Cortaderia jubata (Lemoine) Stapf

Other Latin names : Gynerium jubatum (Lem.); Cortaderia quila Stapf.; Cortaderia rudiuscula Stapf.; Gynerium quila Nees

Common name(s) : Andean pampas grass

Photo by Philip A. Thomas (used with permission)

Other illustration sources: The Haleakala National Park Field Station of the Biological Resources Division of the U.S.G.S. has a number of slides from various locations on Maui of both planted (cultivated) and naturalized *Cortaderia jubata*.

Cortaderia jubata is an erect perennial, tussock-forming grass, up to three meters tall (Cowan 1976), with narrow (1 cm wide), deep green, attenuate leaves with serrulate margins. Leaf blades are pubescent toward the base of the abaxial surface (versus glabrous in *C*. *selloana*). Inflorescences consist of several large (30-70 cm long), nodding plumose panicles which are pink to deep violet when immature (versus light violet to silvery white in *C*. *selloana*) and creamy white when mature. The ratio of the height of the flowering stalks to the vegetative leaf height for *C. jubata* is noticeably more than 1:1 (up to 2 to 4 times higher), versus a ratio of only 1:1 in the other commonly planted *Cortaderia* species, *C*. *selloana*. Spikelets of *C. jubata* consist of 3 to 5 pistillate florets, with hairy, acuminate, shortly-awned lemmas, stigmas not exserted, and with the caryopses easily separating from the rachilla (Costas-Lippmann 1976). *C. jubata* possesses a breeding system termed agamospermous apomixis which allows plants to asexually produce seeds, i.e. without fertilization, despite the fact that all plants are female (Costas-Lippmann 1979). This process contrasts with the breeding system of *C*. *selloana*, in which plants are either pistillate or hermaphroditic, and are therefore gynodioecious and functionally dioecious (Connor 1965; 1973), or simply dioecious (Costas-Lippmann 1979). Because of its method of reproduction, an isolated plant of *C. jubata* is capable of producing viable, albeit genetically identical, seeds whereas *C*. *selloana* must have hermaphroditic (predominantly staminate) and pistillate plants in close proximity to set seeds (Baker 1986).

Federal Noxious Weed?	Y	Hawaii State Noxious Weed?	Y
Federal Seed Act?	?	Hawaii State Seed Act?	Y

Native to where : The distribution of *Cortaderia jubata* in its native range includes Andes of northern Argentina, Bolivia, Peru and Ecuador from 2800 to 3400 m above sea level (Connor and Edgar 1974; Costas-Lippmann 1977).

Native climate : The upper elevation of *Cortaderia jubata* in its native range is (2800 to 3400 m) in the Andes mountains.

Costas-Lippmann (1976) found that, in California, *Cortaderia jubata* is climatically restricted to coastal zone with summer moisture due to aspects of its germination, growth and flowering behavior and its sensitivity to frost. Plants on Maui have been recorded in an elevational range of approximately 2000 feet to just under 7000 feet from areas with as little as 500 mm of rainfall a year to extremely wet localities with over 5000 mm a year (Giambelluca *et al*. 1986).

Biology and ecology : *Cortaderia jubata* reproduces through the process of agamospermous apomixis. All plants are female and are able to produce viable, genetically identical seed without pollination (Costas-Lippmann 1979). The relatively minor amount of isozyme variability found by Costas-Lippmann and Baker (1980) in *Cortaderia* plants collected from discrete populations in disjunct geographic locales can be attributed to this method of reproduction.

In California, Costas-Lippmann (1976) found that *Cortaderia jubata* usually flowered once, or occasionally twice if adequate moisture existed. This flowering period began as early as July and continued until October, with the lengths of the flowering periods of different populations varying from two to seven months. In Hawaii, *Cortaderia jubata* flowers from early August to late October, versus mid-September to mid-November for *C*. *selloana*. If young plants reach a suitable size, they are capable of flowering after one to two years (Cowan 1976), and having

flowered once, will continue to produce flowers in each subsequent year (Costas-Lippmann 1976). In Hawaii, *C. jubata* plants have been observed to flower after two to four years (Loope and Medeiros 1991).

Seeds of *C. jubata* are primarily wind-dispersed (Connor 1973) and, with adequate moisture levels, light exposure and temperatures around 10 C, can be established on a number of different soil substrates, including shale, quartz diorite, sand, clay, and serpentine rock (Costas-Lippmann 1976). These conditions can often be met on the bare soil areas of disturbed or human-modified habitats such as road cuts, eroded banks, cliffs and cut-over areas. In Argentina and California, Costas-Lippmann (1976) found that both *C. jubata* and *C. selloana* do not tend to become successfully established in grassland vegetation, or if already established in such habitat, do not spread significantly.

Research in California indicates that seeds of *Cortaderia jubata* do not have a significant dormant period there, with the highest germination rates occurring after two to ten days. Costas-Lippmann (1976) achieved only 0-4% germination of seeds collected in a period of four to 18 months after seed set. In recent studies in California, only 2% of seeds germinated after a period of five months (J. DiTomaso pers. comm.) . The lack of longevity in the seeds, along with their small size, favor the rapid establishment of *C. jubata* on bare soil, where the seedlings do not have to compete with other grasses (Baker 1974).

Once established, *Cortaderia jubata* competes very successfully with other vegetation, and can produce thousands to millions of seeds per year during its 10 to 15 year life span (Cowan 1976; Pleasants and Whitehead 1977). With adequate moisture, it can thrive in full sunshine and tolerate drought due to its extensive, deep root system (Potter 1970).

Value to humans : Horticultural

Cortaderia jubata, along with the morphologically similar C. selloana, have been widely planted as ornamentals (Connor 1973). The more attractive C. selloana was first introduced into cultivation in Ireland and France, and later to California sometime before 1850 (Costas-Lippmann 1976); in 1874, horticulturists discovered that the plant is functionally dioecious and that flowering plumes from female plants are more beautiful than male plants (Kerbavaz 1985). Thereafter, female plants were grown commercially for decorative plumes in Santa Barbara County and shipped worldwide until about 1895. It was also planted by the Soil Conservation Service for erosion control (Costas-Lippmann 1976). At some time in the twentieth century, C. jubata was brought to California for landscaping and for many of the same purposes as C. selloana, but was not recognized as having been naturalized until the 1950s (Munz 1958).

The morphologically similar Cortaderia selloana has been planted ornamentally in Hawaii (Neal 1965), and in other parts of the United States, at least in Kansas (Gates 1936) and South Carolina (Blomquist 1948). Cortaderia has also been cultivated in Central and Southern Europe (Costas-Lippmann 1976), in South Africa for erosion control (James 1966) and New Zealand (Costas-Lippmann 1976). Graf (1992) recommends drying the plumes for indoor decoration.

In addition to the ornamental value of Cortaderia, it has also been planted in both California and New Zealand as a cattle forage (Lemon and Taylor 1949; Pleasants and Whitehead 1977; Anonymous 1985; Anonymous 1987).

Problems : Andean pampas grass, *Cortaderia jubata*, widely planted as an ornamental along with the morphologically similar *C. selloana*, has proven to be an aggressive invader in California (Kerbavaz 1985; Mooney *et al*. 1986), New Zealand (Connor 1973; Anonymous 1985) and South Africa (Robinson 1984). Through its rapid growth, production of large quantities of vegetative biomass, competition with native flora for light, water and nutrients, prolific seed production and long distance wind-aided dispersal capability, *C. jubata* threatens the biological integrity of a number of habitats in its introduced ranges from coastal fog zones, to inland sandhills, from low elevations to higher altitude mountainous regions with both warm and cool

temperature, and from naturally to artificially disturbed bare soil habitats.

C. jubata has, within the past nine years, demonstrated its ability to escape from cultivation and become established in a wide range of elevations and habitats on both East and West Maui, in dry areas with approximately 500 mm of rainfall annually, to extremely wet rainforest with up to 5000 mm of rainfall annually (Giambelluca *et al*. 1986). It now has been documented occurring just below the 2000 foot level on the western slopes of East Maui to just under 7000 feet within the boundaries of Haleakala National Park, and in varying elevations in between. To date, none of the naturalized populations occupy very large spatial areas, but, because of its record of invasiveness from California and New Zealand, and its recent discovery in rainforest habitats in both West and East Maui far removed from the nearest known reproductive populations, *C. jubata* could just be starting to exhibit its potential capability to invade and modify both native and disturbed ecosystems throughout the island.

A population of over 100 *C. jubata* plants on a small parcel of property at approximately 3160 feet elevation in Kula has tenaciously regrown and persisted despite repeated mechanical and one chemical control effort directed against it since 1992. The site, a former residential property landscaped with a number of ornamental plants, was becoming impassable in spots due to the extremely large, up to two meter wide, interconnected grass tussocks that formed barriers with the razor sharp leaves. Mechanical and chemical control measure initiated in 1992 knocked the population back considerably, but a lack of time and manpower has allowed the population to recover somewhat and flower once again. Without more control efforts against this population, it will undoubtedly, and within a few years, reach a level of infestation equal to the original pre-control population.

In late October 1989, a large individual of *C. jubata* with three to four meter flowering stalks was sighted from a helicopter by Haleakala National Park personnel just inside the park boundary at about 6600 feet elevation on the wall of Haleakala crater in Ko`olau Gap. Flowering stalks were destroyed by park personnel, but the plant was too large and firmly rooted to be removed mechanically, necessitating treatment with the herbicide Roundup. At the time, the plant appeared large enough to have flowered in at least one previous year. Since that time, several seedlings have been recorded in the vicinity of the parent plant, and in late 1996, one small seedling was discovered and uprooted on the parks Halemau`u trail (Art Medeiros, pers. comm.) Due to the large amount of barren area and cinder within Haleakala National Park, *C. jubata* has a much larger potential range to exploit and will continue to pose a threat to the natural areas in and around the park as long as large flowering individuals persist on East Maui.

In addition to the plants found within Haleakala National Park, seedlings and the occasional large, flowering individual continue to appear along the road leading up to the park and within the gulches of Haleakala Ranch. It is unknown whether these plants are becoming established from seeds blown up the mountain from the large number of ornamentally planted and naturalized *C. jubata* plants located in Kula below, or are the progeny of undiscovered or unreported flowering plants in the closer vicinity of Haleakala Ranch.

Within the past two years, at least three disjunct populations of *C. jubata*, two on West Maui and one or more on East Maui, have been discovered in extremely wet and isolated natural areas with average annual rainfalls of up to 5000 mm. The East Maui population, first discovered from a helicopter by Robert Hobdy in November 1995, is composed of several flowering individuals and occupies an area of approximately 0.1 acres. One West Maui population, discovered by Hank Oppenheimer and Scott Meidell of Maui Pineapple Company in the fall of 1995, is located at approximately 3200 feet elevation within the Kahakuloa NARS growing in a very wet area around the margins of a bog. Based on the number and size of the flowering individuals, Hank estimates the population to be several years old. The other West Maui population, growing within Iao Valley, was recently discovered by a pilot for Pacific Helicopter Tours Inc. and needs to be surveyed more thoroughly to determine the size and extents of the problem. These three populations of *C. jubata* represent the first known naturalized rainforest infestations of this species in Hawaii, and therefore, in the world. The implications of these populations are frightening as the capability of pampas grass to invade

remote wet forest habitats, possibly aided by ungulate-induced or other disturbances, opens up a whole new realm of potential invasion sites for undiscovered or future infestations.

Control strategies : VARIOUS (SEE NOTES)

California
1985-present: Herbicidal control efforts and monitoring of *Cortaderia jubata* in the Nature Conservancy's Ring Mountain Preserve, Tiburon, California (Peterson 1988).

1985-present: Mechanical control efforts using ropes/chains and vehicles to uproot tussocks of *C. jubata* in the Camp Pendleton Marine Corps Base, California (Peterson 1988).

1987-present: Manual and herbicidal control efforts of *Cortaderia jubata* between the Gualala River and Point Arena areas by the Dorothy King Young (DKY) Chapter of the California Native Plant Society (Madison 1993; 1994).

1988: Mechanical removal of *C. jubata* using heavy equipment in the Golden Gate National Recreation Area (Nelson 1991).

1990-present: Manual control efforts of *C. jubata* in the California state parks of the Santa Cruz mountains by the Wildlands Restoration Program (Moore 1994).

Ongoing: Manual and chemical control efforts of *C. jubata* in California state parks (Gray 1992).

New Zealand
Ongoing: Mechanical and chemical control recommendations for *C. jubata* invading forest plantations of New Zealand (Anonymous 1985).

Ongoing: Replacing pampas grass with native species in New Zealand (Anonymous 1987).

Tasmania
Ongoing: Mechanical and herbicidal control of pampas grass in natural and agricultural settings.

Hawaii
1992-present: Mechanical and herbicidal control efforts of *C. jubata* in upcountry Maui and Haleakala National Park by National Park Service resource management personnel, Biological Resources Division-USGS personnel and Sierra Club volunteers.

In all of the control strategies mentioned, a combination of mechanical and herbicidal methods was utilized to selectively eradicate smaller populations of *C. jubata* or contain its spread from larger infestations. In most instances, eradication, if possible, can only be achieved on a small scale basis as the sizes or extents of many infestations makes complete control impractical if not impossible. In brief, seedlings and smaller plants can either be hand-pulled or dug out, making sure that the entire root crown is removed to prevent resprouting. Use of heavier equipment and herbicides on larger populations, when available, makes control strategies more efficient and allows for coverage of greater areas over time. The following provides more details on some of the techniques employed and discusses the relative effectiveness of the individual methods.

Mechanical Methods

Due to the serrated edges of *Cortaderia*s leaves, it is important that workers protect themselves from cuts to the skin and hands by wearing long pants, long-sleeved shirts and leather gloves before attempting to control any pampas grass infestations.

When feasible, smaller plants and seedlings can be hand-pulled, provided that gloves are worn and that the entire root crown is removed. Resprouting will generally not occur in this

case, but the small plants roots should not be allowed to contact any soil to further guard against regrowth. This can usually be accomplished by either hanging the plant from adjacent vegetation, such as a tree, which causes the roots to dry out, or by bagging the individual and removing it from the site.

Larger plants can also be removed mechanically, when practical, but even on a small scale this is often quite labor intensive. Due to the large size of some individuals, it is often necessary to first remove some of the drooping foliage surrounding the plant before the root crown can be reached. Removing this foliage can be accomplished by utilizing a machete, a pulaski (both fairly labor intensive), or a chain saw or heavy duty, gas-powered brushed cutter, such as the STIHL FS 81, with a saw blade. Once the root crown is reached, a pulaski can then be employed by alternately cutting into the root crown with the ax edge and chopping underneath the crown with the adze edge to pry the root stock from the ground (Moore 1994). A shovel can also be used but is generally not as versatile as the pulaski. Once again, it is important that the entire root crown be removed to prevent resprouting. After removal, attempt to prevent the root mass from contacting the soil to avoid resprouting. This can be most easily accomplished by turning the plant upside down and exposing the roots to the desiccating effects of the sun and wind. In certain instances, it is often desirable to cut and bag the inflorescences to decrease the chances of further seedling establishment, but care should be taken in the disposal of the seeds to avoid establishment of new populations at the disposal site. Madison (1994) found that cut, but immature flowering stalks of pampas grass, when not bagged, contained enough reserve energy to produce some mature seeds.

In large scale infestations, other mechanical methods have involved the use of heavy equipment, such as bulldozers or back-hoes to remove larger plants (Nelson *et al*. 1991). Dawn Lawson, of the Camp Pendleton Marine Corps base, has achieved success by tying a rope or chain to larger individuals and uprooting them with a vehicle (Peterson 1988).

Fire has also been suggested as a method to eliminate foliage for the later mechanical removal or chemical treatment of the plant. According to George Gray (1992), Associate Resource Ecologist for the California Department of Parks and Recreation, fire will not kill pampas grass, but makes it unhappy. Madison (1994), however, found that the high silica content in the leaves of pampas grass acted as a fire retardant and was not very effective in eliminating the foliage.

As an alternative to herbicide use, BRD-USGS employees are experimenting with the use of heavy duty plastic tarps to kill previously cut plants and to prevent the subsequent establishment of seedlings. If successful, however, this method would only be useful on a small scale basis, and only when potentially more practical alternatives, such as herbicide use, are not desirable.

Chemical Control Methods

For a comprehensive source of information concerning the specific uses, applications, and restrictions of particular herbicides, land managers should consult the Herbicide Handbook (Ahrens 1994).

Roundup and Rodeo, with the active ingredient glyphosate, have been the most widely, and successfully used herbicides in the control of pampas grass seedlings and larger individuals. To increase their effectiveness, it is recommended that these herbicides be applied to actively growing plants, early in the morning. Herbicides can be sprayed directly on the foliage of large plants, but this can prove costly due to the larger volume of chemicals that must be used. In addition, more green foliage on the plant may increase the chances that some may be missed, thereby reducing the effectiveness of the treatment, unless copious amounts of herbicide are used. To remedy this, mechanical removal of the foliage using one of the methods described can be combined with a regimen of herbicide application. However, it is important that, following cutting or burning of the plant, the pampas grass be allowed to resprout and actively grow before being treated with the herbicide. Depending on the climate of the area, pampas grass will begin to resprout within a few weeks to a month after mechanical control efforts.

Gray (1992) suggests spraying plants with a 1-1/2 to 2% solution of Roundup herbicide plus a 1/2% V/V of a nonionic surfactant, or a 1-1/2% solution of Rodeo herbicide plus 1/2% V/V of a nonionic surfactant so that the plant is wet, but not to the point of runoff. After six to eight weeks, the plants should be browning and can be cut down, removed mechanically, or left to decompose naturally, but retreatments with herbicide may be necessary to control resprouts from the roots, shoots that may have been missed, or newly established seedlings.

Madison (1993) describes a method of using 13 liter capacity SOLO (tm) 425 backpack sprayers (3.43 gallons), and a combination of a 8 2/3 ounces of glyphosate (a 2% solution), 1/2 ounce of Triton (r) AG 98, a non-ionic surfactant, and 2 ounces of Blazon (r) , an agricultural marker dye, to treat uncut plants. He suggests that plants should not be cut as there will be more surface area for the herbicide to penetrate and has achieved a 90% kill rate on plants treated in this manner. The biggest obstacle to control of *C. jubata* in the area between the Gualala River and Point Arena was not any lack of effectiveness in the technique described, but rather the continuous and prolific seed production by large reproductive plants outside the control area and in other inaccessible localities. This factor therefore guarantees, for the foreseeable future, an unlimited source of seeds for the recruitment of new seedlings, and necessitates ongoing efforts to maintain a pampas grass free environment in the designated control area. After five years with the DKY Chapter of the California Native Plant Society, Madison (1993) reports removing approximately 95% of the pampas grass in the selected area.

As another effective method of control, Cowan (1976) suggests soaking the crown of large pampas grass tussocks with diesel oil after mowing them down to ground level. However, the negative impacts of residual oil in the environment will have to be weighed against the benefits of localized pampas grass control.

The New Zealand Forest Service (Anonymous 1985) has also published a table of chemical control options to eradicate or control varying degrees of a pampas grass infestation in forest plantations as follows:

CURRENT CHEMICAL CONTROL OPTIONS FOR PAMPAS
New Zealand Forest Service (Anonymous 1985)

Degree of infestation	Before or after planting	Method of application	Size of plants	Recommended treatments
Light*	Before	Knapsack pump	All (mixed sizes)	B,G,C,D
Light*	Before	Brushgun-and-hose**	All (mixed sizes)	B,G,C,D
Light*	Before	Helicopter***	Large (only)	B,G,C,D
Light*	After	Weedwiper	Small (<50cm tall)	A
Light*	After	Knapsack pump	Small (<50cm tall)	B,F
Light*	After	Spotgun	Medium****	E
Light*	After	Knapsack pump	Medium****	E
Light*	After	Knapsack pump	Large	B,G
Medium to heavy	Before	Broadcast aerial	All (mixed sizes)	D, I
Medium to heavy	After	Weedwiper	Small*****	A
Medium to heavy	After	Knapsack pump	Small*****	F
Medium to heavy	After	Knapsack pump	Medium	B,G
Medium to heavy	After	Knapsack pump	Large******	B,G
Medium to heavy	After	Broadcast aerial	All (mixed sizes)	I

*widely-scattered individuals
**roadside cleanup
***spot treatment of inaccessible individuals
****up to 20cm basal diameter
*****in planting lines
******off-line clumps

Treatments

A. Roundup 1L + water 2L, wipe both ways.
B. Roundup 1L + water 50L, barely wet foliage
C. Roundup 1L + water, 100L, spray to wet but not to run off.
D. Roundup 12L + water 188L, apply at 200L/hectare.
E.Velpar-90 25 g/liter of water, apply to foliage and soil at 12 ml/clump (0.5 m2).
F. Velpar-90 25 g/liter of water, apply to foliage and soil at 16 ml/clump (=4 kg/hectare).
G. Velpar-90 25 g/liter of water, apply to foliage and soil at 24 ml/clump (=6 kg/hectare).
H. Velpar-90 6 kg + water 300 liters, apply at 150 ml/5 m2 (=300 liters/hectare).

I. Velpar-90 6 kg + water 300 liters, apply at 300 liters/hectare.
J. Velpar-90 6 kg + water 2000 liters, apply to foliage and soil at 200 ml/m2.

It should be reemphasized that these recommendations are for forestry plantations in New Zealand only, and should be utilized as suggestions, and not rules, for control of pampas grass infestations in Hawaii or the continental United States.

In Tasmania, the Tamar Valley Weed Strategy Working Group has also recommended using glyphosate and hexazinone (Velpar LR) for the control of pampas grass, and lists a number of other strategies applicable to control of this weed relating to specific times of the year.

In Maui, herbicidal control of pampas grass has been performed on a limited basis using a 2% Roundup solution as described by Madison (1993) and Gray (1992).

Local history :

Neal (1965) stated that pampas grass, *Cortaderia selloana*, is seen in gardens here and there in Hawaii. St. john (1973) listed *Cortaderia selloana*, noting that it occurs only in cultivation and was first introduced to Hawaii in 1925. *Cortaderia jubata* was not included in the recent Manual of the Flowering Plants of the Hawaiian Islands (Wagner *et al*. 1990), and until 1990, there has been no record of *C. jubata* occurring or being naturalized in the Hawaiian Islands. For several years, beginning in the late 1980s. employees of the Haleakala National Park Research Division (now the Biological Resources Division of the U.S. Geological Survey) had been aware of the large stand of flowering *Cortaderia* along Haleakala Highway in upper Kula, Maui at approximately 3160 feet elevation, and of several seedlings further up the road at approximately 4900 to 5900 feet elevation. For the first time in October 1989, several of those smaller plants developed flowering stalks, which were subsequently removed. At that time, Haleakala researchers reviewed the literature of *Cortaderia* in California and became aware that two distinctive morphological types of the genus occurred in upcountry East Maui, which seemed to correspond to the two taxa present in California, the non-invasive *C*. *selloana* and the invasive *C. jubata*. Following this discovery, several voucher specimens of *Cortaderia* species, including one collected from upper Kula on September 26, 1990, were collected from upcountry Maui and sent off to be identified by Dr. Paul M. Peterson, Associate Curator of Grasses at the Smithsonian Institution. On July 26, 1991, Dr. Peterson verified that the collected material **(Collection #?)** was indeed *Cortaderia jubata*, making this the first confirmed record of this species in the Hawaiian Islands. Since that time, several additional individuals and populations of plants, some naturalized but many also landscaped throughout upcountry Maui, were identified as *Cortaderia jubata*, although several also proved to be the relatively non-invasive *C*. *selloana* (see maps).

Invasive attributes :

Costas-Lippmann (1976) lists a number of attributes contributing to the weediness of *C. jubata* including similar germination requirements for all individuals, even those of different origins, continuous patterns of germination, the ability to germinate in a diverse range of soil conditions, improved germination with ample light, possibly contributing to its establishment on barren soil which in turn could help to minimize competition with other plants, a brief vegetative phase of as short as eight months between germination and flowering, the capability to maintain extended flowering periods of up to seven months and even the potential to flower more than once during a flowering season. Other factors, such as *C. jubata*'s ability to flower in each subsequent year after the initial flowering period, its large ratio of reproductive tissue to vegetative tissue, the early production of aposporous embryo sacs, the maturation of 100% of ovules into mature seeds, and even its ability to vegetatively reproduce likely contribute to the aggressiveness and success of this noxious weed.

Invaded ecosystem attribs :

Cortaderia jubata is somewhat restricted to coastal areas in California as a result of its limited cold tolerance and need for summer moisture (Baker 1986). In Hawaii, it would most likely thrive in mesic to wet, middle elevation sites not occupied by closed vegetation. The recent discoveries of populations on the exposed, yet moist, ridgetops and open sites of Koolau Gap, Iao Valley, and the Kahakuloa NARS seem to bear testimony to this prediction. To date, it is still not known whether *C. jubata* can withstand the hard freezes commonly encountered during the winter months above 7000 feet on East Maui, yet the occasional discovery of seedlings and larger plants near this upper limit appear to indicate that it can and will tolerate such climatic conditions. Should this prove true, *C. jubata* could become a major invader in the barren and

relatively open confines of Haleakala's montane and subalpine regions.

Misc. notes :

Synonyms: *Gynerium jubatum* (Lem.); *Cortaderia quila* Stapf.; *Cortaderia rudiuscula* Stapf.; *Gynerium quila* Nees

Connor and Edgar (1974) describe 23 additional species in the genus *Cortaderia*, including four native to New Zealand, one native to New Guinea, and 18 more native to South America.

Cortaderia jubata has not been federally listed as a Noxious Weed as of August 11, 1995. The Federal Seed Act status of *Cortaderia jubata* is unknown, but it is unlikely that seeds of *Cortaderia jubata* have been listed as restricted by the Federal Seed Act. *Cortaderia jubata* has been locally listed as a Noxious Weed for eradication or control purposes by the Hawaii Department of Agriculture, as of June 18, 1992. *Cortaderia jubata*'s seed has been locally listed as a prohibited noxious weed seed by the Hawaii Department of Agriculture as of August 22, 1992.

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Lists and describes control strategies for pampas grass on their Web site:
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http://www2.hawaii.edu/~halesci/hnis/index.html#CorJub (species info & control methods summary)
http://www2.hawaii.edu/~halesci/AlienSpeciesInHawaii/InfoIndexPlants.htm#CorJub
http://www2.hawaii.edu/~halesci/AlienSpeciesInHawaii/AlienPlantDistributionMapsBySpecies.htm#CorJub
http://www.tnc.org/science/src/weeds/cortjuba.htm
http://www.tassie.net.au./TVWS.Weeds/pampas.html
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