Plant Assessment Form

For use with the "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association (Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Cynodon dactylon* (L.) Pers. (USDA 2005)
Synonyms:	*Capriola dactylon* (L.) Kuntze, *Panicum dactylon* L. (USDA 2005)
Common names:	Bermudagrass, devilgrass, grama-seda, chiendent pied-de-poule, motie molulu, manienie, common stargrass, baramagrass, dhubgrass, bahama grass, dogtoothgrass, couch grass, vinegrass, wiregrass, scutchgrass
Evaluation date (mm/dd/yy)**:**	10/29/04
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Committee review date:	11/19/04 and 03/01/05
List date:	03/01/05
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	**B**	Other published material	**"Impact"** **Section 1 Score:** **B**	**"Plant Score"** **Overall Score:** **Medium** **Alert Status:** **None**
1.2	Impact on plant community	**B**	Other published material		
1.3	Impact on higher trophic levels	**U**	Observational		
1.4	Impact on genetic integrity	**D**	Other published material		
2.1	Role of anthropogenic and natural disturbance	**B**	Other published material	**"Invasiveness"** *For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:* **14 pts** **Section 2 Score:** **B**	
2.2	Local rate of spread with no management	**B**	Observational		
2.3	Recent trend in total area infested within state	**C**	Observational		
2.4	Innate reproductive potential	**A**	Other published material		
2.5	Potential for human-caused dispersal	**A**	Other published material		
2.6	Potential for natural long-distance dispersal	**B**	Other published material		
2.7	Other regions invaded	**C**	Observational		RED FLAG **NO** Something you should know.
3.1	Ecological amplitude	**A**	Observational	**"Distribution"** **Section 3 Score:** **A**	
3.2	Distribution	**A**	Other published material		

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **B** *Doc'n Level:* **Other pub**.
Identify ecosystem processes impacted: Soil ecology, geomorphological and hydrological processes
Rationale: *Cynodon dactylon* (Bermudagrass) forms dense mats that displace native plants, alter the soil ecology, alter geomorphological and hydrological processes, and alter successional processes (Guertin and Halvorson 2003; no specifics were provided). In Carey (1995): Belesky et al. (1991) has Bermudagrass being adapted to plant communities that regularly experience fire. Skousen and Call (1987) and Vogl (1974) state that Bermudagrass prevents soil erosion and stabilizes river banks. Carey (1995) cites multiple sources as saying fire may or may not increase the spread of Bermudagrass, depending on soil moisture following a fire (Morris 1968, Monson et al. 1974, Powell et al. 1979, Hamilton 1980). A fire will kill the above ground portion of Bermudagrass, leaving the rhizomes to reproduce quickly after a fire under favorable conditions (Van Rensburg 1972). Although there is a great deal of information on how fire affects Bermudagrass, this researcher found no information on how Bermudagrass affects the fire regime. Bermudagrass prevents erosion through its thick and extensive root mass, so is used in bank stabilization projects and to revegetate lignite surface mine spoils (Vogel 1981, Skousen and Call 1987, Harris and Zuberer 1993, Guertin and Halvorson 2003).
Sources of information: See cited literature.

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **B** *Doc'n Level:* **Other pub.**
Identify type of impact or alteration: Moderate impact effecting plant composition, structure and interactions.
Rationale: Bermudagrass is an early successional species (Guertin and Halvorson 2003), which means it can colonize and take hold before other plant species can establish. Bermudagrass can develop into dense turf, which dominates an understory habitat (Guertin and Halvorson 2003). However, shade or a complete canopy closure could reduce or eliminate Bermudagrass (Burton et al. 1959). In Carey (1995): Bermudagrass is frequently found as an understory plant in velvet mesquite bosques (Boeer and Schmidly 1977). Carey (1995) further cites the same source saying that Bermudagrass, combined with saltcedar and mesquite, is a new vegetation association that has replaced native associations. Bermudagrass is suspected of having allelopathic qualities (Weller et al. 1985, McDonald 1986), which may interfere with plant establishment and growth. Bermudagrass is said to have enhanced postflood development of aquatic macrophyte communities in Arizona riparian areas (D'Antonio and Vitousek 1992). The Nature Conservancy (TNC 2001) researched the effects of Bermudagrass on the growth of young mesquite trees. They found that mesquite trees with a high (>40%) Bermudagrass grass cover experienced less growth, including shorter height, smaller stem diameters, and shorter mean shoot lengths than mesquite trees with low (<40%) Bermuda grass cover. This study shows that "…abundant Bermudagrass appears to depress mesquite growth rates…" (TNC 2001). Guertin and Halvorson (2003) cited Weller et al. (1985) as having shown Bermudagrass to inhibit the growth of newly planted peach trees. It is uncertain where the allelopathic qualities originate, but may be from biologically active substances produced by living, and dead, subterranean tissue (Guertin and Halvorson 2003).

Personal observations (K. Klementowski, 2004) at the Pratt Nursery, in Yuma county found Bermudagrass to dominate the understory. The Pratt Nursery was converted from an agricultural field to an outdoor nursery dominated by cottonwoods and willow, with Bermudagrass making up the majority of the understory. Bermudagrass in this case, could be preventing the recruitment of other native plants.

Sources of information: See cited literature. Also considered personal observations by K. Klementowski (Natural Resource Specialist, Bureau of Land Management, Yuma, Arizona, 2004).

Question 1.3 Impact on higher trophic levels *Score:* **U** *Doc'n Level:* **Obs.**

Identify type of impact or alteration: Negligible, provides forage for desert tortoise.

Rationale: Because Bermudagrass changes large portions of the understory and forms monotypic stands, the Working Group (on 03/01/05) inferred that there would be some impact, though unknown at this time, on higher tropic levels.

Bermudagrass is commonly used as forage for captive desert tortoises (Van Devender 2002). Bermudagrass can be intensively grazed by livestock (Newman 1992). A combined diet of Bermudagrass, alfalfa, clover, dichondra, and ryegrass has shown to be adequate nutritional regime for captive tortoises over a 20 year period (Van Devender 2002). Sherry Barrett (personal communication, 2004) states that Bermudagrass is a diet item for backyard tortoises, in fact some exist almost solely on Bermudagrass. Cecil Schwalbe (personal communication, 2004) believes that tortoises "will eat it in the wild if it is in their home range". Matt Goode (personal communication, 2004) commented that there is no conclusive evidence of Bermudagrass affecting lizard movement. He further said "the existence of large stands of non-native plants [in general] certainly alter the habitat of a variety of species and I suspect there can be benefits or costs depending on the species and its biology...".

Because Bermudagrass is used as forage for cattle, the grass may be used by native ungulates.

Sources of information: See cited literature. Also considered personal communications with S. Barrett (Southwest Arizona Field Supervisor, U.S. Fish and Wildlife Service, Arizona Ecological Services Field Office, Tucson, Arizona, 2004), C. Schwalbe (Research Ecologist, U.S. Geological Survey, Sonoran Desert Research Station, Tucson, Arizona, 2004), and M. Goode (Assistant Research Specialist, University of Arizona, School of Natural Resources, Tucson, Arizona, 2004) and Working Group inference.

Question 1.4 Impact on genetic integrity *Score:* **D** *Doc'n Level:* **Other pub.**

Identify impacts: Bermudagrass has been known to produce 5,000 hybrids when crossing two variants (Burton 1993).

Rationale: Although Bermudagrass is a highly variant species, the literature cites only non-native hybridization. There are no native congeners in Arizona (Kearney and Pebbles 1960).

Sources of information: See cited literature.

Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* **B** *Doc'n Level:* **Other pub.**

Describe role of disturbance: Requires anthropogenic or natural disturbance to establish

Rationale: Newman (1992) cites Bermudagrass as growing only in disturbed areas. Bermudagrass is typically found in disturbed areas where moisture collects, such as waterholes, springs, seeps, irrigation ditches, roadsides (Chambers and Hawkins 2002), landscapes, orchards, vineyards, gardens, turf, industrial areas, waste places, and riparian areas (Guertin and Halvorson 2003). Guertin and Halvorson (2003) cite the grass as being found in natural areas, along sandy washes of remote canyons and as an understory in mesquite bosques. Weber County Weed Abatement in Utah (2004) has stated that Bermudagrass "…does not, as a rule, invade natural grasslands or forest vegetation".

It is fair to say, according to the mixed reports in the literature, that Bermudagrass can be found in areas with or without human disturbance (Guertin and Halvorson 2003). Bermudagrass is mostly found in anthropogenically disturbed areas, but can be found in relatively natural areas. In its native region, Bermudagrass thrives in communities where fire is a regular occurrence (Carey 1995, Guertin and Halvorson 2003).

Sources of information: See cited literature. Also considered information from Weber County Weed Abatement on Bermudagrass (available online at: http://www.co.weber.ut.us/weeds/types/Bermuda grass .asp; accessed November 8, 2004).

Question 2.2 Local rate of spread with no management *Score:* **B** *Doc'n Level:* **Obs.**

Describe rate of spread: Increases but less rapidly than doubling in <10 years.

Rationale: Guertin and Halvorson (2003) described an experiment by Horowitz (1996). In this study Bermudagrass formed a dense sod after 1 ½ to 2 ½ years measuring 13 and 25 m^2, respectively. The average expansion rate thereafter was approximately 1 m^2 per month and exceeded 2 m^2 in the warmer summer months.

In Newman 1992: The open growth pattern of Bermudagrass's stolons provides for greater land coverage than seen with species which lack stolons, such as *Sorghum halepense*; the average monthly area increase in the warm season for *Cynodon dactylon* and *Sorghum halepense* is 1.6 m^2 and 1.3 m^2, respectively (Horowitz 1973). Aerial growth from shoots, tillers and previous season's rhizomes produce an abundance of stolons, which in turn produce more shoots, rhizomes and roots (Horowitz 1972a). This growth pattern explains the tremendous spreading capacity of Bermudagrass; the highest monthly area increase was 6 m^2 during July and August (Horowitz 1972a). However, the average area increase for *Cynodon dactylon* is only 0.9 m^2 per month.

Although we don't know the locale of these growth/spread studies by Horowitz, Working Group members have observed increased spread of Bermudagrass but not doubling in size in less than 10 years.

Sources of information: See cited literature. Also considered Working Group member observations.

Question 2.3 Recent trend in total area infested within state *Score:* **C** *Doc'n Level:* **Obs.**

Describe trend: Bermudagrass is found throughout Arizona, below 6,000 feet elevation (Newman 1992).

Rationale: Discussion from the Working Group suggested that Bermudagrass occurs throughout the state and it occupies the full extent of its potential range.

Sources of information: See cited literature. Also considered Working Group member observations.

Question 2.4 Innate reproductive potential *Score:* **A** *Doc'n Level:* **Other pub.**

Describe key reproductive characteristics: Bermudagrass reproduces through rhizomes and stolons, but is reported to be most effective by use of stolons (Fuls and Bosch 1990). There is some conflicting literature as to whether the seeds that are produced are viable or have a viable germination rate. However, it is reported that plants in the southwest produce a good seed set (Newman 1992).

Rationale: Guertin and Halvorson (2003) cite that *Cynodon dactylon* var. *dactylon* does not produce mature seeds, but *Cynodon dactylon* var. *aridus* will produce viable seeds in favorable conditions. Bermudagrass variations are known to hybridize extensively, producing sterile hybrids that depend on vegetative reproduction. Different variations and hybrids of Bermudagrass species may exist in Arizona, so seed reproduction ability and viability are unknown, but likely.

Seed set can be less than 1% in the rest of the U.S. and 95% in Arizona and California where it is grown as a seed crop. Carey (1995) cites Bermudagrass as producing viable seeds but with a low germination rate until scarified. The vegetative reproduction ability of Bermudagrass is more rapid than by seed

reproduction. If the seeds are viable, they can survive and remain viable for three to four years under favorable conditions (Guertin and Halvorson 2003). Bermudagrass requires hot and dry conditions to produce viable seeds and are known to flower May through November in Arizona (Guertin and Halvorson 2003).

Horowitz (1972b in Newman 1992)) reported Bermudagrass, in the second year of growth, can produce 87 inflorescences per square meter (78 in the first year). Guertin and Halvorson (2003) cited the Institute of Pacific Islands Forestry (2001), which stated that each Bermudagrass inflorescence can produce an average of 230 seed per infloresence. With these two facts, one can infer that one Bermudagrass plant stand can potentially produce over 20,000 seeds per square meter.

Sources of information: See cited literature.

Question 2.5 Potential for human-caused dispersal *Score:* **A** *Doc'n Level:* **Other pub.**

Identify dispersal mechanisms: Humans have played a major part in the increased spread of Bermunda grass. The seeds are dispersed by irrigation water, soil movement, agricultural and landscape machinery, as a commercial seed contaminant, in livestock feed and bedding, and various other human activities including ship ballast and packing materials (Guertin and Halvorson 2003).

Rationale: Bermudagrass is used as a lawn turf and forage crop (Newman 1992). Bermudagrass is readily available for use as a lawn grass and in fact its use is encouraged by the University of Arizona Cooperative Extension's Turf Tips (2004). It is used as a principal pasture grass in southeastern U.S. and as a seed crop in the southwestern U.S. (Guertin and Halvorson 2003). The Yuma County Cooperative Extension (2004) cites Bermudagrass as one of the best perennial grasses for irrigated summer pastures and recommends it for commercial pasture or hay production. Collection record in Bapchule, Pinal County (SEINet 2004) documented the 1989 collection from L. Enos' pasture, who was cultivating it for horse forage.

Sources of information: See cited literature. Other sources: Turf Tips (available online at: http://ag.arizona.edu/turf/tips203%20.htm; accessed November 12, 2004), Yuma County Cooperative Extension recommendations (available online at http://cals.arizona.edu/yuma/urbanhorticulture/Bermudaforage.htm, accessed November 12, 2004), and SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed October 14, 2004).

Question 2.6 Potential for natural long-distance dispersal *Score:* **B** *Doc'n Level:* **Other pub.**

Identify dispersal mechanisms: Bermudagrass seeds are dispersed by water (especially on rivers), wind, soil movement and when eaten by animals (Guertin and Halvorson 2003).

Rationale: Because this plant is used as a crop plant, one can infer that plant material and seeds could readily fall from trucks transporting the Bermudagrass hay.

Sources of information: See cited literature.

Question 2.7 Other regions invaded *Score:* **C** *Doc'n Level:* **Obs.**

Identify other regions: Invades ecological types that are invaded already in Arizona.

Rationale: Working Group concluded that all Arizona ecological types that are susceptible to Bermudagrass are invaded. Therefore, no different ecological types which are invaded elsewhere have equivalent environments in Arizona.

Sources of information: Working Group consensus

Question 3.1 Ecological amplitude *Score:* **A** *Doc'n Level:* **Obs.**

Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: The earliest herbarium collection date is documented as July 1891 by J. Toumey in Pima County. Bermudagrass is most likely native to Africa (Guertin and Halvorson

2003). Bermudagrass is able to tolerate a wide range of soils and soil conditions (Guertin and Halvorson 2003); however, there is no information on how this directly impacts the soil ecology. Bermudagrass is adapted to various soils, from fertile, sandy to silty soils or alluvium to heavy clay, acidic to alkaline, and arable to non-arable (Guertin and Halvorson 2003).

From SEINet (2004: based on over 1000 records from Arizona in Arizona's herbaria): Arizona Upland Sonoran desertscrub, in sand in arroyo bottom in Silver Bell Moutain ; along Colorado River (river mile 143.5), river right, below junction. of Kanab Creek and river, 50 to 60 m from river's edge at 8000 cfs; Santa Cruz floodplain at San Rafael State Park, King Canyon and Chimena Canyon, Saguaro National Park-moist areas; several collections from Dead Horse Ranch state park in Yavapai County; Sycamore Canyon Wilderness Area, Sycamore Creek, south of Summer Spring,. about 3 km southwest of Black Mountain (cottonwood-willow riparian area).

Tonto National Forest. Superstition Wilderness Area. Miles Ranch Trailhead, near Paradise Spring. Forest Rd. 287, approximatley 12 miles from U.S. Highway 60 turnoff to Magma Copper Mine. Trail 271. Associated Species**:** *Cupressus arizonicus, Juniperus erythrocarpa, Quercus dunnii, Quercus emoryi* (specimen collected by K. Rice in 1991).

Rationale: There are 4 major and at least 6 minor ecological types invaded.

Sources of information: See cited literature. Also considered collections records from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed October 14, 2004).

Question 3.2 Distribution *Score:* **A** *Doc'n Level:* **Other pub.**

Describe distribution: According to multiple herbarium records, Bermudagrass is found in 12 of the 15 counties in Arizona (SEINet 2004). Gould (1951) and Kearney and Peebles (1960) report Bermudagrass being distributed throughout all 15 counties in Arizona.

Rationale: Based on Working Group discussion and observations. See Worksheet B. Dave Madison (personal communication, 2004) has over 265 observations of Bermudagrass in and around Phoenix, including the banks of the Agua Fria River and on many roadsides.

Sources of information: See cited literature. Also considered collections records from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed October 14, 2004) and observations by D. Madison (Quarantine Program Manager, Arizona Department of Agriculture, Phoenix, Arizona, 2004).

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**Yes**	**No**	**1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**Yes**	**No**	**2 pt.**
Populations of this species produce seeds every year.	**Yes**	**No**	**1 pt.**
Seed production sustained for 3 or more months within a population annually	**Yes**	**No**	**1 pt.**
Seeds remain viable in soil for three or more years	**Yes**	**No**	**2 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes**	**No**	**1 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes**	**No**	**1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes**	**No**	**2 pt.**
Resprouts readily when cut, grazed, or burned	**Yes**	**No**	**1 pt.**

Total pts: 11 Total unknowns: 1

Score : A

Note any related traits:

Worksheet B. Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	
	Mohave desertscrub	
	Chihuahuan desertscrub	**D**
	Sonoran desertscrub	**C**
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
Freshwater Systems	lakes, ponds, reservoirs	
	rivers, streams	
Non-Riparian Wetlands	Sonoran wetlands	**D**
	southwestern interior wetlands	**U**
	montane wetlands	**U**
	playas	
Riparian	Sonoran riparian	**B**
	southwestern interior riparian	**A**
	montane riparian	
Woodlands	Great Basin conifer woodland	**D**
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	
Tundra (alpine)	tundra (alpine)	

*A means >50% of type occurrences are invaded; B means >20% to 50%; C means >5% to 20%; D means present but ≤5%; U means unknown (unable to estimate percentage of occurrences invaded).

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