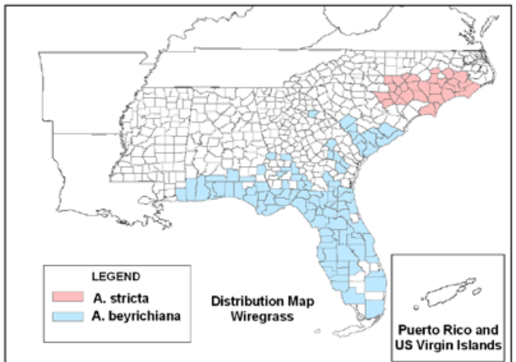
Fire Management Species Profile

WIREGRASS
(*Aristida stricta* Michaux & *Aristida beyrichiana* Trinius & Ruprecht)

FWS Ranking Not ranked

State Ranking *A. beyrichiana*-S5 (Secure): FL; Not Ranked: AL, GA, MS, SC | *A. stricta*-S4 (Apparently Secure): NC; Not Ranked: SC



Data Source: [**47**]

Photo: Nancy Jordan / USFWS

Bio Facts

Life Form: Bunch grass

Flowering: Flowers in fall

Pollination: Wind

Habit: Warm-season perennial

Wetlands Status [**46**]: *A. beyrichiana*-Facultative (FAC) and Upland (UPL); *A. stricta*-FAC

Fire Adaptation: Buds develop below soil surface. New tillers produced following growing - season fire.

Landscape Conservation Cooperatives (LCC): *A. beyrichiana* = South Atlantic, Peninsular Florida, and Gulf Coastal Plains & Ozarks; *A. stricta* = South Atlantic

Landfire Zones: 46. 54. 55. 56. 58. 59. 99

Desired Vegetation Structure and Fire Components	
Criteria	**Monitoring Variables**
Canopy/Sub-canopy	Open-canopied forest; greatest wiregrass growth in areas with basal areas <60 sq ft/acre.
Mid-story	Little (<5% cover) to no mid-story >3 ft; large amounts of trees and shrubs in mid-story act as fuel ladders allowing fires to spread into the forest canopy which prevents low intensity surface fires from occurring.
Shrub	Variable, and often related to site productivity. Low shrub coverage can equal wiregrass coverage in most sites. Once the shrub strata reaches > 3 ft height and shrub cover values begin to exceed the herbaceous cover, wiregrass can decline.
Ground Cover	Average density of 5 wiregrass clumps/meter^2 in flatwoods, sandhills, and savannas. Associated grasses include: bluestems, dropseeds, toothache grasses, love grasses, muhly grasses, and panic grasses. Associated woody species include: saw palmetto, hollies, wax myrtle and blueberries. In wetter areas pitcher plants and other carnivorous plants may occur.
Fire Regime	Natural Fire Regime: 2-5 years.
Seasonality	Growing season (May-June) fire promotes greatest amount of reproductive success (seed production) in wiregrass. Dormant or growing season burns can reduce woody competition, increase light availability, and control litter accumulation.
Fuel Models	Grass (GR3, GR5, GR6, GR9); grass-shrub (GS3, GS4); possibly shrub (SH4); possibly timber-understory (TU3).
Burn Severity	Low to moderate burn severity acceptable; CBI <2.3.
Fire Behavior	Low to moderate fireline fires; flame heights <10 ft; <75% burn cover is acceptable.
Landscape Considerations	Fire management should consider timing and spatial arrangement of treatments within the landscape matrix to promote wildlife habitat and movement corridors, increase ground cover species diversity, and provide optimal conditions for Threatened and Endangered Species.

The objective of the Fire Management Species Profile project is to identify habitat management objectives that are specific, measurable, achievable, clearly communicate among habitat management professionals and are firmly based in the best available science. Their use is intended to guide habitat managers in setting local objectives for habitat management in fire-adapted ecological systems. Fire management objectives are specific to habitat conditions in which maintenance and improvement, rather than restoration, of habitat condition is the goal.

Desired Habitat Conditions

Desired future habitat conditions for wiregrass can generally be described as open-canopy forests with low levels of leaf litter and a sparse woody understory. In many longleaf - wiregrass sites across the South, wiregrass grows best in areas with open stands where there is not excessive overstory competition or heavy needle-fall. Stands with >75% wiregrass cover typically have overstory basal areas of 40 to 50 sq. ft/acre (K. Outcalt, USFS, pers. comm., Aug. 2009). The relationship between wiregrass and shrub cover often varies by site productivity. On more productive sites, wiregrass and shrub coverages tend to be very similar. For example, sites with 10% wiregrass cover often have a similar amount of understory shrub covers. These conditions may arise when the understory is heavily suppressed by dense overstory and midstory layers. Typically, understory shrubs do not need to be eliminated for wiregrass to flourish. Often, areas with wiregrass cover of 80 to 90% will have woody shrub cover at similar levels. Such shrubs are typically short-statured species, such as blueberries and runner oaks, growing between the wiregrass clumps and may be overtopped by wiregrass' seed stalks. Once shrub cover exceeds 100%, which occurs because of overlapping shrub crowns of different species, wiregrass cover declines (K. Outcalt, USFS, pers. comm., Aug. 2009). On poor sandhill sites, wiregrass cover is often greater than shrub cover, especially in areas with wiregrass cover exceeding 30% (K. Outcalt, USFS, pers. comm., Aug. 2009).

Species Information and Life History

Distribution: Wiregrass was historically a significant understory species in many natural stands dominated by longleaf pine (*Pinus palustris*) on the Atlantic and Eastern Gulf Coastal Plains [**2, 42**]. These pine-wiregrass communities covered millions of acres from North Carolina to Florida, and westward to Mississippi. The 'wiregrass gap' is an area within the Coastal Plain of central South Carolina that is devoid of wiregrass. Northern wiregrass (*Aristida* stricta) is located north of the gap, in North Carolina and northern South Carolina; southern wiregrass (*Aristida beyrichiana*) is located in the southern Coastal Plain counties of South Carolina, Georgia, Florida, Alabama, and Mississippi [**35**].

Plant Classification: Although there has been much debate regarding the taxonomy of wiregrass, many scientists agree there is much variation within its native geography. Peet [**35**] divided wiregrass into two species based on geographic and morphologic patterns—northern and southern wiregrass. Wiregrass belongs within the grass genus, *Aristida*, three-awn grass, distinguishable by the three bristles (awns) on each lemma.

Plant Communities: Wiregrass, which once provided large areas of grass cover across much of the Southeastern Coastal Plain (east of the Mississippi River), is strongly associated with open canopy pine forests and woodlands composed of varying densities of longleaf pine and occasionally slash pine (*Pinus elliottii*). Wiregrass can also occur in open, treeless savannas of wet sedges (*Carex* spp. and *Rhynchospora* spp.) and pitcher-plant (*Sarracenia* spp.) depression meadows [**11**]. Peet [**36**] developed a classification of longleaf pine vegetation using geography, soil moisture, and soil texture, and described six broad categories of longleaf community types. In order of increasing soil moisture, these are: 1) Xeric Sand Barrens and Uplands (species associated with wiregrass include sand live oak (*Quercus geminata*) and turkey oak (*Quercus laevis*)); 2) Subxeric Sandy Uplands (species associated with wiregrass include bluejack oak (*Quercus incana*), sand post oak (*Quercus margarettiae*), and little bluestem (*Schizachyrium scoparium*)); 3) Silty Uplands (species associated with wiregrass include little bluestem and bluestem (*Schizachyrium scoparium* and *Andropogon spp*.)); 4) Clayey and Rocky Uplands (species associated with wiregrass include creeping blueberry (*Vaccinium crassifolium*) , sand myrtle (*Leiophyllum buxifolium*), and flowering pixiemoss (*Pyxidanthera barbulata*)); 5) Flatwoods (species associated with wiregrass include dwarf huckleberry (*Gaylussacia dumosa*), dwarf blueberry (*Vaccinium myrsinites*), saw palmetto (*Serenoa repens*), Curtiss's dropseed (*Sporobolus curtissii*), toothache grass (*Ctenium aromaticum*), running oaks (*Quercus pumila, Q. minima*), and gallberry (*Ilex glabra*)); 6) Savannas, Seeps, and Prairies (species associated with wiregrass include toothache grass and muhly grass (*Muhlenbergia expansa*), and little bluestem.

Life History: Wiregrass is a native warm-season, perennial bunchgrass that can grow in large clumps. Hundreds of narrow, wire-like, leaves grow in these clumps, but many die off within a year (as much as 85% may die off in the first 12 months [**34**]). Thus, abundant dead and living leaves are often present on individual wiregrass plants, particularly if they have not been recently burned. Flowering in wiregrass occurs in the summer or fall following some defoliation event (e.g., fire, grazing) within the past nine months [**45**]. Studies suggest that flowering and seed production may be maximized by burning during the late spring and into the summer months [**34**]. Wiregrass seedling establishment can be influenced by a number of factors including amount of viable seed, loss to herbivory or fungal infections, and site conditions. In research conducted in the Sandhills of the Carolinas, seedling establishment was lower on xeric sites than on sites with loamy, silty soils, suggesting that moisture stress was a contributing factor [**48**]. Even though seed may be lost before it germinates, seedling establishment has been documented up to two years after seed production [**23**]. Influenece of environmental stochastic events, e.g., rainfall at the right time, can have significant positive effects on wiregrass germination and establishment. Wiregrass vegetative growth typically follows a disturbance that removes top-growth from underground roots and tillers [**11**]. Over time, the central portion of a wiregrass clump dies, leaving a 'doughnut'-shaped living portion that expands and forms smaller clumps [**11**].

Fire Effects: Wiregrass is a keystone species of the Southeastern Coastal Plain longleaf pine ecosystem because of its structural abundance and its function as a high-quality fuel source [**16, 29, 30, 40**]. Without fire, wiregrass production gradually diminishes over time [**11**]. Conversely, an increase in wiregrass growth and flowering normally occurs following fires (see discussion below). Wiregrass tends to decline in vigor from light and nutrient deficits brought on by canopy closure and hardwood encroachment in fire suppressed systems. However, wiregrass is very robust and can survive and recover once fire is returned to the system. Wiregrass often forms dense patches. This spacing allows leaves of individual clumps to overlap with leaves of neighboring clumps and other potential fuels [**18**]. Additionally, leaves catch falling needle cast from canopy and subcanopy pine trees [**4**]**.** Furthermore, dead leaves of wiregrass decay slowly [**10**]. Together, these factors result in an accumulation of highly flammable material which can reach a peak of approximately 2.75 to 3.5 tons/acre in three to four years of dead biomass [**33, 34**]. Burning stands with dense wiregrass will typically remove all flammable aboveground biomass in the herb layer [**9**]. After fire, new top-growth is initiated from underground tillers and roots; wiregrass cover reaches pre-burn live cover within several months [**45**]. Hardwood encroachment and resulting leaf litter accumulations may raise near-surface soil temperatures during fires, which may adversely affect wiregrass survival by damaging underground portions of the plants [**11**].

Sexual reproduction in wiregrass is triggered by mechanisms that remove above-ground portions of a plant, with fire directly prior to the growing season typically producing the most flowering individuals [**34**]. In Florida, Abrahamson [**1**] observed minimal flowering following winter burns, but vigorous flowering following burns during May through July. Similar patterns were observed in a long-term study at St. Marks NWR, where Platt et al. [**37**] observed flowering in 78.5% of wiregrass stems following growing season burns, and flowering in only 5.9% of stems following dormant season burns. Similar patterns were also observed from long-term plots at St. Marks NWR by Streng et al. [**43**]. Prescribed fire in a longleaf pine savanna in late February resulted in 94% of wiregrass plants flowering in North Carolina [**9**]. Throughout the wiregrass range, fire-stimulated flowering is short-lived, with little or no flowering occuring during the second growing season after fire [**33, 34**]. Hiers et al. [**19**], found that increased forest floor (duff) depth was associated with reductions in bunchgrass (including wiregrass) stems/m^2.

The indirect effects of fire on wiregrass (or other mechanisms that reduce overstory growth) have been investigated. Brockway et al. [**6**] found that a significant reduction (93%) in turkey oak cover contributed to an 86% increase in wiregrass biomass in Florida sandhills. Harrington et al. [**17**] determined that percent cover of wiregrass declined from 20% on plots without pines to 0% in stands where pine densities were 300 trees/acre; a result of accumulated needle-fall (plots remained unburned throughout the study) and reduced light levels.

Restoration and Management Considerations

Efforts to restore and maintain wiregrass must include frequent burning in order to limit competition with hardwood species. High frequency fire (≤3 years) is generally thought to be the historical disturbance regime for much of the longleaf pine ecosystem in the Southeastern U.S. [**41**] and the keystone process by which a number of species' life history traits (i.e., sexual reproduction in wiregrass and other ground flora species; Bachman's sparrow nesting, amphibian migration) are synced [**30**]. Seasonality of natural fire throughout the wiregrass range is variable, but fires are typically most common during the growing season [**20**, **24**]. By modeling wiregrass sexual reproduction with historical fire records from the the South Carolina Coastal Plain, Fill et al. [**14**] found that early summer (May – June) fires promoted more inflorescence growth than fires in either early spring (March - April) or late summer (August). Earlier studies have suggested that fire frequency plays an equal or greater role (than seasonality) in the maintence of the longleaf pine community by controlling woody hardwood and shrub species advancement and increasing coverage of grasses and forbs [**5, 27, 50**]. Frequent burning, whether applied in the growing or dormant season, may be a successful management tool to reduce non-longleaf pine woody stem encroachment as well as promote overall herbaceous species coverage. However, in cases where wiregrass densities are low and restoration is needed, early summer burning and additional tools such as planting, may be necessary to promote sustained growth.

Maintaining a fire frequency of two to five years will promote wiregrass growth and diminish likelihood of fire-induced mortality, as two years is the minimum time post-seed fall that wiregrass seedlings establish [**28**]. Furthermore, regular, frequent fires control invasive species [**39**], promote longleaf pine regeneration [**49**], and increase ground flora diversity [**51**]. Wiregrass-dominated woodlands are highly vulnerable to invasion by non-native plants due to the relatively slow growth and low reproductive potential of wiregrass [**21**]. Wiregrass may be able to resist invasion by some non-native plants through frequent fires. However, some invasive species, such as cogongrass (*Imperata cylindrica*) have the ability to completely dominate wiregrass communities [**12, 25**]. In addition, cogongrass can alter the fire regime, creating high-intensity fires that significantly alter the native species composition [**26**].

Management techniques other than fire may be necessary to promote wiregrass on degraded sites where native propagules are absent or severely reduced [**3**]. Walker and Silletti [**53**] discuss several advantages and disadvantages of direct seeding versus outplanting to restore native populations of longleaf pine ground flora. With respect to direct seeding, higher germination rates have been observed from wiregrass seeds collected in December in North and South Carolina sandhill locations [**48**]. It is important to consider that using non-local populations of wiregrass in restoration efforts could genetically contaminate native populations, thus selection of local, neighboring populations of wiregrass in the restoration process is recommended [**15**, **54**]. Prior to seeding, site treatments to reduce non-targeted species may be necessary, and may include 1) herbicide application, 2) several iterations of disking (3-4 weeks following herbicide treatment; every month for 6 months), and 3) soil compaction treatment (i.e., rolling) [**13**]. With respect to outplanting, seedling plugs can be expensive ($10k/acre, Walker and Silletti [**53**]), but can be very effective when coupled with mechanical techniques that reduce competition [**33**].

Burning, herbicide, and mechanical treatments have been tested to determine their effectiveness in reducing hardwood competition in sandhill longleaf pine ecosystems [**7, 8, 31, 32, 38, 52**]. The effects of both herbicide and mechanical treatments on ground flora species of the longleaf pine ecosystem, including wiregrass, is poorly understood, and results often are varied in the published literature. Both Provencher et al. [**38**] and Brockway and Outcalt [**7**] reported increases in native ground cover species following chemical treatment (hexazinone) on sites followed by prescribed fire. Jose et al. [**22**] report that an imazapyr chemical treatment (0.21 a.e. kg/ha) provided the highest quality results (increased longleaf pine growth, significant reduction in shrubs, no effect on grasses and herbs) when compared with other chemicals on a peninsular Florida flatwoods site. In lab experiments, Kaeser and Kirkman [**23**] observed negative effects on native herbaceous and graminoid seedlings of typical chemicals used to control woody vegetation in longleaf pine woodlands.

Wiregrass recovery at Carolina Sandhills National Wildlife Refuge was slowest on sites where mechanical treatments were followed by dormant season fires, and quickest on sites that were burned during the growing season, regardless of mechanical treatment [**52**]. Drum chopping has been shown to successfully reduce saw palmetto in south Florida pine flatwoods [**44**]. However, intense mechanical treatments can negatively affect wiregrass, particularly on more mesic sites. Mechanical disturbance of the soil causes wiregrass mortality through direct plant destruction or root desiccation and disturbed areas are typically slow to recover [**31, 32**].

The one constant in successful wiregrass restoration projects is the application of frequent prescribed fire (typically in the growing season) that stimulates plant reproduction, growth, and reduces competion from non-target species. Areas requiring immediate hardwood control can utilize a combination of chemical and mechanical (e.g., drum chopping) treatments, but fire is necessary for long-term restoration success [**38**].

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