

Vulpia elliottea

Squirrel-tail Six-weeks Grass

Poaceae



Vulpia elliottea from Britton and Brown 1913, courtesy USDA NRCS 2024a

***Vulpia elliottea* Rare Plant Profile**

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

501 E. State St.
PO Box 420
Trenton, NJ 08625-0420

Prepared by:
Jill S. Dodds
jsdodds@biostarassociates.com

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For:
New Jersey Department of Environmental Protection
Office of Natural Lands Management
New Jersey Natural Heritage Program
natlands@dep.nj.gov

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Life History

Vulpia elliottea (Squirrel-tail Six-weeks Grass) is a shallowly rooted annual grass that grows in single spikes or small tufts. Typical *V. elliottea* culms are 15–60 cm high, although Hermann (1935) found a New Jersey population with unusually short stems (mostly 6–10 cm) and noted that similarly sized plants had also been reported in Maryland. The leaves are smooth with blades up to 10 cm long and 1 mm wide which may be flat or roll inward along the edges. The inflorescence is a panicle 5–20 cm in length. The spikelets of *V. elliottea* are 3–5 mm long and contain 3–6 long-awned florets. The florets have subequal glumes (the lower nearly two-thirds the length of the upper) and their pubescent lemmas are 2.5–3.5 mm long, a combination of characteristics which can readily distinguish *V. elliottea* from other *Vulpia* species that occur in New Jersey. The fruits (caryopses) are also smaller than those of other local species, ranging from 1.5–2.5 mm in length. (See Britton and Brown 1913, Henrard 1937, Fernald 1950, Hitchcock 1950, Gleason and Cronquist 1991, Chamberlain 2018, Lonard 2021).



Left: Hitchcock 1950, courtesy USDA NRCS 2024b. Center: Boufford and Schram 1974.
Right: Michael J. Oldham, 1990.

Vulpia species are generally short-lived, flowering and fruiting early in the growing season (Lonard and Gould 1974, Tucker 1996). *Vulpia elliottea* usually completes its reproductive cycle from March to May (Callahan 2021, Weakley et al. 2022). Hough (1983) noted early May to June for New Jersey but recent monitoring of an extant population revealed that most of the fruit had been dispersed by the end of May and the plants were already senescing (NJNHP 2024).

Pollinator Dynamics

The majority of grasses are pollinated by wind but that is seldom the case in *Vulpia*. Plants in the genus mainly produce cleistogamous flowers that remain closed and are self-fertilized. Minimal investment is made in male reproductive organs. Most *Vulpia* florets only have one small anther and pollen production is very limited—as few as 12 pollen grains per anther have been reported (Fernald 1945, Lonard and Gould 1974, Campbell et al. 1983).

Close examination of *Vulpia microstachys*, a related and structurally similar species, indicated that the species was primarily cleistogamous but tended to produce a few chasmogamous (outcrossing) flowers in each population (Kannenberg and Allard 1967). Kannenberg and Allard observed that chasmogamy was more frequent when environmental conditions were favorable. The anthers of chasmogamous florets were larger than those of typical florets and produced copious amounts of pollen. The authors noted that individual florets occasionally contained both types of anthers, and that cleistogamous and chasmogamous florets could be present in the same spikelet.

Seed Dispersal and Establishment

The fruit of *Vulpia elliottea* is a dry, one-seeded grain. At maturity, the florets separate between the lemmas and are released as individual units (Gleason and Cronquist 1991). A study of dispersal in *Vulpia ciliata*—a species with a comparable life history and similar habitat preferences—found that the fruits were initially freed from the inflorescence by wind and landed an average of 6 cm from the parent plants, although the distribution distance could be tripled by a person walking through the grasses (Carey and Watkinson 1993). Short dispersal distances may be advantageous to species that can thrive in short-lived habitats and are capable of rapid reproduction (Cheplick 2022).

Long distance dispersal in the Poaceae is generally facilitated by animals. Grass seeds are an important food source for numerous birds and they are also frequently consumed by other animals (Fassett 1957, Baskin and Baskin 1988). The defecation of viable seeds is a particularly effective form of dispersal for many grasses (Janzen 1984, Bilal 2015, Milotić and Hoffmann 2016), and rodents may either consume the seeds or cache them in new locations (Vander Wall 2010, Lucero and Callaway 2018). The long awns of *Vulpia elliottea* also increase the likelihood of seed attachment to mammal fur and subsequent transport (Hovstad et al. 2009, Peterson and Kellogg 2022).

Plants in the genus *Vulpia* follow a life cycle that is typical of winter annuals. The seeds require high summer temperatures in order to break dormancy and the majority germinate during the cooler autumn months of the same year. Germination is favored by light. Slow vegetative growth during the late fall and winter is followed by rapid development and reproduction in the spring. *Vulpia* populations generally don't form a seed bank, although under certain conditions the seeds of some species may persist in the soil for several years (Baskin and Baskin 1988, Carey and Watkinson 1993, Dowling 1996). Associations with dark septate fungi and arbuscular

mycorrhizal fungi have been documented in *Vulpia ciliata* ssp. *ambigua* (Newsham 1999, Wang and Qui 2006).

Habitat

Vulpia elliottea generally grows on well-drained substrates and is often associated with sand (Reverchon 1886, Gilman 1957, Lonard 2021, Weakley et al. 2022) or with other coarse, shallow soils (Kral 1955, Hoagland and Buthod 2007, Buthod and Hoagland 2020). The sites may be dry to xeric (Hough 1983, MacRoberts et al. 2002), although Tompkins (2011) reported an unusual occurrence in hydric soil on a wet prairie.

In coastal areas *Vulpia elliottea* can be found on barrier dunes, where it may grow out in the open or in shrub thickets (Pohl 1946, Higgins 1969, McCaffrey 1990, Dilustro and Day 1997, Steury 1999 & 2000). In New Jersey, *V. elliottea* has been found growing on open sand behind dunes and in dry fields on the coastal plain (Hermann 1935, Pohl 1946, NJNHP 2024). Further inland it may occur in prairies, grasslands, or open woodlands (Oberholser 1925, MacRoberts et al. 2002, Tompkins 2011, Lonard 2021). Eastern coastal plain communities have been described as open oak-sassafras barrens, pine/scrub oak sandhills, and mesic pine savannas (Hermann 1935, Callahan 2021). Midwestern grassland communities where the grass was reported included a *Schizachyrium scoparium-Sorghastrum nutans* association and a *Bouteloua hirsuta-B. curtipendula* association (Hoagland and Buthod 2007, Buthod and Hoagland 2020). Hermann (1935) noted the co-occurrence of *Vulpia elliottea* and *V. octoflora* at a New Jersey site. Associates noted more recently at the same site included a prickly-pear cactus (*Opuntia* sp.) and a frostweed (*Crocyanthemum* sp.) NJNHP 2024).

Throughout its range, *Vulpia elliottea* frequently establishes in anthropogenically altered habitats. Examples include abandoned agricultural fields, pastures, disturbed woodlands, roadsides and ditches, transportation and utility corridors, and developed areas (Kral 1955, Odum 1960, Gilman 1957, Golley and Gentry 1965, Gullidge and Judd 2002, Hoagland and Buthod 2006, Sorrie et al. 2006, Majure 2007, Philley 2019, Callahan 2021, Lonard 2021, Sorrie 2021, Weakley et al. 2022).

Wetland Indicator Status

Vulpia elliottea is not included on the National Wetlands Plant List (NWPL). Any species not on the NWPL is considered to be Upland (UPL) in all regions where it occurs. The UPL designation means that it almost never occurs in wetlands (U. S. Army Corps of Engineers 2020).

USDA Plants Code (USDA, NRCS 2024c)

VUEL

Coefficient of Conservancy (Walz et al. 2020)

CoC = 2. Criteria for a value of 1 to 2: Native invasive or widespread native that is not typical of (or only marginally typical of) a particular plant community; tolerant of anthropogenic disturbance (Faber-Langendoen 2018).

Distribution and Range

The native range of *Vulpia elliottea* is restricted to the continental United States (POWO 2024). The map in Figure 1 depicts the extent of the species in North America.

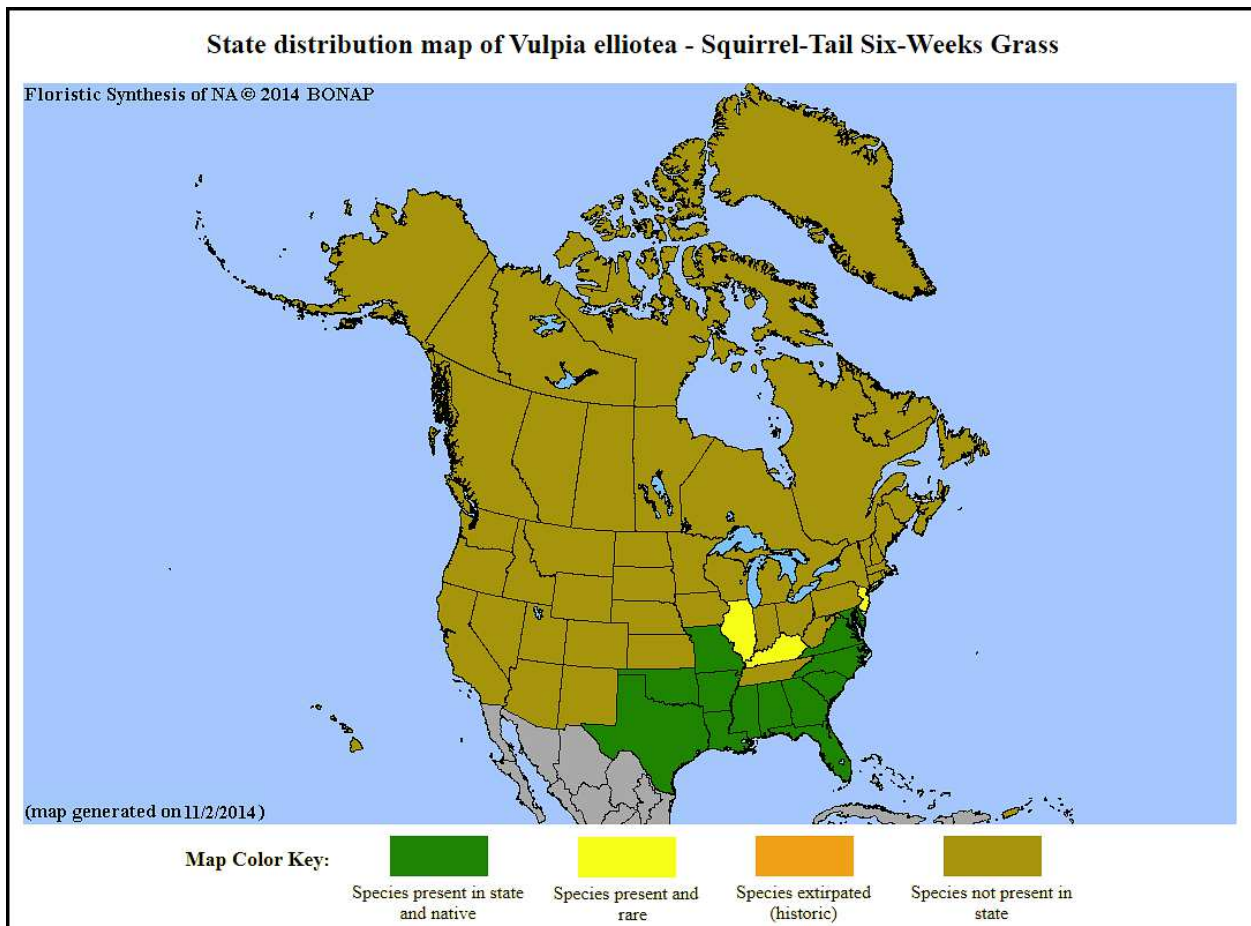


Figure 1. Distribution of *V. elliottea* in North America, adapted from BONAP (Kartesz 2015).

The USDA PLANTS Database (2024c) shows records of *Vulpia elliottea* in five New Jersey counties: Atlantic, Camden, Cape May, Gloucester, and Salem (Figure 2 below). The data include historic observations and do not reflect the current distribution of the species.

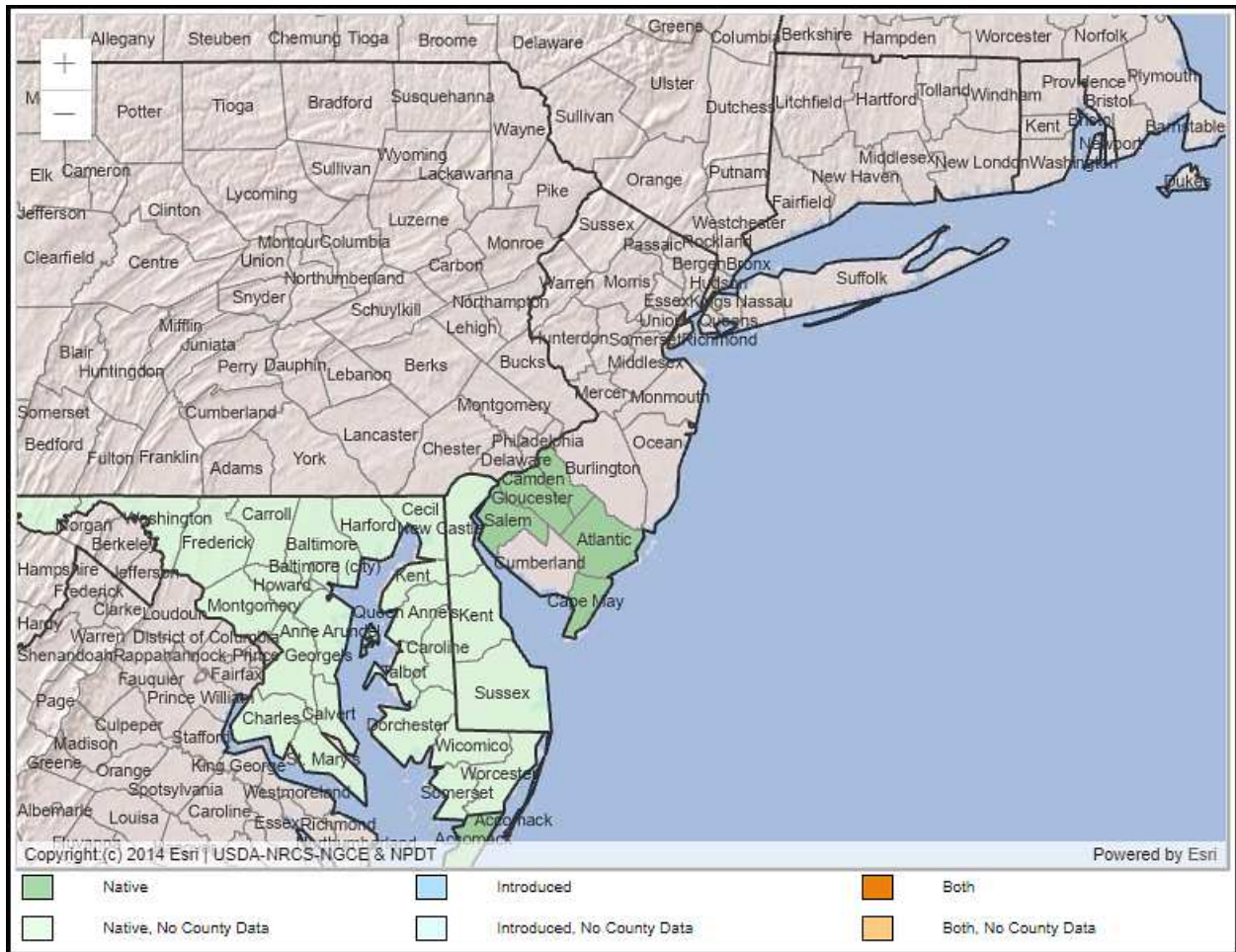


Figure 2. County records of *V. elliottea* in New Jersey and vicinity (USDA NRCS 2024c).

Conservation Status

Vulpia elliottea 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 2024). The map below (Figure 3) illustrates the conservation status of *V. elliottea* throughout its range. Squirrel-tail Six-weeks Grass is critically imperiled (very high risk of extinction) in two states and vulnerable (moderate risk of extinction) in one state. It appears to be secure in Virginia and has not been ranked in the majority of states where it occurs.

New Jersey is one of the states where *Vulpia elliottea* is critically imperiled (NJNHP 2024). The S1 rank signifies five or fewer occurrences in the state. A species with an S1 rank is typically either restricted to specialized habitats, geographically limited to a small area of the state, or significantly reduced in number from its previous status. *V. elliottea* 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 *V. elliottea* signify that the grass is eligible for protection under the jurisdictions of the Highlands Preservation Area (HL) and the New Jersey Pinelands (LP) (NJNHP 2010).

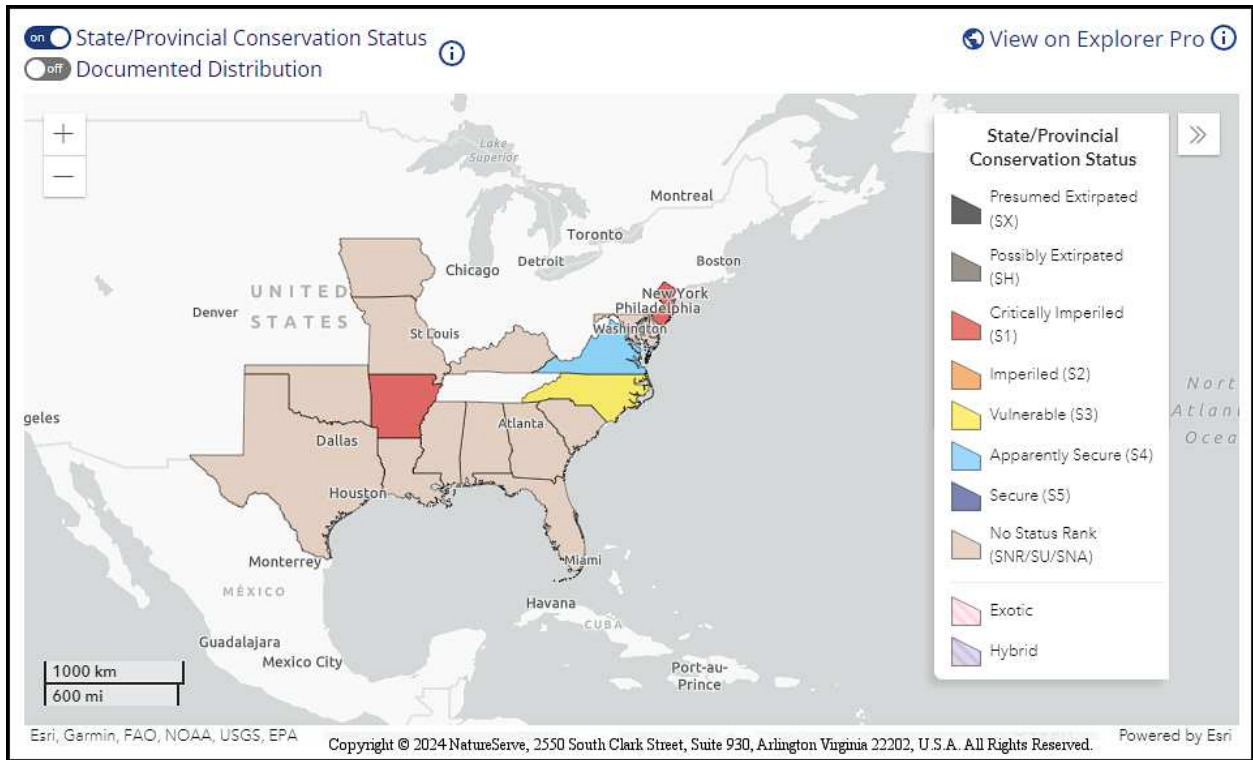


Figure 3. Conservation status of *V. elliottea* in North America (NatureServe 2024).

Vulpia elliottea was not included in New Jersey's early floras, and when Hermann (1933) first collected it in Gloucester County he believed it to be the first record of the species north of Maryland. In actuality *V. elliottea* had been collected from three other locations in southern New Jersey between 1865 and 1919. Shortly after Hermann's discovery the grass was also found in Cape May County and a subsequent collection was made in Salem County during 1974. *Vulpia elliottea* is still present at the site where Hermann found it but all of the other occurrences are now ranked as historical or extirpated (NJNHP 2024).

Threats

New Jersey's population of *Vulpia elliottea* is restricted to a small area but the species has slightly increased in abundance at the site over the past two decades. The occurrence appears to be stable and no threats have been noted (NJNHP 2024).

Vulpia elliottea could potentially be threatened by changes in habitat characteristics resulting from succession or from the proliferation of invasive plant species. *V. elliottea* has many characteristics of a ruderal species as described by Grime (1977). Such plants are likely to favor open or periodically disturbed habitats and typically respond poorly to competition, which appears to be the case for *V. elliottea*. The grass was recently documented in a North Carolina

prairie community where succession had been managed using a combination of annual mowing and periodic prescribed burns (Tompkins 2011). A *V. elliottea* population on barrier dunes along the Virginia coast declined in response to fertilization, likely because the addition of nutrients increased the habitat's suitability for other more competitive species (Day et al. 2004).

Climate Change Vulnerability

Information from the references cited in this profile was used to evaluate the vulnerability of New Jersey's *Vulpia elliottea* population to climate change. The species was assigned a rank from NatureServe's Climate Change Vulnerability Index using the associated tool (Version 3.02) to estimate its exposure, sensitivity, and adaptive capacity to changing climactic conditions in accordance with the guidelines described by Young et al. (2016) and state climactic computations by Ring et al. (2013). Based on available data *V. elliottea* was assessed as Less Vulnerable, meaning that climate change is not expected to have a notable detrimental impact on its extent in New Jersey by 2050.

In New Jersey, the effects of climate change include higher temperatures, more frequent and intense precipitation events, and increasing periods of drought (Hill et al. 2020). The shifting climactic conditions do not appear to directly threaten *Vulpia elliottea* based on our current understanding of the species. However, some possible indirect consequences may have been underestimated due to a lack of species-specific information. For example, the actual extent of *V. elliottea*'s reliance on self-fertilization is not known but limited genetic variation could make the species less adaptable to changing conditions (Jump and Peñuelas 2005). Additionally, poor competitive ability in *V. elliottea* has been inferred but not studied. As the climate continues to warm, a number of exotic plant species that are already present in the region are expected to become more abundant and the establishment of many other non-native species is likely to be favored (Coville et al. 2021, O'Uhuru 2022, Salva and Bradley 2023). Warmer conditions might also allow *V. elliottea* to expand its range along its northern boundary, but the role that climate has played in shaping the species' distribution has not been examined.

Management Summary and Recommendations

The one known population of *Vulpia elliottea* in New Jersey appears to be the northernmost extant occurrence of the species in the Mid-Atlantic region. Populations situated along range edges can be particularly valuable because they may be uniquely adapted to local conditions (Rehm et al. 2015). Additional research could help to predict the long-term viability of the species in the state. It would be useful to know the ratio of cleistogamous and chasmogamous flowers in a typical population, impacts of temperature on the species' life cycle, and how the grass responds to burns at different seasons, frequencies, or intensities.

New Jersey's extant population of *Vulpia elliottea* is likely to benefit from the maintenance of open habitat conditions. Since it has been known at the same site for nearly a century and threats were not reported during a recent (2022) survey little action may be needed. Periodic monitoring is recommended, with an emphasis on evaluating changes in the plant community. In the event

that a need for the control of succession or invasive species is identified, only a modest effort would likely be required due to the small area occupied by the occurrence. A number of the sites where *V. elliottea* was formerly collected have not been searched and suitable habitat may still be present (NJNHP 2024). Because the grass has a short lifespan and brief reproductive period, the best time to look for it is during the latter part of May.

Synonyms

The accepted botanical name of the species is *Vulpia elliottea* (Raf.) Fernald. Orthographic variants, synonyms, and common names are listed below (ITIS 2024, POWO 2024, USDA NRCS 2024c). Some of the synonyms are still in use; for example *Vulpia sciurea* (Lionard 2021), *Festuca sciurea* (Weakley et al. 2022), and *Festuca quadriflora* (POWO 2024).

Botanical Synonyms

Festuca quadriflora Walter
Festuca sciurea Nutt.
Vulpia sciurea (Nutt.) Henr.
Dasiola elliottea Raf.
Festuca monandra Elliott
Vulpia quadriflora Trin. ex Steud.

Common Names

Squirrel-tail Six-weeks Grass
Squirreltail Fescue

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