# Index of Species Information

**SPECIES: Cynodon dactylon**



## Introductory

**SPECIES: Cynodon dactylon**

**AUTHORSHIP AND CITATION :**
Carey, Jennifer H. 1995. Cynodon dactylon. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, September 24].

**ABBREVIATION :**
CYNDAC

**SYNONYMS :**
NO-ENTRY

**SCS PLANT CODE :**
CYDA
CYDAA
CYDAD

**COMMON NAMES :**
Bermuda grass

**TAXONOMY :**
The currently accepted scientific name for Bermuda grass is Cynodon dactylon (L.) Pers. (Poaceae) [28,31,40,41]. Two varieties are recognized [77]:

Cynodon dactylon var. dactylon (L.) Pers.
Cynodon dactylon var. aridus Harlan & de Wet

Numerous cultivars have been developed. Many of the studies cited in this report were conducted using Bermuda grass cultivars. The specific cultivar name is only mentioned here if it is compared to another

cultivar.

**LIFE FORM :**
Graminoid

**FEDERAL LEGAL STATUS :**
No special status

**OTHER STATUS :**
NO-ENTRY

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# DISTRIBUTION AND OCCURRENCE

## SPECIES: Cynodon dactylon

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**GENERAL DISTRIBUTION :**
Bermuda grass, native to Africa, occurs throughout the world in tropical to warm temperate climates between 45 degrees north and 45 degrees south latitude [58]. In the United States Bermuda grass is most common in the subtropical regions from southern California east to the Gulf Coast and southeastern states. It is adventive north to Washington, Idaho, Utah, Colorado, Iowa, Michigan, New York, Massachusetts, and New Hampshire [25,28,31,41]. Populations occurring in cool temperate climates may be winter hardy cultivars [5].

**ECOSYSTEMS :**

| | |
|---|---|
| FRES12 | Longleaf-slash pine |
| FRES13 | Loblolly-shortleaf pine |
| FRES14 | Oak-pine |
| FRES15 | Oak-hickory |
| FRES16 | Oak-gum-cypress |
| FRES17 | Elm-ash-cottonwood |
| FRES20 | Douglas-fir |
| FRES28 | Western hardwoods |
| FRES29 | Sagebrush |
| FRES30 | Desert shrub |
| FRES31 | Shinnery |
| FRES32 | Texas savanna |
| FRES33 | Southwestern shrubsteppe |
| FRES34 | Chaparral-mountain shrub |
| FRES35 | Pinyon-juniper |
| FRES36 | Mountain grasslands |
| FRES38 | Plains grasslands |
| FRES39 | Prairie |
| FRES40 | Desert grasslands |
| FRES41 | Wet grasslands |
| FRES42 | Annual grasslands |

**STATES :**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| AL | AZ | AR | CA | CO | CT | DE | FL | GA | HI |
| ID | IL | IN | IA | KS | KY | LA | MD | MA | MI |
| MS | MO | NE | NV | NH | NJ | NM | NY | NC | OH |
| OK | OR | PA | RI | SC | TN | TX | UT | VA | WA |
| WV | DC | MEXICO | VI | PR | GU | | | | |

**BLM PHYSIOGRAPHIC REGIONS :**
1 Northern Pacific Border
3 Southern Pacific Border
4 Sierra Mountains
5 Columbia Plateau
6 Upper Basin and Range
7 Lower Basin and Range
11 Southern Rocky Mountains
12 Colorado Plateau
13 Rocky Mountain Piedmont
14 Great Plains

**KUCHLER PLANT ASSOCIATIONS :**
NO-ENTRY

**SAF COVER TYPES :**
Bermuda grass probably occurs on suitable sites within most SAF Cover Types that fall within its distribution.

**SRM (RANGELAND) COVER TYPES :**
201 Blue oak woodland
202 Coast live oak woodland
203 Riparian woodland
409 Tall forb
422 Riparian
717 Little bluestem-Indiangrass-Texas wintergrass
718 Mesquite-grama
719 Mesquite-liveoak-seacoast bluestem
727 Mesquite-buffalograss
728 Mesquite-granjeno-acacia
729 Mesquite
730 Sand shinnery oak
731 Cross timbers-Oklahoma
732 Cross timbers-Texas (little bluestem-post oak)
801 Savanna
804 Tall fescue
807 Gulf Coast fresh marsh
808 Sand pine scrub
809 Mixed hardwood and pine
810 Longleaf pine-turkey oak hills
811 South Florida flatwoods
812 North Florida flatwoods
813 Cutthroat seeps
815 Upland hardwood hammocks
819 Freshwater marsh and ponds

**HABITAT TYPES AND PLANT COMMUNITIES :**
In the southeastern United States, Bermuda grass occurs in pastures and fields and in the understory of open woods, forests, orchards, and pine (Pinus spp.) plantations. In Georgia it occurs in a 15-year fallow field with blackberry (Rubus spp.), American plum (Prunus americana), sassafras (Sassafras albidum), smooth sumac (Rhus glabra), and numerous herbaceous plants [48]. In South Carolina it occurs in an 8-year fallow field dominated by broomsedge bluestem (Andropogon virginicus) and paintbrush bluestem (A. ternarius) [30]. Bermuda grass occurs with slender woodoats (Chasmanthium laxum var. sessiliflorum) and big bluestem (Andropogon gerardi var. gerardi) in the herbaceous layer of a pine-oak (Quercus spp.) forest in eastern Texas [88].

In the southwestern United States, Bermuda grass occurs in riparian areas and in grasslands adjacent to streams and marshes. It is a frequently encountered understory grass in velvet mesquite (Prosopis

velutina) bosques [11]. A mixed honey mesquite (Prosopis glandulosa var. glandulosa)-saltcedar (Tamarix ramosissima)-Bermuda grass association has replaced some native associations in the Rio Grande floodplain in Big Bend National Park, Texas [8]. On Santa Rosa Island, California, Bermuda grass is a common understory plant in a riparian woodland composed of black cottonwood (Populus trichocarpa), arroyo willow (Salix lasiolepis), and goosefoot (Chenopodium spp.) [16]. In the Sacramento River valley, California, Bermuda grass occurs in a gravel bar thicket community dominated by sandbar willow (Salix exigua) where the willow canopy is not dense [18].

# MANAGEMENT CONSIDERATIONS

## SPECIES: Cynodon dactylon

**IMPORTANCE TO LIVESTOCK AND WILDLIFE :**
Bermuda grass is eaten by livestock [74]. No information was found discussing beneficial or detrimental effects of Bermuda grass on wildlife.

**PALATABILITY :**
Bermuda grass is highly preferred by cattle [23].

**NUTRITIONAL VALUE :**
Bermuda grass has good forage value for cattle [74], and is acceptable for sheep [59]. Bermuda grass, sampled in September in Oklahoma, contained 8.1 to 10.2 percent crude protein and was 41.6 to 44.4 percent digestible [9].

Nutritional contents (% dry matter) of Bermuda grass stems and leaves sampled from the Edwards Plateau region of Texas are as follows [44]:

| | phosphorus | crude protein | digestible organic matter |
|---|---|---|---|
| May 24 | 0.22% | 12% | 58% |
| June 28 | 0.21% | 12% | 56% |

Crude protein was measured for four Bermuda grass cultivars in New Mexico. Coastal Bermuda grass had the highest crude protein values: 5.5, 7.5, and 7.4 percent for July, August, and October, respectively. [52].

**COVER VALUE :**
NO-ENTRY

**VALUE FOR REHABILITATION OF DISTURBED SITES :**
Bermuda grass is commonly used to revegetate lignite surface mine spoils in the southeastern and Gulf Coast states [37,69,81]. It provides good initial erosion control as well as high forage quality. However, its

use is limited because optimal establishment requires planting by sprig rather than by seed. Seeding rates and sprig spacings are described [8]. Bermuda grass planted on uranium mine spoils should not be used for forage because of potentially high plant selenium concentrations [43].

Bermuda grass declines on mine spoils if not fertilized on a yearly basis. It may be a good species for initial erosion control followed by later replacement with lower maintenance plants [69,81]. Harris and Zuberer [37] found that Bermuda grass production increased when grown with subterranean clover (Trifolium subterraneum) inoculated with rhizobia (Rhizobium spp.). The clover grows during the winter months and increases soil nitrogen which the Bermuda grass then utilizes during the summer growing season [37].

Bermuda grass increases streambank substrate stability during floods; it armours sand and resists scouring [55]. In Arizona riparian areas, Bermuda grass enhanced postflood development of aquatic macrophyte communities [19].

**OTHER USES AND VALUES :**
Bermuda grass is used as a turf grass for lawns, athletic fields, and golf courses [64,75,81].

**OTHER MANAGEMENT CONSIDERATIONS :**
Bermuda grass is a widely planted turf, hay, and pasture grass in the southern United States. Many cultivars have been developed for increased drought resistance, cold hardiness, disease resistance, and forage production. Quisenberry [64] reviewed the research conducted in the southeastern United States relevant to the resistance of Bermuda grass cultivars to insects and mites.

Bermuda grass requires regular fertilizing to maintain high yields and turf quality. Bermuda grass pastures can be safely and adequately fertilized with municipal sewage sludge [51].

Bermuda grass is considered a weed in corn, alfalfa, citrus, grape, cotton, sugarcane, and other crops, as well as in landscaping and nonBermuda grass lawns [33]. Bermuda grass is a troublesome weed in native plant restoration projects [1,35]. In Everglades National Park in Florida, Bermuda grass primarily colonizes disturbed sites and is not considered a threat to native vegetation [86]. No information was found concerning the ability of Bermuda grass to invade and outcompete undisturbed native vegetation.

Bermuda grass is difficult to eradicate without herbicides. Numerous herbicides have been tested on Bermuda grass and its various cultivars. Herbicide application rates and effectiveness are described [4,22,46,47,66]. Soil solarization is only partially effective at killing Bermuda grass [3]. The phytotoxins of several fungi which utilize Bermuda grass have been isolated. Investigations of their possible use as a control are ongoing [72].

Bermuda grass is widely used in timber pastures. Timber pastures are usually fertilized annually. Bermuda grass is tolerant of competition from a periodically thinned pine overstory. However, pine litter restricts Bermuda grass reproduction by stolons. Use of prescribed burning to enhance Bermuda grass by removing litter without damaging young pines is described [17]. Shade reduces Bermuda grass forage yields, but as long as pines are small and spaced so that direct sunlight reaches grass during a portion of each day, yields are satisfactory [14].

Bermuda grass is suspected of having allelopathic qualities [54,84]. It inhibited the growth of newly planted peach (Prunus persica) [84]. Bermuda grass produces cyanogenic compounds [59].

# BOTANICAL AND ECOLOGICAL CHARACTERISTICS

## SPECIES: Cynodon dactylon

**GENERAL BOTANICAL CHARACTERISTICS :**
Bermuda grass is an introduced, perennial, mat-forming, warm season grass. It is both rhizomatous and stoloniferous. Erect or ascending culms grow 0.3 to 1.3 feet (0.1-0.4 m) tall. The panicle has two to seven digitate branches [40]. Rhizomes are hard, scaly, and 0.06 to 0.13 inch (1.5-3.3 mm) in diameter. Stolons are flattened and several feet long, rooting at nodes [33]. Main root length per plant of four cultivars ranged from 2.3 to 37.1 feet (0.7-11.3 m) while total root length ranged from 43 to 4,854 feet (13.0-1,480 m). Root hairs contributed 64 to 95 percent of the total root length [32].

**RAUNKIAER LIFE FORM :**
Geophyte
Hemicryptophyte

**REGENERATION PROCESSES :**
Although Bermuda grass reproduces by seeds, it spreads most rapidly by stolons and rhizomes. Both stolon and rhizome branching intensities were reduced in response to lower light and lower nutrient levels. Average stolon and rhizome internode and total lengths are reported under differing light and nutrient conditions [21]. In a study of six Bermuda grass variants present in southern Africa, vegetative reproduction was greater by rhizomes than by stolons [26].

Seeds, eaten by animals, are widely dispersed. Bermuda grass seeds present in domestic sheep dung germinated in "large numbers" [39]. Fernald [25] stated that seeds are rarely perfect. Seed viability of the six variants from southern Africa ranged from 0 to 3.5 percent [26]. Germination of viable seeds is low unless scarification occurs. Seeds treated with sulfuric acid for 10 minutes had 68 percent germination after 4 days, but untreated seeds had only 4.5 percent germination after 10 days [12]. Prolonged exposure to acidic conditions decreases seed germination. Bermuda grass seeds did not germinate in sulfuric acid solutions of pH 3 or less. In pH 4 and 5 solutions, germination was about 5 and 10 percent, respectively, after 12 days [68].

Bermuda grass seeds were present in intact soil/litter samples collected for a germination study from an upland site in Arizona; seeds may have come from an aerial seeding of an adjacent property. Equal amounts of Bermuda grass seeds germinated in the control sample and in the scarified soil surface treatment. No seeds germinated from soil samples which had the litter manually removed or burned [29].

**SITE CHARACTERISTICS :**
Although adaptable to most soil types, Bermuda grass grows best on fertile, sandy to silty soils or alluvium [75,81].

Bermuda grass occurs in regions that receive more than 16 inches (410 mm) of rainfall a year. In areas with less rainfall, it requires a surface source of water or irrigation [75]. Bermuda grass is classified as a facultative to facultative upland species [67]. In the southwestern United States, Bermuda grass occurs in irrigated areas and along streambanks [40,85]. Bermuda grass can expand a short distance into the upland by transferring water via stolons. In a laboratory study, Bermuda grass plants in separate moist and dry-soil compartments transferred water from one compartment to the other [79]. In Organ Pipe National Monument, Arizona, Bermuda grass occurs in damp areas but shows no tendency to spread [6].

Bermuda grass has deep roots and is capable of extending roots during drought stress. Ten cultivars distributed at least some roots 47 to 59 inches (120-150 cm) deep during a drought stress laboratory test. The bulk of the root mass was within the top 24 inches (60 cm) [38].

Bermuda grass is susceptible to cold temperatures, especially those occurring in the early winter. Anderson and others [2] studied the freeze tolerance of six cultivars grown in cone-tainers and held overnight at freezing temperatures. The temperature resulting in fifty percent mortality ranged from 15 degrees Fahrenheit (-9.6 deg C) to 18 degrees Fahrenheit (-7.7 deg C) for the six cultivars [2]. A winter hardy cultivar survived three winters in Morgantown, West Virgina, even though temperatures reached as low as -8 degrees Fahrenheit (-22 deg C) [53].

Bermuda grass is generally tolerant of low soil pH and high salt concentration. Six strains collected from southern Africa survived at soil pH of 2.7 [26]. Vogel [81] reported Bermuda grass growing in soil with pH as low as 3.2. Bermuda grass dry matter yields were unaffected by one growing season of irrigation with brackish water, but were reduced in the second season [61]. Although tolerant of salty soils [75,81], Bermuda grass does not appear to occur in saltwater wetlands. It occurs only in the freshwater vegetation type in the Louisiana coastal region [15]. Although common in the lower Sacramento River valley, Bermuda grass does not occur in the tidal streambank community [87].

In California Bermuda grass occurs below 2,950 feet (900 m) elevation [40]. In Colorado it occurs from 4,200 to 5,300 feet (1,280-1,620 m) elevation [20]. In Utah it occurs along waterways below 465 feet (1,525 m) [85].

**SUCCESSIONAL STATUS :**
Bermuda grass is an early successional species. Shade reduces Bermuda grass vigor, and complete canopy closure may eliminate Bermuda grass [14]. It inhabits open locations subject to frequent disturbances such as grazing, flooding, and fire [21]. After a major flood in March on the Hassayampa River in Arizona, Bermuda grass cover increased to near preflood levels by September [73]. In a study of unreclaimed lignite mines, Bermuda grass was most frequent on recently abandoned sites. It was not present on sites 20 years old or older [70].

On the Rio Grande Valley National Wildlife Refuge in southern Texas, Rooseveltweed (Baccharis neglecta), buffel grass (Pennisetum ciliare), and Bermuda grass were the dominant species after 5 years of old-field succession. The two grasses may have inhibited the establishment of other species by successfully competing for moisture and light [83].

In central Utah, Bermuda grass was present in young saltcedar communities (age 2 to 3.1 years) but was absent from older communities, possibly because saltcedar lowers the water table [10]. Horton [42] observed that spaces between individual saltcedar are usually dominated by Bermuda grass or salt grass (Distichlis spicata) if the water table is 5 feet (1.5 m) deep or less.

**SEASONAL DEVELOPMENT :**
Bermuda grass begins growth late in the spring, continues to grow during the hot summer months, and becomes dormant when the weather cools in the fall [76]. Near Bakersfield, California, Bermuda grass emerged when soil temperatures at a depth of 2 inches (5 cm) reached 63 degrees Fahrenheit (17 deg C) [49]. In Morgantown, West Virginia, growth did not begin until mid- to late May [53]. Bermuda grass flowers from July to October [25].

# FIRE ECOLOGY

## SPECIES: Cynodon dactylon

**FIRE ECOLOGY OR ADAPTATIONS :**
In its native Africa, Bermuda grass occurs in grassland communities that regularly experience fire [5]. In North America, Bermuda grass has established in plant communites that experience fire such as grasslands and pine and oak forests. Grassland fires tend to burn quickly, consuming aboveground fuels but usually not heating the soil enough to damage rootstocks [82]. The ability of Bermuda grass to reproduce from rhizomes probably enables it to survive most fires [80].

**POSTFIRE REGENERATION STRATEGY :**
Rhizomatous herb, rhizome in soil
Secondary colonizer - on-site seed

# FIRE EFFECTS

## SPECIES: Cynodon dactylon

**IMMEDIATE FIRE EFFECT ON PLANT :**
Fire top-kills Bermuda grass but rhizomes probably remain undamaged except during severe fire that burns organic soil [80]. Cultivars that are strongly stoloniferous may be more damaged by fire than those that are predominantly rhizomatous [62]. Soil- or litter-stored Bermuda grass seed did not germinate after litter was removed by fire; seeds may have been destroyed by fire [29].

**DISCUSSION AND QUALIFICATION OF FIRE EFFECT :**

NO-ENTRY

**PLANT RESPONSE TO FIRE :**
Bermuda grass productivity and cover have both increased and decreased after early spring fires. Bermuda grass response depends on postfire moisture conditions and nutrient levels [34,56,57,63].

Four treatments (fertilized, burned in early April, burned and fertilized, and control) were applied to an Oklahoma grassland of prairie threeawn (Aristida oligantha), Bermuda grass, little bluestem (Schizachyrium scoparium), and paintbrush bluestem. Bermuda grass cover increased significantly ($P<0.05$) over control levels with fertilization and the burning-fertilizing combination, but increased only slightly with burning alone. The burning-fertilizing treatment resulted in slightly higher cover than the fertilized treatment [63].

A March 5 fire on a Georgia old field resulted in a decrease in Bermuda grass yield. The control produced 14.7 grams per square meter and the burned area produced 0.24 gram per square meter in the summer after the fire. Bermuda grass was a minor species on the site [60]. Postfire moisture conditions were not reported.

No change was detected in Bermuda grass cover after a dormant season fire in a mid-grass community in Serengeti National Park, Tanzania, Africa [5].

Spring burning stimulates seed production of Bermuda grass. In Georgia Bermuda grass burned on March 29 produced 46 pounds of seeds per acre compared to 16 pounds per acre on the unburned control. The following year the site was burned on April 15, and Bermuda grass produced 29 pounds per acre on the burn compared to 3 pounds per acre on the control [13].

**DISCUSSION AND QUALIFICATION OF PLANT RESPONSE :**
NO-ENTRY

**FIRE MANAGEMENT CONSIDERATIONS :**
Early spring prescribed burning is regularly used in Bermuda grass pastures to remove old stubble and manure, reduce insects and disease, control woody sprouts, and reduce weeds [34,36,45,56,57,62]. Prescribed burning of Bermuda grass may control leaf spot and stem blight caused by Helminthosporium spiciferum and H. rostratum [36]. Hamilton [34] recommended burning only in years with sufficient soil moisture to promote rapid postfire growth. However, in areas with high rainfall (30 to 40 inches [760-1,020 mm]) or where irrigation is available, burning can be done on an annual basis [34]. Pinkerton and Rice [62] reported that some cultivars can be burned as often as needed with either headfires or backfires. Burning should take place while plants are still dormant. The recommended time is 1 week before the average date of the last killing frost [34,56].

Average dry matter yield of Bermuda grass pasture burned March 1 in Georgia was 832 pounds per acre (1,000 kg/ha) higher than yields of unburned controls. Digestibility and crude protein content of the Bermuda grass were not affected by burning. Because of an increase in absorbed solar radiation, burning increased the soil temperatures at 1-, 2-, and 4-inch (2.5, 5, and 10 cm) depths for 2 to 3 weeks after burning. Dry matter yields were positively related to soil temperatures, but the relationship was subject to the modifying influences of rainfall, air temperature, and soil fertility [56].

Morris [57] reported that burning Bermuda grass pastures had differing effects on forage yields depending on fertilization levels. Yields increased by 1,017 pounds per acre (1,140 kg/ha) after annual spring burning followed by a high level of fertilization on a Georgia site, but

yields remained unchanged with medium and low levels of fertilization. Burning reduced weeds regardless of fertilization level. Burning on April 1 provided better weed control than burning on January 1 or March 1 [57].

The effects of fire on Bermuda grass yield vary among cultivars. Pinkerton and Rice [62] investigated the effects of annual March backfires and headfires on the yields of six Bermuda grass cultivars. After 3 years of annual burning, yields of `Coastal,' `Common,' `Brazos,' and `Tifton 44' were unaffected by either backfire or headfire; `Tifton 78' was reduced by backfire only; and `Grazer' was reduced by both backfire and headfire. Fire-related yield reductions occurred during only the first two of the five yearly harvests. Yield reductions appeared to be related to how stoloniferous the cultivar was, with the more stoloniferous cultivars showing greater reductions, particularly when burned with backfires which traveled more slowly than headfires [62].

Spring burning prior to urea application may decrease the amount of gaseous ammonia lost when urea reacts with organic matter. In a Georgia study Bermuda grass yields from fields burned and fertilized with urea did not differ significantly from fields fertilized with ammonium nitrate fertilizer [45].

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## SPECIES: Cynodon dactylon

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