GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Imperata cylindrica***

Imperata cylindrica 简体中文 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Plantae	Magnoliophyta	Liliopsida	Cyperales	Poaceae

Common name Blutgras (German), gi (Fijian), cogon grass (English), ngi (Fijian), alang-alang (English), japgrass (English), speargrass (English), lalang (English), carrizo (English), kunai (English), blady grass (English), satintail (English), paille de dys (French), paillotte (French), impérata cylindrique (French)

Synonym *Imperata arundinacea* , Cirillo
Lagurus cylindricus , L.

Similar species *Imperata brasiliensis*

Summary Native to Asia, cogon grass (Imperata cylindrica) is common in the humid tropics and has spread to the warmer temperate zones worldwide. Cogon grass is considered to be one of the top ten worst weeds in the world. Its extensive rhizome system, adaptation to poor soils, drought tolerance, genetic plasticity and fire adaptability make it a formidable invasive grass. Increases in cogon grass concern ecologists and conservationists because of the fact that this species displaces native plant and animal species and alters fire regimes.

view this species on IUCN Red List

Species Description
Although *Imperata cylindrica* can have leaf blades of up to 1.5 m tall in conditions of good soil moisture and fertility (Holm *et al*. 1977, in Daneshgar & Shibu 2009), the majority of its biomass occurs below ground comprising greater than 60% of the total biomass (Sajise 1976, in Daneshgar & Shibu 2009). Cogon grass is stemless erect perennial growing in loose to compact tufts with slender flat linear-lanceolate leaves arising from the rhizomes. The scabrous leaves are 4 to 10 mm wide with prominent white midribs that are slightly off center. The leaves may be 15 to 150 cm tall, depending on habitat, with narrow sharp points (Bryson & Carter 1993; Hubbard *et al*. 1944, in Dozier *et al*. 1998). For more information on morphology see Dozier *et al*. 1998.

Lifecycle Stages
Rhizome production from a seedling plant takes about 4 wk. Seed viability is short lived with no dormacy. As many as 4.5 million shoots have been reported more than 10 metric tons of leaf material and more than 6 metric tons of rhizomes produced from a single hectare (Bryson & Carter, 1993).

Uses
Imperata cylindrica is used as thatch, short-term forage production, soil stabilisation and paper making (Watson & Dallwitz 1992, in Dozier *et al*. 1998). In surveys conducted in the coastal/derived savanna (Benin and Nigeria) and southern Guinea savanna (Ivory Coast) in Africa some farmers indicated that *I. cylindrica* was an important source of cheap roofing material, animal fodder and medicines. Silica bodies in the leaves contribute to its unpalatability to grazers (Coile & Shilling 1993, in Dozier *et al*. 1998). *I. cylindrica* was imported and distributed by the United States Department of Agriculture for use as a forage grass and for soil erosion control. In the United States, an ornamental variety of the grass is promoted for landscape use (Johnson & Shilling 2009). Although the ornamental varieties, known as 'Rubra,' 'Red Baron,' or 'Japanese Blood Grass' are not aggressive, plants grown from callus tissue can revert to the invasive form (Greenlee 1992, in Dozier *et al*. 1998).

Habitat Description
Imperata cylindrica occurs in a wide range of habitats, including degraded forests, grasslands, arable land, and young plantations within tropical and subtropical climates with 75 to 500 cm of annual rainfall. It can be found growing in almost all eco-types from the dryest flatwoods to the margins of permanent bodies of water. Cogon grass has invaded areas from highly xeric, upland sites to fully shaded, mesic sites. It invades sandhills, flatwoods, hardwood hammocks, sand dunes, grasslands, river margins, swamps, scrub, and wet pine savanna communities. It is known to occur from latitudes 45°N (Japan) to 45°S (New Zealand) and from sea level to over 2,000 m elevation (Langeland and Burks, 1998; Chikoye, 2003; Van Loan Meeker and Minno, 2002).
Cogon grass typically does not invade closed forests unless they are degraded for agriculture or lumbering. It is very successful in areas that are frequently burnt, overgrazed, or intensively cultivated and rapidly colonizes such disturbed sites. A high root-rhizome to shoot ratio provides *I. cylindrica* a substantial source of regeneration following cutting or burning. Its rhizomes are very resistant to heat and breakage and may penetrate soil up to 1.2 m deep, but generally they only reach the top 0.15 m in heavy clay soil and the top 0.4 m in sandy soils. Its capabilies of recovery and colonization after fire allow it to take advantage of slash and burn forestry practices (Bryson & Carter, 1993, Peet *et al*, 1999; Chikoye, 2003; Van Loan Meeker and Minno, 2002).
A fast-growing species, *I. cylindrica* thrives in areas of minimal tillage, such as orchards, lawns, and roadsides. It does not generally survive regular, deep tilling. While cogon grass is tolerant of a wide variety of soil conditions, including variations in fertility, organic matter, and moisture, it grows best in relatively acidic soils (pH 4.7). Temperature markedly affects shoot and rhizome growth, with increased growth occurring at 29º/23ºC (day/night). Temperatures of -4.5°C or lower for exposure periods of 24 hours were found to be lethal to rhizomes (Wilcut *et al*., 1988). While in general rhizomes do not exhibit extreme cold hardiness, stands of cogon grass may survive temperatures as low as –14ºC (Langeland and Burks, 1998; Van Loan Meeker and Minno, 2002).

Reproduction
The ecological resiliency of *Imperata cylindrica* and its ability to regenerate from any man-made or natural disturbance, is primarily attributed to the well-protected rhizome network. The rhizome biomass can accumulate up to 1100 g m-2 in a mature sward (Soerjani 1970, in Ramsey *et al*. 2003). *I.\r\ncylindrica* can reproduce asexually from rhizome fragments as small as 0.1 g (Ayeni & Duke 1985, in Daneshgar & Shibu 2009). It is a prolific seeder, producing as many as 3 000 seeds per plant (Holm *et al*. 1977, Daneshgar & Shibu 2009). Indications are that seed viability is extremely short-lived.

Nutrition
One of the reasons for the high invasive potential of *Imperata cylindrica* is its ability to grow on a wide range of soil types with no special nutrient requirements. It has extremely efficient nutrient uptake and forms associations with mycorrhizae which enhance nutrient uptake on unfertile soils (Collins & Jose, 2009 and references therein).\r\n\r\n
I. cylindria assimilates carbon via the C4 photosynthetic pathway (Paul & Elmore, 1984) giving it a competitive advantage over C3 plants in many conditions and contributing to its invasiveness. It is a strong competitior for water, light and nutrients because it sprouts and grows more rapidly than most crops. However, like other C4 plants it is relatively intolerant of shade.

General Impacts
For a detailed account of the environmental impacts of *Imperata cylindrica* please read: *Imperata cylindrica* (cogon grass) Impacts Information. The information in this document is summarised below.
Increases in *I. cylindrica* concern ecologists because this species displaces native plant and animal species and alters fire regimes (Lippincott 1997 2000, in Brewer & Cralle 2003). Dense swards of *I. cylindrica* create an intense competitive environment for commercially important species (Bryson and Carter 1993, Kuusipalo *et al*. 1995, Premalal *et al*. 1995, Dozier *et al*. 1998).
Displacement: Invasion of longleaf pine communities by *I. cylindrica* will likely cause significant losses of short habitat-specialists and reduce the distinctiveness of the native flora of these threatened ecosystems (Brewer 2008).
Agricultural: The interference of *I. cylindrica* with the growth of tropical crop species, both herbaceous and woody, is well documented (Brook 1989, in King & Grace 2000b).
Habitat alteration: *I. cylindrica* invasion of an emerging pine forest may be an example of a grass converting a woodland with high understory diversity into a grassland with low diversity. *I. cylindrica* presents a case where its ability to deprive competitors of N may lead to the conversion of the ecosystem (Daneshgar & Shibu 2009).
Modification of nutrient regime: The changes in nutrient cycling caused by exotic grasses can endanger young tree seedlings in a regenerating forest (Daneshgar & Shibu 2009). Because *I. cylindrica* allocates significant carbon below-ground, it is able to recover quickly after fire, which is why Lippincott (2000, in Daneshgar & Shibu 2009) suggested that frequent intense fires could convert a pine savanna into an *I. cylindrica*-dominated grassland.
Ecosystem change: A study by Holly and colleagues (2008) supports the growing consensus that invasive plant species alter normal ecological processes and highlights a possible mechanism (alteration of microbial assemblages) by which *I. cylindrica* may alter an ecosystem process (decomposition).
Competition: The results of a study by Brewer and Cralle (2003) suggest that *I. cylindrica* is a better competitor for phosphorus than are native pine-savanna plants, especially legumes. The competitive effects of this species on plant diversity may be of more immediate conservation concern relative to the effects of this species on fire regimes in longleaf pine ecosystems (Brewer 2008).
Threat to endangered species: Longleaf pine savannas of the southeastern USA contain extraordinarily species-rich plant communities and are home to numerous threatened endemic plant and animal species (Walker & Peet 1983, Bridges & Orzell 1989, Brockway & Lewis 1997, in Brewer & Cralle 2003).
Inhibits other species: The extensive rhizome network of *I. cylindrica* not only allows rapid regeneration of foliage, but also produces allelopathic root exudates that can inhibit germination and growth of other plants, including some pines (Hussain *et al*., 1994, in Ramsey *et al*. 2003).
Modification to fire regime: Lippincott (2000) found that sandhill invaded by *I. cylindrica* had significantly greater fine-fuel loads that resulted in fires that had higher maximum temperatures at greater heights. Fire-induced mortality of juvenile longleaf pine was higher for pines growing in invaded sandhill.
Other: The density of the below-ground rhizome network makes *I. cylindrica* a mechanical hindrance to root growth of native species. The rhizome tips are sharp: they may even penetrate the roots of native species, leading to damage or mortality by infection (Eussen & Soerjani 1975, in Daneshgar *et al*. 2008).

Management Info
For more detailed information on management of *Imperata cylindrica* (cogon grass) please read: *Imperata cylindrica* (cogon grass) Management Information. The information in this document is summarised below.\r\n
Preventative measures: A Risk assessment of *Imperata cylindrica* for the Pacific region was prepared by Pacific Island Ecosystems at Risk (PIER) using the Australian risk assessment system (Pheloung 1995). The result is a score of 19 and a recommendation of: reject the plant for import (Australia) or species likely to be a pest (Pacific).\r\n
Results from a study by King and Grace (2000a) suggest that efforts to prevent *I. cylindrica* invasion should focus on preventing *I. cylindrica* propagules (seeds and rhizomes) from reaching sensitive communities. \r\n
Chemical control: Ramsey and colleagues (2003) report that herbicides may temporarily control *I. cylindrica* foliage up to 12 to 24 months (Willard *et al*. 1996 1997, in Ramsey *et al*. 2003). Without the re-establishment of desirable species, viable rhizomes will eventually allow cogon grass to re-infest the area (Shilling *et al*. 1995, in Ramsey *et al*. 2003). Controlling rhizomes with herbicides is a difficult task. A combination of glyphosate applied at 2.8 kg ai ha_1, followed by fertilization and reseeding with Bermuda grass (*Cynodou doctylon*) showed that rhizome reserves were sufficient for cogon grass to recover from both treatments (Johnson 1999, in Ramsey *et al*. 2003). In another study, cogon grass recovered after imazapyr was applied at 2.24 kg ai ha_1 in a 2-year-old loblolly pine plantation (Miller 2000, in Ramsey *et al*. 2003). Even these relatively high herbicide application rates there is still a remnant population of viable rhizomes that has the potential to re-infest the treated site. Further research is needed to integrate herbicide usage, which provides short-term control and a ‘‘window for re-establishment’’, with bio-control using desirable, yet highly productive plant species for long-term control (Ramsey *et al*. 2003). \r\n
Recommendations (Demers *et al*. 2008) to control cogon grass in the southeastern USA are to treat infestations in autumn (May through to October) with glyphosate and/or imazapyr herbicides. These recommendations are consistent with a wide range of studies conducted (Miller 2003, Faircloth *et al*. 2005, in Demers *et al*. 2008). Fluazifop is also an effective option (Demers *et al*. 2008). Guidelines for herbicide control are detailed by Demers and colleagues (2008).\r\n
Integrated management : Shade, repeated herbicide application, and mechanical control have all been used to control *I. cylindrica* (Macdicken *et al*. 1997, Terry *et al*. 1997, in Brewer & Cralle 2003). An integrated approach that combines burning, tillage (mechanical control) and chemical applications provide the best approach for cogon grass management (MacDonald *et al*. 2009). Cogon grass should first be burned or mowed, preferably in summer, to remove excess thatch and older leaves. Subsequent regrowth (of one to four months) will reduce rhizome biomass and allow herbicides to target actively growing leaves which maximises herbicide effectiveness. Once control of cogon grass has been achieved planting of desirable vegetation should occur as quickly as possible to prevent reinvasion (MacDonald *et al*. 2009).\r\n
Other: Brewer and Cralle (2003) found that short-lived, high-level pulses of phosphorus addition reduce the competitive advantage *I. cylindrica* has over native plants without negatively affecting native plant diversity. Additional work is needed, however, to elucidate the mechanism of inhibition of *I. cylindrica* by P addition (Brewer & Cralle 2003).

Pathway
A special concern is that several nurseries are now selling a cultivar of cogongrass. 'Japanese Blood Grass' or 'Red Baron', in the United States (Bryson & Carter 1993). If additional populations are found outside of the existing range, please contact the U.S. Department of Animal and Plant Health Inspection Service or the appropriate state agency.Cattle ranchers wanting to improve forage spread the grass throughout Florida (Dickens 1976, in Dozier *et al*. 1998). It was intentionally introduced from the Philippines into Mississippi as forage (Demers *et al*. 2008).*Imperarta cylindrica* was accidentally introduced as packing material from Japan in Mobile, Alabama in 1911 (Demers *et al*. 2008).Moved with heavy equipment from job to job.

Principal source:

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ALIEN RANGE

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[1] VENEZUELA
[1] ZAMBIA

Red List assessed species 2: VU = 1; NT = 1;

Fallicambarus gordoni **NT**
Gopherus polyphemus **VU**

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