Red fescue

Festuca rubra ssp. litoralis and Festuca rubra ssp. rubra and others

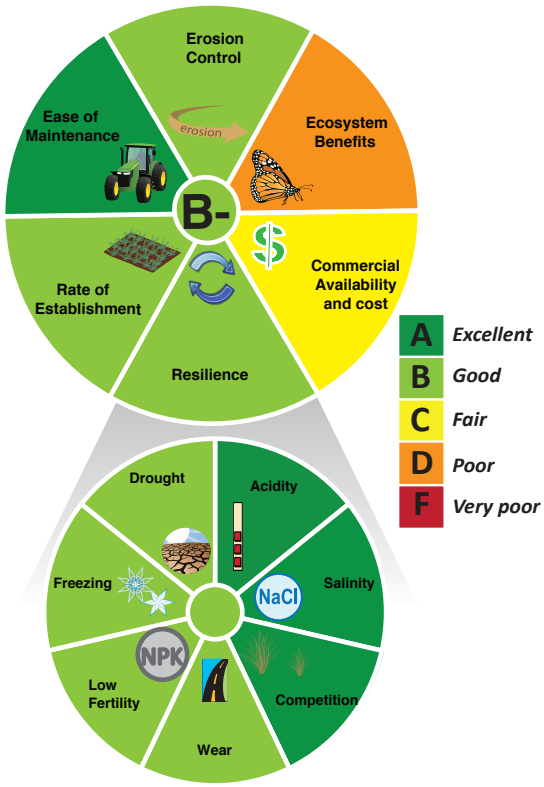
Red fescue is an introduced fine fescue species that produces rhizomes and hence dense sod. A low-growing species that establishes quickly, is tolerant of saline soils, and is commercially available at low cost; this species is a preferred roadside species in New England. Several species attributes make red fescue less suitable for Mid-Atlantic States resulting in an overall rating of Good to Fair (grade = B-):

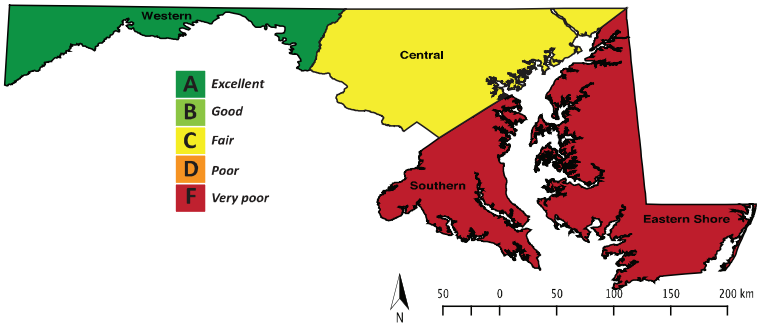
Red fescue is disease prone compared to hard and chewings fescue and may also become weedy in Maryland.

Red fescue produces a shallow root system, which may lead to slope failure when planted on steep slopes.

Red fescue is more drought and heat sensitive than other fine fescue species and is therefore less resilient in the summer heat of Maryland.

Red fescue has the cheapest cost per pound of the fine fescues, however it has a high sowing rate which leads to a moderate cost per acre.





Owing to its heat sensitivity, red fescue is only suitable for Western Maryland. Its use is not recommended for Southern Maryland and the Eastern Shore.

Red fescue cultivars that are recommended for Maryland in 2016 are from the strong creeping red fescue subspecies and include Chantilly (new variety) and Navigator II. Updates to recommended cultivars in Maryland are published annually in the University of Maryland Turfgrass Technical Update TT77 (Maryland Turfgrass Council).

Creeping red fescue (Festuca rubra)

Slender creeping red fescue (*Festuca rubra ssp. litoralis = Festuca rubra var litoralis = Festuca rubra ssp. tricophylla = Festuca rubra ssp. eu-rubra var. genuina subvar. vulgaris*)

Strong creeping red fescue (*Festuca rubra ssp. rubra = Festuca rubra ssp. vulgaris = Festuca rubra ssp. eu-rubra var. genuina = Festuca glaucescens = Festuca rubra ssp. glaucodea = Festuca rubra var. glaucescens = Festuca rubra var. lanuginosa*)

Biology: Creeping red fescues are perennial cool-season grasses within the red fescue species complex. Two subspecies of creeping red fescue are recognized – slender creeping (42 chromosomes; *Festuca rubra ssp. trichophylla = Festuca rubra ssp. litoralis)* and strong creeping (56 chromosomes; *Festuca rubra ssp. rubra*) red fescue (Marcum 2008a). Both subspecies produce rhizomes with strong creeping fescue producing strong, long rhizomes and slender creeping fescue producing finer, shorter rhizomes. In both cases, plants form sod that is fine textured with high shoot density. Creeping red fescues originated in Europe (Ruemmele et al. 2003 but USDA also lists Asia and North America as sites of origin) and are the most widely used of the fescues for turfgrass purposes (Beard 1973). Creeping red fescues are particularly well adapted to New England where summer heat is not as intense as further south. In New England, creeping red fescue is an important roadside grass (Brown et al. 2010). Creeping red fescues are used for low-input turf purposes (Krishnan 2010) including mine reclamation (Ruemmele et al. 2003), and are planted in lawns, athletic fields, golf courses, and playgrounds (John et al. 2012). Red fescue has the ability to accumulate metals in its leaf tissue and is therefore useful for phytoremediation (John et al. 2012).

Seeds per pound: 615,000 seeds per pound (University of Tennessee extension)
Cost per pound: $1.80 per pound from Chesapeake Valley Seed
Cost per acre: $315.00 per acre
Suggested sowing rate: 175 pounds per acre (Chesapeake Valley Seed)
Sowing depth: <1/2 inch (John et al. 2012)
Germination time: 7-14 days (University of California IPM)
Seeding timing: spring or early fall
Length of growing season: spring to fall with a period of dormancy in hot summers
Leaf length: 4.25 inches grown in gravel and full sun to 17.75 inches grown in peat and shade (Kjellqvist 1961); 2-12 inches (Ruemmele et al. 2003); 2-6 inches (John et al. 2012).
Height at seed head stage: maximum height reached = 13 inches (McKernan et al. 2001); 24-35 inches (Barkworth et al 2007 in Brown et al. 2010); 24 inches for slender creeping red fescue and 43 inches for strong creeping red fescue (Ruemmele et al. 2003); 12-39 inches (John et al. 2012).
Shade tolerance: good (Beard 1973, VanHuylenbroeck and VanBockstaele 1999)
Suggested mowing height: 4-6 inches (Doak et al. 2004); avoid scalping because it will cause substantial mortality (Booze-Daniels pers. communication)
Tolerance of wet conditions: Does not tolerate wet and poorly drained soils (Beard 1973, Ruemmele et al. 2003) but can tolerate spring flooding (John et al. 2012).
Humidity tolerance: Red fescue is adapted to cool humid climates (Beard 1973) and therefore is very tolerant of high humidity.

Disease resistance: Most prone to *Helminthosporium* and red thread and more susceptible to *Fusarium* patch and *Typhula* blight than Kentucky bluegrass (Beard 1973). Slender creeping red fescue is susceptible to *Laetisaria fuciformis* and *Sclerotinia homeocarpa* (Ruemmele et al. 2003). Strong creeping red fescue has good resistance to *Erisyphe graminis* and *Magnaporthe poae*; and resistance to *Drechslera dictyoides, Laetisaria fuciformis* and *Sclerotinia homeocarpa* has only been moderately improved in newer cultivars (Ruemmele et al. 2003). Endophytes are introduced to enhance disease resistance (Ruemmele et al. 2003).

Services:

Commercial availability and cost: Creeping red fescue seed is produced in high quantity in the United States and abroad. Commercial availability is excellent. Seed of creeping red fescue is the least expensive of the fine fescues. However, the sowing rate of red fescue is high which leads to a moderately expensive cost per acre.

Rate of establishment: Establishment of red fescue in general is good; somewhat slower than perennial ryegrass but faster than Kentucky bluegrass (Beard 1973). Using photosynthetic measurements, VanHuylenbroeck and VanBockstaele (1999) found that creeping red fescue had a faster growth rate than chewings fescue. Among 80 cultivars tested in New York, 4 cultivars of red fescue ('Salsa' and 'Boreal', 'SRX 52961', and 'Aberdeen') were among the top six fine fescue cultivars for high seedling vigor, which affected turf quality even into the next growing season as well as weed infestation (Bertin et al. 2009). Nutrient seed coating slightly increased germination capacity in red fescue (Sochorec et al. 2013).

Ease of maintenance: Creeping red fescue requires a low culture intensity with minimal to no irrigation and fertilization (Beard 1973). Vertical growth is slower than most cool season species and the growth habit is creeping (Beard 1973). Creeping red fescue is a low stature plant but it can reach heights of up to 60-90 cm when culms are included (Barkworth et al. 2007). In most cases, however, plants will be 30 cm tall or less (Ruemmele et al. 2003, John et al. 2012). Creeping red fescue was shorter in stature than tall fescue and perennial ryegrass cultivars in roadside trials (Brown and Gorres 2011). Creeping red fescue grew from 21.6 to 42.8 cm mean height and was one of the shortest species tested in Brown et al. 2010.

Erosion control: Creeping red fescue has an extremely dense and fibrous root system (Beard 1973). It has a high root-to-shoot ratio compared to 5 other turfgrass species (Dziamski et al. 2012) and higher root mass in the upper soil layers compared to its close cousin chewings fescue (Ruemmele et al. 2003). For this reason, creeping red fescue is considered an excellent soil stabilizer and is therefore used extensively for stabilizing slopes, banks, cuts and fills (USDA Plant Guide). However, roots are shallow with most of the root mass distributed within the top 5-15 cm. Brown et al (2010) observed 66% to 84.3% of creeping red fescue root mass to occur within the top 7.5 cm of the soil. Mean rooting depth for creeping red fescue was 33.4 to 43.1 cm, which was one of the shallowest rooting depths in three field trials along roadsides that compared 7-19 species. This shallow root distribution can lead to slope failure beneath the root zone (Simon and Collison 2002) and sod sloughing during heavy rains (Brown et al. 2010). Water retention in the soil cultivated with creeping red fescue was not as high as tall fescue and perennial ryegrass owing to differences in root morphology among species (Glab and Szewcyk 2014). Therefore, creeping red fescue is poor in maintaining infiltration capacity, an important factor in erosion control, relative to other cool season grasses.

Ecosystem benefits: Creeping red fescue is non-native although John et al. (2012) propose that some red fescue varieties also have North American origins. Owing to creeping red fescue's use throughout the United States and the world, original ecological or geographical distribution patterns are complex and therefore challenging to determine (Ruemmele et al. 2003). Red fescue produces a dense sod, in cooler climates, which decreases weed invasion but also limits species diversity (John et al. 2012). In hotter climates, such as Maryland, red fescue often becomes disease-prone and weedy. Wildlife will feed on leaves but creeping red fescue is not recommended for forage production owing to its low nutritional value and some endophyte containing cultivars (John et al. 2012). Cover value for small birds and mammals is fair (U.S. Forest Service Information System).

Resilience:

Drought: Fescues as a group are drought tolerant (Carroll 1943, Ruemmele et al.2003, Bertin et al. 2009) because they have low evapotranspiration rates (Beard and Kim 1989, McCann and Huang 2008) compared to other cool-season grasses, and summer dormancy (Johnson 2003). Creeping red fescue can avoid drought by increasing root-to-shoot ratios in response to drought (Dziamski et al. 2012). Drought tolerance is higher than Kentucky bluegrass or creeping bentgrass (Beard 1973, Wallner et al. 1982) but lower than bermudagrass (Wallner et al. 1982). Beard (1973), however, argues that red fescue does not persist in warm humid climates owing to a lack of heat tolerance (but see Wallner et al. 1982). In a British study comparing 16 turfgrass species (Carroll 1943), red fescue performed poorly (25-45% survival) compared to chewings fescue (65-70% survival) under low-input conditions when subjected to higher soil temperatures. Under high air temperatures, red fescue had one of the lowest survival rates (20%) among the 16 species (Carrol 1943). In the same study (Carroll 1943), red fescue survived lower soil moisture conditions well. It was not as drought tolerant as chewings fescue in low fertility soils but more drought tolerant in high fertility soils. In a low-maintenance study in the Ridge and Valley of Virginia (Doak et al. 2004), four strong creeping red fescues produced 60-70% cover, whereas the slender creeping cultivar 'Dawson' produced 80% cover after 4 years, which included a severe drought in the third year of the study. In contrast, six hard fescue cultivars maintained 80-90% cover suggesting that hard fescue is more drought and hear tolerant than creeping red fescue. At a Piedmont site, the same cultivars produced up to 53% cover (Dawson produced 15% cover) whereas hard fescue produced up to 80% cover and tall fescue up to 75% cover after the severe drought in year 3 (Doak et al. 2004). Generally, creeping red fescue will not tolerate hot and dry summers of Central and Eastern Maryland (Turner personal communication). However, because western Maryland is cooler and wetter than the rest of the state, red fescue may perform better in the western part of Maryland.

Low fertility: Wakefield et al. (1974) evaluated persistence of turfgrass species along roadsides in Rhode Island and found that creeping red fescue had the best coverage along roadsides 1 and 2 years after seeding. Similarly, Brown et al. (2011) in a Rhode Island roadside study found that creping red fescue showed the best persistence and cover (~30%) in a plain soil treatment, which increased up to 82% when the soil was treated with biosolids. Survival of slender creeping red fescue cultivar 'Dawson' was high in a low fertility environment; however, the environment needed to be mesic (McKernan et al.

2001). After comparing turf quality of four cultivars of fine fescues and one cultivar of tall fescue, Dernoeden et al. (1998) concluded that creeping red fescue cultivar 'Flyer' would not be as good of a choice in low input environments as hard, chewings, or sheep fescue.

Freezing*:* Red fescues are distributed from sea level to 11,000 ft (3,350 m; John et al. 2012). Creeping red fescue has medium freezing tolerance, comparable to tall fescue and zoysiagrass but lower than Kentucky bluegrass (Beard 1973, Stier and Fei 2008). Percent survival of creeping red fescue was 60-80% up to -10°C, which was a lower survival rate than chewings fescue (Carroll 1943). No survival was observed at -15°C and below. Cold acclimation is rated less than creeping bentgrass and Kentucky bluegrass but superior to perennial ryegrass (Ruemmele et al. 2003).

Salinity: Red fescues have a wide range of reported salinity tolerances (Humphreys 1981, Marcum 2008, Krishnan 2010) from 3-6 dS/m (Marcum 1999), 6-10 dS/m (Uddin and Juraimi 2013) and 8-12 dS/m (Butler et al. 1985). Different authors therefore rank salinity tolerance of creeping red fescue between poor to moderately tolerant (Marcum 2008a). The most tolerant cultivars belong to the hexaploid slender creeping group (Harvandi et al. 1992, Rose-Fricker and Wipff 2001, Brown et al. 2011, Friell 2012), followed closely by the octoploid strong creeping fescues, although differences within creeping red fescue may not be a distinction among species but rather a difference in origin (Humphreys 1981, Marcum 2008a). Cultivar 'Dawson' shows salinity tolerances as high or higher as known salt tolerant species such as alkaligrass (Torello and Symington 1984, but see Harivandi et al. 1982). Percent germination of Red fescue decreased from 65% in controls to up to 30% at the highest NaCl concentration (Wrochna et al. 2010). Percent germination decreased from 65% to 11% and from 85% to 64% in cultivars 'Dawson' and cultivar 'Seabreeze', respectively, when subjected to salt baths ranging from distilled water to 15,000ppm brine (Rose-Fricker and Wipff 2001). Seedling growth and root length were also affected by salinity levels ranging from 0 to 12 g/dm^3 (Wrochna et al. 2010). Dry matter yield was not affected by salt treatment but foliage injury was high (Greub et al. 1985). Other studies of red fescue cultivars have shown that cultivars 'Dawson' and 'Golfrood' were most salt tolerant whereas cultivars 'Ruby', 'Rainier', 'Steinacher', 'Illahee', 'Pennlawn', and 'Common' were less tolerant (Marcum 2008a). Overall, studies comparing red fescue with other turfgrasses typically show high salinity tolerance in red fescue. In a comparison of 74 turfgrass species and cultivars along two Minnesota roadsides (Friell et al. 2012), some cultivars of slender ('Shoreline', 'ASR 050', 'Seabreeze GT') and strong creeping red fescue ('Navigator', 'McAlpin', 'Cardinal', and 'OR1') survived the winter better than many other fine fescue cultivars, tall fescue, perennial ryegrass and Kentucky bluegrass. Slender creeping red fescue exhibited similar salt tolerance to perennial ryegrass and tall fescue and higher salt tolerance compared to 8 other fine fescue cultivars (sheep, hard, and chewings) on agar and in hydroponics (Zhang et al. 2013). Similarly, creeping red fescue had higher salinity tolerance than Kentucky bluegrass (Torello and Symington 1984), chewings fescue, hard fescue, and sheep fescue, in decreasing order, after 71 days of exposure to 20,000 ppm NaCl (Ahti et al. 1980). Red fescue exhibited higher salt tolerance than tall fescue, sheep fescue and hard fescue in decreasing order (Krishnan 2010). In contrast, red fescue had lower salinity tolerance in germination trials on germination paper compared to sheep fescue, tall fescue, and creeping bentgrass, but had higher salinity tolerance than these species in a hydroponic system (Zhang et al. 2011).

Acidity: Red fescue prefers soil with pH between 5.5 and 6.5 (Beard 1973) but can tolerate pHs ranging from 5-8 (Ernst Conservation Seed). Creeping red fescue has less resistance to acid soils with high aluminum content than hard fescue and chewings fescue (Liu et al. 2008). Aluminum tolerance, however, is increased by some endophyte infected cultivars (Liu et al. 2008).

Wear tolerance: Beard (1973) ranks the wear tolerance of creeping red fescue as moderate, similar to colonial bentgrass but less than perennial ryegrass and Kentucky bluegrass (Ruemmele et al. 2003). Wear tolerance of slender creeping red fescue is reported to be higher than for strong creeping red fescue (Ruemmele et al. 2003). In an experiment that compared wear tolerance of 7 cool season species, creeping red fescue was ranked last (Canaway 1981). After two years growth, red fescue turf cover ranged between 51% to 88% in control plots and 2-17% in plots subjected to a traffic simulator while turf cover for tall fescue, Kentucky bluegrass and perennial ryegrass maintained >50% cover (Glab et al. 2015). Red fescue cultivars 'Bargreen II' and 'Barpearl' were the most wear tolerant cultivars. Turf quality and shoot density decreased as well. In all, creeping red fescue ranked 5th out of 7 species in wear tolerance. Red fescue overseeded on Bermudagrass in California showed marginal tolerance to traffic simulation (Cockerham et al. 1990), and were severely damaged by traffic in a similar experiment in Missouri (Dunn et al. 1994). As another form of wear, moderate grazing will not impact yield of red fescue; overgrazing will decrease yield, however, similar to most species (John et al. 2012).

Competition: Red fescue can resist invasion and weed encroachment (Davis 1958, McKernan et al. 2001). In a low-input study in Utah, creeping red fescue (cultivar 'Vista') and chewings fescue were more competitive than buffalograss in mixtures (Johnson 2003). Red fescue is more competitive than Kentucky bluegrass in low-input environments (Beard 1973, Ebdon and Skogley 1985) but Kentucky bluegrass will dominate in high input environments (Davis 1958). Bertin et al. (2009) found that red fescues as a group were strongly weed suppressive with >70-80% weed suppression. Red fescue cultivars with the best weed suppression included 'Shademater II', 'Salsa', 'ABT-CR2', 'PST 47T', and 'SRX52LAV'. Weed suppression may be a function of fast establishment as well as bioherbicidal activity from root-derived photochemicals (Bertin et al. 2009). Even as living mulch or killed sod strong creeping red fescue was highly weed suppressive (Weston 1990).

Mixes: Creeping red fescue (20-25%) mixed with sheep fescue (20-25%), hard 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. Creeping red fescue was mixed with perennial ryegrass (68%) and clover (~1%) in an 'Ecology Lawn Mix'; with perennial ryegrass (30%), Kentucky bluegrass (25%) in a 'Sunnylawn mix'; and with sheep fescue (33%) and hard fescue (33%) in a 'Fine Fescue mix' with good quality and color ratings over three years in a low maintenance study in Minnesota (Meyer and Pederson 1999). 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. A mix of red fescue with buffalograss may allow irrigation levels to be lowered; however red fescue tends to be more competitive than buffalograss in

mixture (Johnson 2003). In West Virginia, creeping red fescue is used at a rate of 2.5-5kg/ha in mixture with tall fescue (2.5-5kg/ha), annual ryegrass (0.875-1.75 kg/ha) and birdsfoot trefoil (2.5kg/ha) and native species (Venable and Skousen 2005, Rentch et al. 2005). Kentucky bluegrass is frequently used in mixture with creeping red fescue (Juska and Hanson 1959, Beard 1973, Ebdon and Skogley 1985) because strong creeping red fescue has shown higher compatibility with Kentucky bluegrass and perennial ryegrass than other fine fescue species (Ruemmele et al. 2003). Seed mixtures containing at least 50% creeping red fescue were able to maintain the desired species composition (Juska and Hanson 1959). An initial seed mixture of 48% Kentucky bluegrass and 52% creeping red fescue maximized turf quality that was acceptable when lawns received 150 and 300 lb/acre deicing salts. Kentucky bluegrass and red fescue appear to offer the best combination of good persistence and slow vertical growth droughty and infertile conditions (Brown and Gorres 2011), where red fescue will dominate (Beard 1973, Ebdon and Skogley 1985). Red fescue may be used to overseed warm-season lawns such as bermudagrass and zoysiagrass to enhance color during the winter (Ruemmele et al. 2003, Rimi and Macolino 2014).

Cultivars: More than 300 varieties of red fescue have been released (John et al. 2011). Selection criteria include increased seed yield, improved heat, drought and disease tolerance and improved turf quality (Ruemmele et al. 2003). Endophytes were introduced into slender creeping red fescue to produce cultivar 'Dawson' with higher disease resistance. Cultivar 'Dawson' was further developed to produce dwarf cultivars 'Logro' and 'Elfin' and cultivar 'Count' with enhanced color (Ruemmele et al. 2003). Despite these improvements, many cultivars of slender creeping red fescue do not show good stress tolerance and have poor seed yields. Early cultivars of strong creeping red fescue included 'Boreal' with high seed yields and 'Wintergreen' with excellent winter hardiness and shade tolerance (Ruemmele et al. 2003). Many cultivars have been introduced since then including cultivars that grow low ('Vista') or have strong vigorous rhizomes to make them suitable for erosion control ('SR 5200E). Cultivars 'Seabreeze GT', 'Sealink', 'Shoreline', and 'ASR050' were the top-performing fine fescue entries following salinity exposure (Friell et al. 2013), with 'Shoreline' performing well among roadsides where exposure to NaCl can be a problem (Friell et al. 2012). Because cultivars differ in their performance in different roadside locations, Friell et al. (2012) suggest the use of a mix of cultivars.

Hybrids: Many inter- and intrageneric hybrid experiments have been conducted with many not producing viable offspring (Ruemmele etal. 2003). Cultivar 'Seabreeze' is a hybrid between slender creeping red fescue and chewings fescue but is released as a slender creeping red fescue cultivar. It is a low growing cultivar with excellent winter color, cold, and shade tolerance, and improved disease resistance for several diseases such as *Sclerotinia homeocarpa* (Ruemmele et al. 2003).