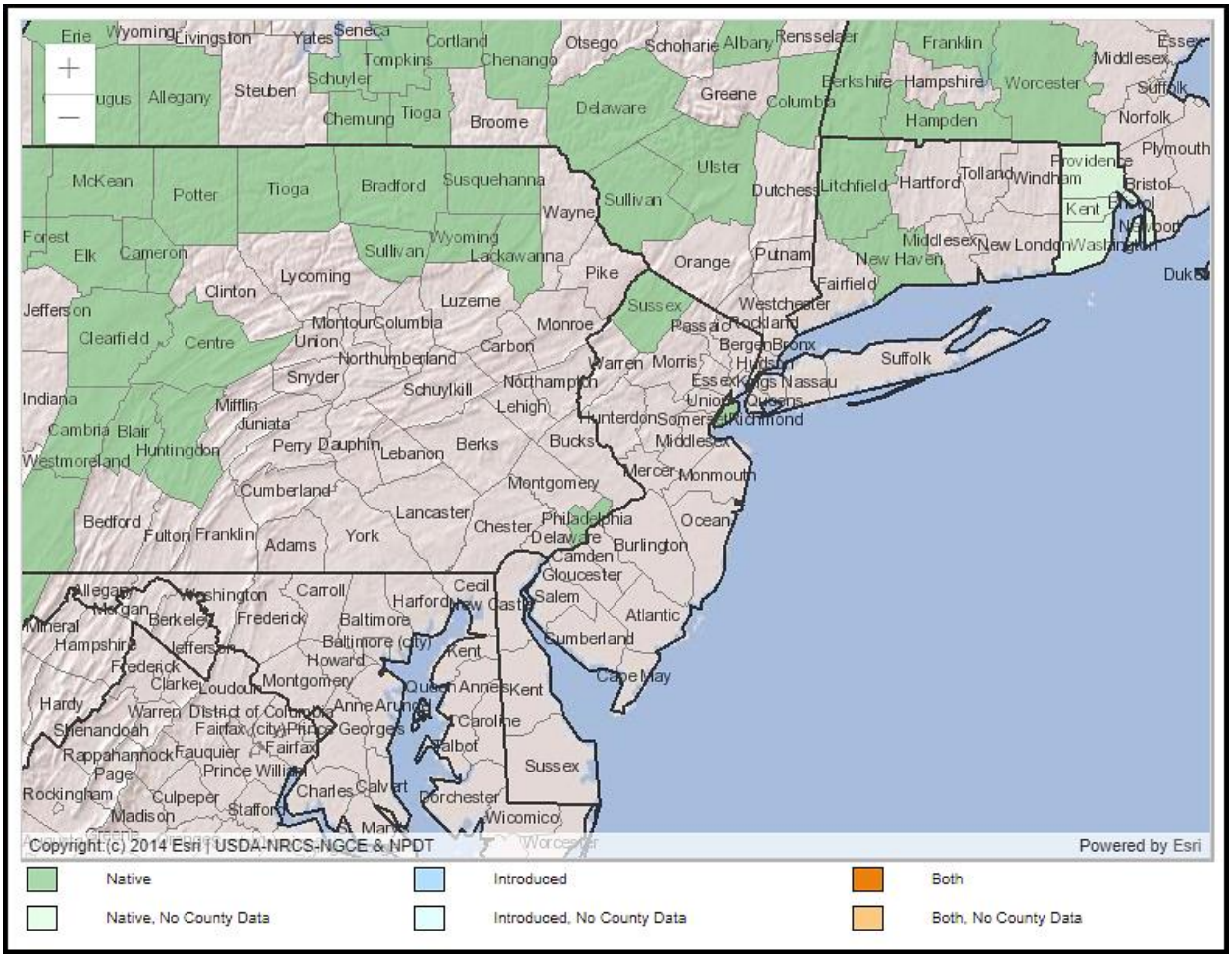

Figure 2. *County records of S. purpurascens in New Jersey and vicinity (USDA NRCS 2022b).*

Conservation Status

Schizachne purpurascens is considered globally secure. The G5 rank means the species has a very low risk of extinction or collapse due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats (NatureServe 2022). The map below (Figure 3) illustrates the conservation status of *S. purpurascens* throughout North America. Purple Oat is critically imperiled (very high risk of extinction) in nine states, imperiled (high risk of extinction) in two states and two provinces, and vulnerable (moderate risk of extinction) in two states and one province. In other districts where the species occurs it is secure, apparently secure, or unranked.

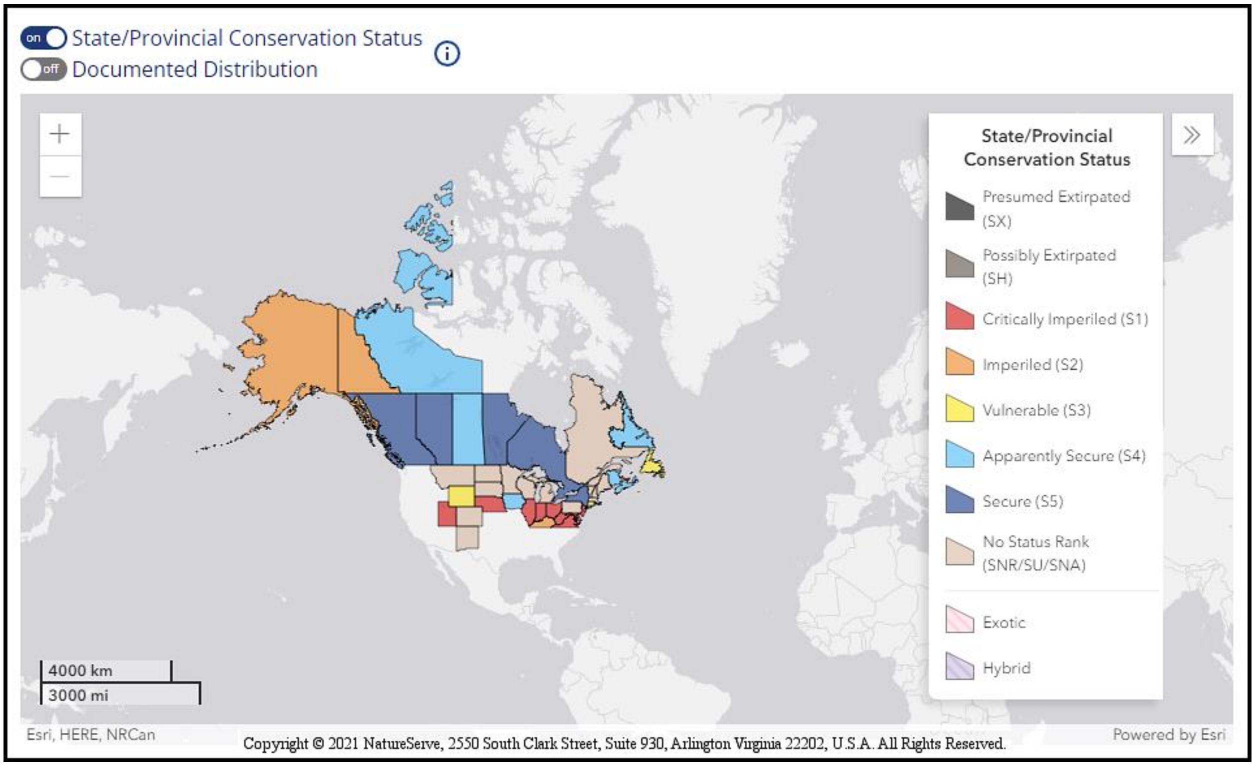

Figure 3. Conservation status of S. purpurascens in North America (NatureServe 2022).

Schizachne purpurascens is ranked S1.1 in New Jersey (NJNHP 2022), meaning that it is critically imperiled due to extreme rarity. A species with an S1.1 rank has only ever been documented at a single location in the state. *S. purpurascens* is also listed as an endangered species (E) in New Jersey, meaning that without intervention it has a high likelihood of extinction in the state. Although the presence of endangered flora may restrict development in certain communities, being listed does not currently provide broad statewide protection for plants. Additional regional status codes assigned to the grass signify that the species is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

New Jersey's only confirmed occurrence of *Schizachne purpurascens* was first documented by a specimen collected in 1935 (Snyder 1989). Nearly a half century later Hough (1983) reported that there were no current records of the species in the state, but shortly thereafter the original population was relocated by David Snyder (Snyder 1989, 2000). At the time of its rediscovery the occurrence consisted of a single clump but notes from recent monitoring visits indicate that the population has persisted and may even be slowly expanding (NJNHP 2022).

Threats

No threats to New Jersey's population of *Schizachne purpurascens* have been identified (NJNHP 2022), and on the whole the grass appears to be fairly resilient. Some large-scale disturbances such as those resulting from industrial resource acquisition can be damaging to local populations: For example, a study of land impacted by fossil fuel exploration and extraction found that *S.*

purpurascens strongly favored intact sites with fewer disruptions (Huff 2009). However, there is also evidence that certain types of disturbance can favor the establishment of Purple Oat. Sidhu (1965) indicated that the grass was more abundant in clearings than in forested areas and Kern et al. (2006) referred to *S. purpurascens* as an "early successional and weedy species." The impact of logging operations also seems to depend on the methodology used. When Qi and Scarratt (1998) compared vegetation in cut, partially cut, and uncut portions of a boreal mixed forest they found that *S. purpurascens* was present in the understory only at the partially cut sites. Habitat created by selective harvesting techniques which produced uneven-aged stands was more favorable for *S. purpurascens* than that of even-aged stands or old-growth communities (Kern et al. 2006), and the species was more frequent in winter-logged sites than in summer-logged sites (Wolf et al. 2008). In Michigan pine forests, Abrams and Dickmann (1982) found that *S. purpurascens* was likely to occur on both clear-cut sites and sites that had been disturbed by fires, and they observed that the grass had become dominant on some of the older burned sites (Abrams and Dickmann 1982, 1983). Mackenzie and Naeth (2019) used plant-derived smoke water and potassium nitrate (KNO_3) to simulate post-fire gap-detection mechanisms and assessed the impact on germination of cold-stratified and non-stratified seeds of common understory plants in a boreal forest. The team found that *S. purpurascens* germination was highest in cold-stratified seeds that had not been exposed to any treatments, suggesting that other factors such as light or temperature might influence post-burn abundance of the species.

Sidhu (1965) compared the interaction of different methods of pasture management and herbivory by livestock and found that in wooded habitat *Schizachne purpurascens* was most abundant under a moderate grazing regime but in more open areas its frequency gradually declined as grazing intensity increased. Coughenour (1985) found that moderate grazing of *S. purpurascens* could stimulate vegetative reproduction. In New Jersey and other parts of the northeast, the mammalian herbivore most often noted as a threat to rare plant species is the White-tailed Deer (*Odocoileus virginianus*). However, both Beguin et al. (2011) and Begley-Miller et al. (2014) reported that *Schizachne purpurascens* is quite tolerant of herbivory by deer, and the latter authors pointed out that many graminoids minimize their susceptibility to deer by regrowing from a basal meristem after they have been browsed. In fact, Frerker et al. (2017) found that *S. purpurascens* benefitted from deer browse and was more abundant in open plots than inside of experimental herbivore exclosures. Some *Schizachne purpurascens* plants may be consumed by larvae of the northern pearly-eye butterfly (*Enodia anthedon*), for which it is a host species (Smreciu et al. 2014), but *E. anthedon* caterpillars are able to utilize a wide variety of woodland grasses (NABA 2017) so they are not likely to comprise a significant threat to Purple Oat.

Some threats to *Schizachne purpurascens* could arise from the establishment of non-native flora or fauna. The colonization of *S. purpurascens* habitat by invasive plant species was noted as a concern for occurrences in West Virginia (Bartgis et al. 2015). In the Great Lakes region *S. purpurascens* displayed a significant preference for sites with low earthworm density, although the species was only considered a moderate indicator of the presence of the exotic worms (Corio et al. 2009). Nevertheless, long-term studies of plant communities in Wisconsin and northern Michigan found that Purple Oat had increased by 217% over a 50-year period (Wiegmann and Waller 2006). The authors suggested that grasses like *S. purpurascens* can adapt well to change because they do not depend on biotic pollinators and they are likely to disperse well, persist vegetatively, and tolerate a range of environmental conditions.

Management Summary and Recommendations

No immediate management needs have been identified for *Schizachne purpurascens* in New Jersey, although note should be taken of emerging threats from invasive plant species during future monitoring visits. Regular updates of the population's status are recommended since Purple Oat is only known from a single location in the state.

All of the districts where *Schizachne purpurascens* is most critically imperiled are situated near the southern end of the species' range (see Figure 3). A recent assessment in Illinois ranked the species as highly vulnerable to climate change, meaning that its abundance or range in the state was likely to decrease significantly by 2050 (Molano-Flores et al. 2019). The opinion conflicts with that of Wiegmann and Waller (2006), who viewed *S. purpurascens* as an adaptable species. No explicit information was found regarding the ways in which climactic conditions might affect the establishment or persistence of *Schizachne* colonies, and research in that area could help to determine what may be required in order to maintain the species as circumstances continue to change. Other areas of study that could help to predict the trajectory of *S. purpurascens* include the identification of a long-distance dispersal mechanism and determination of whether the colonization of gaps depends primarily on the introduction of fresh propagules or on banked seed.

Synonyms

The accepted botanical name of the species is *Schizachne purpurascens* (Torr.) Swallen. Orthographic variants, synonyms, and common names are listed below (ITIS 2022, POWO 2022, USDA NRCS 2022b).

Botanical Synonyms	Common Names
Avena striata Michx.	Purple Oat
Avena striata f. albicans Fernald	False Melic
Avena torreyi Nash	False Melicgrass
Bromelica striata (Hitchc.) Farw.	
Melica purpurascens (Torr.) Hitchc.	
Melica striata Hitchc.	
Melica striata f. albicans (Fernald) Fernald	
Schizachne purpurascens f. *albicans* (Fernald) Fernald	
Schizachne purpurascens f. *purpurascens* (Torr.) Swallen	
Schizachne purpurascens ssp. *callosa* (Turcz. ex Griseb.) T. Koyama & Kawano	
Schizachne purpurascens ssp. *capillipes* (Kom.) Tzvelev	
Schizachne purpurascens ssp. *purpurascens*	
Schizachne purpurascens var. *pubescens* Dore	

Schizachne striata (Hitchc.) Hultén
Schizachne stricta (Michx.) Hultén
Trisetum purpurascens Torr.

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