Hard fescue

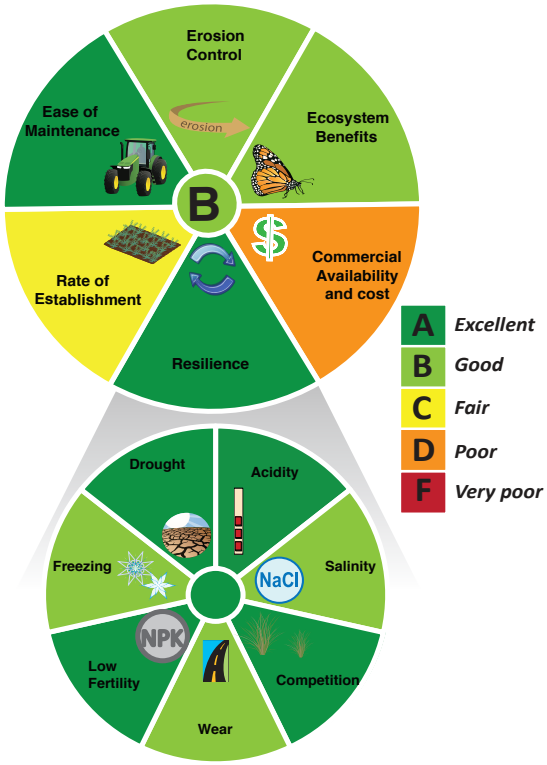
Festuca trachyphylla, F. ovina var. duriuscula, F. duriuscula, F. longifolia, F. brevipila

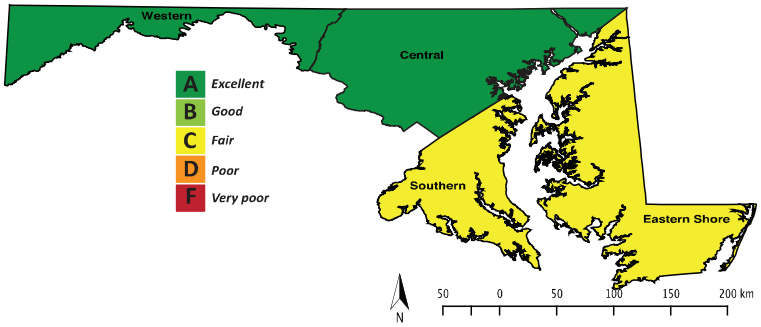
Hard fescue is a low-growing perennial turf grass that is considered to be one of the best species to use in low-maintenance areas. The species is resilient to environmental conditions encountered along roadsides in the mid-Atlantic region including drought, salinity, low fertility, and freezing temperatures. It is an excellent competitor against weeds yet it can be mixed with other desirable species. Hard fescue is widely available commercially and requires mowing only twice a year in late spring and fall. For these reasons, hard fescue receives a rating of Good (grade = B) for use along roadsides in Maryland with only a few management concerns:

Hard fescue has excellent tolerance to summer heat through dormancy. While dormant, however, the species is very susceptible to traffic and should therefore not be mowed between early June and early October during the heat of the mid-Atlantic summer.

Hard fescue develops dense sod, but produces a shallow root system under some conditions. Although it is a good species to use for erosion control, it may not be the ideal species to plant on steep slopes where slope failure may be a concern.

Hard fescue is moderately expensive due to a high sowing rate. Seed per pound, however, is affordable and only marginally more expensive than tall fescue seed.





Hard fescue is particularly well adapted to grow in Western and Central Maryland. It is less suitable for use along roadsides in Southern Maryland and the Eastern Shore where heat stress may limit performance.

Hard fescue cultivars that are recommended for Maryland include Beacon, Gotham, Spartan II, and Sword (T. Turner *pers. communication*).

Biology: Hard fescue is a perennial species that is found in native to open forests and forest edge habitats of Central Europe (Beard 1973, Ruemmele et al. 2003). It was introduced throughout the United States and is now naturalized. It produces densely tufted narrow blades that are wider and tougher than its close cousin sheep fescue (Beard 1973). Hard fescue plants do not produce rhizomes. Hard fescue is now used for turf and reclamation with multiple uses along roadsides, railways, parks and sports grounds, and is considered as one of the best species to use in low-maintenance areas and along roadsides (Beard 1973, Watschke 1990, Ruemmele et al. 2003).

Seeds per pound: 592,000 (Ernst Conservation Seed)
Cost per pound: $3.45 per pound from Ernst Conservation Seed
Cost per acre: $603.75 per acre
Suggested sowing rate: 175 pounds per acre (Cheasapeake Valley Seed)
Sowing depth: <1/4 inch (USDA Plant Fact Sheet)
Germination time: 7-14 days (University of California IPM)
Seeding timing: early spring
Length of growing season: spring and fall
Leaf height: 35 cm = 13.5 inches (McKernan et al. 2001)
Height at seed head stage: 30 inches (USDA Plant Fact Sheet)
Shade tolerance: Hard fescue tolerates a variety of light conditions, including shade (Beard 1973, Watschke 1990, Ruemmele et al. 2003)
Suggested mowing height: Hard fescue does not tolerate mowing <1 inch (Beard 1973). >6 inch mowing height and no scalping is successful for Virginia roadsides (Booze-Daniels pers. communication).
Tolerance of wet conditions: Hard fescue needs well-drained soil but can tolerate higher soil moisture than sheep fescue.
Humidity tolerance: Hard fescue is adapted to cool humid climates (Beard 1973) is therefore tolerates humidity.
Disease resistance: Hard fescue is relatively disease resistant (Beard 1973, Watschke 1990). It is noted to have poor leaf spot resistance with variation among cultivars (Ruemmele et al. *2003).* Hard fescue has superior *Laetisaria fuciformis* resistance compared to chewings fescue and creeping red fescue and improved resistance to *Drechslera dictyoides, Colletotrichum graminicola,* and *Sclerotinia homeocarpa.*

Services:

Commercial availability and cost: Hard fescue is commercially available and seed is only marginally more expensive than tall fescue. While the cost of hard fescue per pound is affordable, the seeding rate per acre makes it moderately expensive.


Rate of establishment: Establishment rate was slow in old varieties but have improved with the new varieties (Watschke 1990). Hard fescue outperformed tall fescue under low maintenance conditions but only in years 2 and 3 of a 3-year study (Dernoeden et al. 1994). Among 80 cultivars tested in New York, hard fescue cultivar 'SR6000' and two strong creeping red fescue cultivars were among the top 3 fine fescue cultivars showing high seedling vigor (Bertin et al. 2009). However, this high seedling vigor did not translate into high turfgrass quality, seedling density or weed suppression.

Ease of maintenance: Hard fescue is a low growing species, low maintenance species that requires little mowing, irrigation, or fertilizer to produce acceptable turf quality (Watschke 1990). New varieties grow slower than other fine fescues (Watschke 1990). Hard fescue exhibited adequate turf quality under low maintenance regimes in a wide range of climates (Diesburg et al. 1997, Watkins et al. 2011, 2014). Hard fescue does not have to be mowed between mid-June and mid-September because the species becomes dormant during these months. In fact, it should not be mowed at all while dormant because maintenance equipment will severely damage the turf (Willmott et al. 2000).

Erosion control: Hard fescue has an extensive root system (Beard 1973) and is thought to be vigorous enough to control erosion (Watschke 1990). However Brown et al (2010) observed 85-95% of hard fescue root mass to occur within the top 7.5 cm of the soil. Mean rooting depth for hard fescue in field trials along roadsides that compared 7-19 species (Brown et al. 2010) was 39.5-51.3cm, which was relatively shallow. Despite the shallow rooting, hard fescue produced a high root mass as opposed to red fescue in one trial, but suffered from drought in another trial to produce longer roots but less root biomass (Brown et al. 2010)..

Ecosystem benefits: Hard fescue is non-native but naturalized. Because hard fescue does not spread by rhizomes, its sod is not as dense as creeping red fescue. Thus, it may be found in association with other native species and can be mixed with other species in seed mixes.

<u>Resilience</u>:

Drought: Hard fescue avoids drought by having a lower evapotranspiration rate (Beard and Kim 1989, McCann and Huang 2008) and a high root biomass. It can maintain evapotranspiration, quality and leaf growth under limited soil moisture compared to Kentucky bluegrass and perennial ryegrass, which declined rapidly when soil water potential reached -50 to -80 kPa (Aronson et al. 1987). Fifteen fine fescue cultivars were planted in 4-year low-maintenance trials in Virginia (Doak et al. 2004). The six seeded hard fescue cultivars germinated and established well with 4 and 5 cultivars maintaining >70% after recovering from a severe drought at a Virginia Piedmont and a Virginia Ridge and Valley site, respectively. The only other cultivars that performed as well as the hard fescues were one strong creeping fescue cultivar and one chewings fescue cultivar at the Ridge and Valley site and a sheep fescue cultivar at the Piedmont site. Thus, hard fescue appears to be the most drought tolerant of the fine fescues, but cultivar performance differs among climatic regions in Virginia with cultivars 'Defiant' and 'Minotaur' the most consistent across sites. In a separate 6-year trial in Blacksburg, VA, Doak et al. (2004) observed hard fescue cover to range between 72% (first year) to 90%. After a drought in the fifth year, cover continued to be maintained at 82-83%. This resilience contrasts with tall fescue, which decreased from 83% in the second year after establishment to 8% in the 6th year. In a 3-year study comparing 25 species and cultivars at two sites in southern Alberta, two hard fescue cultivars ('Aurora' and 'Spartan'), a sheep fescue cultivar, and blue grama maintained long-term superior area coverage despite a drought (McKernan et al. 2001). Hard fescue drought tolerance is less than sheep fescue but greater than red fescue (Beard 1973), and was rated higher than chewings fescue in Rhode Island trials (Watschke 1990).

Low fertility: Hard fescue (cultivar 'Berkshire') was a top performing species across 2 years in a low-maintenance eight-state study in the North Central US (Watkins et al. 2011). In the same region, hard fescue cultivars ('SR 3150', 'Predator', 'Firefly', and 'Reliant

IV) had acceptable turf quality ratings in low-maintenance trials across most states (Watkins et al. 2014). Ratings were some of the highest in the fall among the 25 turfgrass cultivars used in the study, but were lower during the summer months. Hard fescue has somewhat higher nitrogen fertility requirements than sheep fescue (Beard 1973). Hard fescue showed the best quality under low-input conditions in Maryland (Dernoeden et al. 1998), and good quality in Iowa, Indiana and Illinois but not in Missouri, Michigan, Ohio, and Wisconsin (Diesburg et al. 1997). Of 23 species of turfgrasses tested (McKernan et al. 2001), persistence of hard fescue cultivars 'Aurora' and 'Spartan' was high in low fertility environments. After two years of growth (but not after the first year), Watkins et al. (2010) observed hard fescue turf quality to be lower than sheep fescue, equal to chewings fescue and higher than tall fescue, perennial ryegrass and Kentucky bluegrass in a Minnesota study comparing 17 turfgrass species.


Freezing*:* Hard fescue has medium cold hardiness with a lethal temperature of -21°C (-5.8°F) (Bhowmik et al. 2008).

Salinity: Hard fescue has lower tolerance to salinity than red fescue (Ahti et al. 1980, Harivandi et al. 1992, Rose-Fricker and Wipff 2001, Marcum 2008a, Krishnan 2010, Brown et al. 2011, Friell et al. 2012, 2013, Zhang et al. 2013) and is generally ranked as salt sensitive (Marcum2008a; but Uddin and Juraimi (2013) rank hard fescue as moderately tolerant). Percent germination in cultivar 'Discovery' decreased from 92% in distilled water to 33% in 5000 ppm salt bath to 0% in 15,000 ppm brine. In contrast, percent germination in two red fescue cultivars was lower in distilled water but was up to 64% in the brine solution (Rose-Fricker and Wipff 2001). Hard fescue generally has lower tolerance to salinity than perennial ryegrass (Wang et al. 2011, Friell et al. 2013, but see Friell et al. 2012) and tall fescue (Krishnan 2010, Wang et al. 2011, Friell et al. 2013, but see Friell et al. 2012). Hard fescue has similar salt tolerance to sheep fescue (Marcum 1999, 2008a, Krishnan 2010, Wang et al. 2011, Friell et al. 2012, 2013, Zhang et al. 2013) and chewings fescue (Friell et al. 2012, 2013, Zhang et al. 2013), but appears to have higher salt tolerance to salt-sensitive Kentucky bluegrass (Wang et al. 2011, Friell et al. 2012, 2013, Zhang et al. 2013).


Acidity: Hard fescue has tolerance to acid soil and aluminum (Liu et al. 2008).


Wear tolerance: Hard fescue is wear tolerant although traffic, including mowing, will cause severe mortality while plants are dormant during the summer months. Dernoeden et al. (1998) in a Maryland low-input study showed that hard fescue cultivar 'Reliant' maintained acceptable quality despite being mowed once per month during the summer months with a rotary mower; Doak et al. (2002) in a 4-year low-maintenance study in Virginia observed no difference in percent cover of hard fescue when never mowed, mowed only in May, mowed in May and September or mowed in May, July, and September. A 6 inch mowing height that reduces risk of scalping is recommended (Booze-Daniels pers. communication). Horgan et al. (2007) observed hard fescue and chewings fescue to be more wear tolerant than other fine fescues in a 3-year study; Willmott et al. (2001) found that hard and chewings fescue maintained better quality than tall fescue and prairie junegrass in an orchard that was mowed in the summer; and, similarly, Watkins et al. (2010) observed hard fescue to be less wear tolerant than sheep and chewings fescue but more wear tolerant than 14 other cool season grasses, including tall fescue, perennial ryegrass, and Kentucky bluegrass. This effect, however, only emerged after in the second

growing season. In contrast, in a low-input study established at 8 sites in 7 states of the Upper Midwest (Diesburg et al. 1997), hard fescue provided the best quality when not mowed. Similarly, hard fescue suffered damage from maintenance equipment (Willmott et al. 2000). Damage was most severe in the summer during heat and drought stress. Thus, equipment traffic on hard fescue during heat and drought stress needs to be avoided (Willmott et al. 2000). In a similar study in Missouri, hard fescue overseeded on bermudagrass was severely damaged by traffic (Dunn et al. 1994).

Competition: Hard fescue resists invasion and weed encroachment (Watschke 1990, McKernan et al. 2001). Hard and chewings fescue maintained the best quality and the lowest weed populations in a 3-year orchard study (Willmott et al. 2000). Tall fescue was less competitive than hard fescue in cooler regions of Virginia but hard fescue will most likely be excluded by tall fescue in coastal areas of Virginia (Doak et al. 2004). Hard fescue and sheep fescue maintained better quality and better resisted weed invasion than two tall fescue cultivars in a three-year study in Maryland without irrigation (Dernoeden et al. 1994). Similarly, hard fescue cultivar 'Reliant II' had excellent weed suppression, which may have been due to allelochemical exudates (Bertin et al. 2009). In contrast, cultivar 'Rescue 911' had poor weed suppression, suggesting that hard fescue cultivars have a wide range of abilities in suppressing weeds.

Mixes: In a New Mexico field study, a mix of 70% hard fescue, 25% sheep fescue, and 5% Kentucky bluegrass showed good germination, excellent turfgrass coverage, and was fastest in achieving 50% coverage at normal and reduced seeding rate and at lower irrigation (Leinauer et al. 2010). Hard fescue (20-25%) mixed with sheep fescue (20-25%), red fescue (20-25%), slender wheatgrass (0-20%), and Canada bluegrass (20-25%) had the highest cover ratings in a 3-year low maintenance study in southern Alberta (McKernan et al. 2001). Weed density in these mixes was lower than in monocultures of the species suggesting a synergistic effect among species. In Pennsylvania, mixtures of hard and creeping red fescue showed the best season-long quality under low maintenance conditions (Watschke 1990). Watschke (1990) mentions that the PA DOT seeds roadsides with 60% red and 40% hard fescue in areas that are not mowed or only mowed once. For shoulders and mowed low-maintenance areas, PA DOT recommend planting 70% tall fescue and 30% fine fescue. In Minnesota, hard fescue was used in a 'no-mow mix' containing 25% chewings fescue, 25% sheep fescue, 25% red fescue, and 25% hard fescue, and also in a 'fine fescue mix' containing 33% each of hard, sheep and red fescue (Meyer and Pedersen 1999). The fine fescue mix ranked higher than the no-mow mix, especially in turf color but also in turf quality and cover over three years (Meyer and Pedersen 1999). Both mixes generally ranked higher than any of the species planted in monoculture. The fine fescue mixes were also used in Minnesota by Miller et al. (2013) to test performance under low maintenance conditions over 3 years. The fine fescue mixtures had acceptable quality ratings. They ranked lower in quality than a tall fescue cultivar blend and native species mixtures but ranked higher than Kentucky bluegrass. Hard fescue is used for overseeding turfgrasses that are dormant in the winter such as bermudagrass (Nelson et al. 2005) and buffalograss (Severmutlu et al. 2013) to maintain adequate winter color and cover.

Cultivars: 'Durar' = 'P-2517' is an early cultivar of hard fescue that was released in 1949 (Beard 1973). 'Scaldis' and 'Waldina' are also early cultivars with slower vertical growth rate and greater heat resistance. Rutgers University released cultivars 'Reliant', 'Apartan', 'Ecostar', 'SR 3000', 'Oxford' and 'Nordic'. 'Ecostar' exhibits excellent shade tolerance, summer density, drought, cold and heat tolerance, and resistance to some diseases. 'Reliant', the projeny of 43 clones, is low

in stature, uniform, winter hardy, and disease resistant, and has high seed yield. 'Spartan' was released in 1984 as the progeny of 142 clones. It is persistent, leafy, low growing, cold, heat and drought tolerant, and resistant to diseases. 'Aurora' was developed for reduced vertical growth, high seed yield, early maturity, and resistance to diseases. 'SR 3100' exhibits a dwarf growth habit, heat and drought tolerance, high endophyte levels, and high disease resistance. 'Discovery' was released in 1996 as a low growing cultivar with high disease resistance. Cultivar 'Valiant' is associated with non-choke inducing endophytes, which improves summer performance and increases resistance to *Blissus leucopterus* (Ruemmele et al. 2003).

In low-maintenance trials in Virginia to select hard fescue cultivars for use along roadsides, Doak et al. (2004) showed that cultivars 'Attlia E', 'Defiant', 'Minotaur', 'Osprey', and 'Rescue' reached 80-90% cover after 3 years of growth in a Ridge and Valley site. Cultivars 'Defiant', 'Minotaur', and 'Scaldis' reached 75-80% cover after 3 years at a Piedmont site.

Hybrids: Hard fescue was crossed with blue fescue (*Festuca glauca*) to produce a synthetic hybrid released as the cultivar 'Minotaur'. The hybrid produces dark green to blue-green turf with short plants that contain high levels of endophytes (Ruemmele et al. 2003). The cultivar 'SR 3200' also originated from a blue fescue x hard fescue cross (Ruemmele et al. 2003).