Arundo donax L.

Native : Asia and Africa

Family : Poaceae

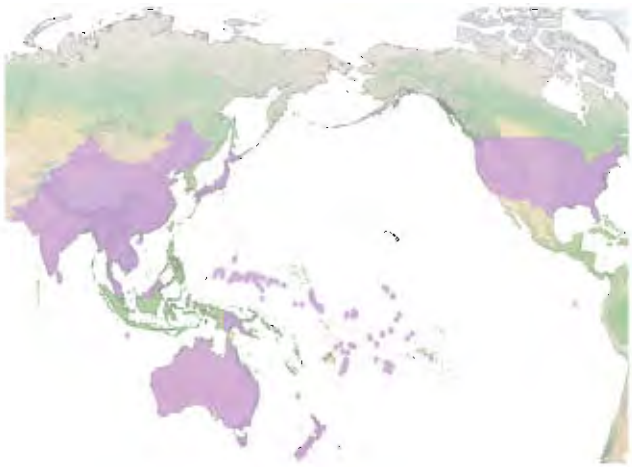
Synonyms : *Aira bengalensis* (Retz.) J.F. Gmel.
Amphidonax bengalensis (Retz.) Nees ex Steud.
Arundo versicolor Mill.

Common names : Arundo grass, bamboo reed, cow cane, donax cane, giant reed cane

Arundo donax is among the top 100 of the world's worst invaders. Once established, it forms dense, homogenous stands at the expense of native plant species, altering the habitat of the local wildlife. It is also a fire and flood hazard. Ancient Egyptians wrapped their dead in the leaves of *Arundo* grass. The canes which contain silica, perhaps the reason for their durability, have been used to make fishing rods, walking sticks and paper. The plant rarely produces seeds and sexual reproduction is unknown. Asexual reproduction is through lateral extension and flow dislodgement of rhizomes.

Description : Robust, perennial, shrubby grass with thick knotty rhizome; culms very stout, erect, 2 - 6 m tall, 2- 3 cm in diameter, unbranched or with bamboo-like clusters of slender branches from nodes. Leaf sheath longer than internodes, usually glabrous except long pilose at the mouth; blade 30 - 60 × 2 - 5 cm, margins scabrous, tapering to a slender filiform apex, ligule 0.7 - 1.5 mm. Inflorescence paniculate, 30 - 60 cm, dense, usually purplish; branches 10 - 25 cm, ascending; spikelets densely clustered, 10-15 mm, florets 2 - 5, rachilla glabrous; glumes hyaline and brownish or purplish, 11 - 13 mm long, palea pale-whitish, membranous, 5 - 10 mm long. Caryopsis elongate, 1- 1.5 mm long.

Habitat : The grass easily invades riparian zones of low-gradient rivers, wetlands, coastal marshlands and along ditches. Once established, it can form huge clones, sometimes covering hundreds of hectares. It is common in agricultural areas, coastlands, deserts, natural forests, planted forests, grasslands, riparian zones, ruderal/disturbed areas, scrub/shrublands, roadsides and urban areas and in moist areas such as along ditches and riverbanks. The plant is highly inflammable and resprouts quickly after burning. Fires help transform communities of native plants into solid stands of *A. donax*.



Distribution : Australia, Bangladesh, Bhutan, Cambodia, China, Christmas Island, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, India, Japan, Kiribati, Lao PDR, Malaysia, Myanmar, Nauru, Nepal, New Caledonia, New Zealand, Pakistan, Palau, Papua New Guinea, Norfolk Island, Samoa, Singapore, Sri Lanka, Thailand, Tonga, United States, Viet Nam, Wallis and Futuna Islands.

Threat and damage : *A. donax* displaces native riparian vegetation and provides poor habitat for terrestrial insects and wildlife. It traps sediments and narrows flood channels, leading to erosion and overflowing. It may reduce water availability through high evapotranspiration. The long, fibrous, interconnecting root mats of the plant form a framework for debris accumulation which blocks stream flow and causes damage to bridges, culverts and other structures. It ignites easily and can create intense fires. *A. donax* can float miles downstream where root and stem fragments may take root and initiate new infestations. Due to rapid growth rate and vegetative reproduction, it can quickly invade new areas and form pure stands outcompeting and suppressing native vegetation.

Uses : Grown as an ornamental due its attractive appearance. The rhizome can be dried and ground into a powder to make bread, usually in conjunction with cereal flours. It can also be roasted or boiled. The root is diaphoretic, diuretic and emollient. A paste of the root can be applied to the forehead to treat headaches. Alkaloids isolated from this plant have been experimentally shown to raise blood pressure and contract the intestine and uterus. The rhizome or rootstock is used in the treatment of dropsy. Boiled in wine with honey, the root or rhizome has been used for treating cancer. *Arundo* grass is an ideal bio-fuel that produces methanol as a by-product while manufacturing cellulose.

Management : Mowing may be somewhat effective, but if small fragments of the root are left in the soil, these may lead to re-establishment. Small populations can be controlled through physical removal of rhizomes. Good control of large populations usually requires foliar or cut-stump application of herbicides like glyphosate. Vertebrate grazers such as cattle and sheep may also be useful in managing the weed. Angora goats have been partially successful in reducing the population of the plant. Several insects and pathogens are under consideration as biocontrol agents.

Asparagus densiflorus (Kunth) Jessop

Native : South Africa

Family : Liliaceae

Synonyms : *Asparagopsis densiflora* Kunth
Asparagus aethiopicus L.
A. sprengeri Regel

Common names : Asparagus fern, foxtail fern, regal fern, smilax, sprengeri fern

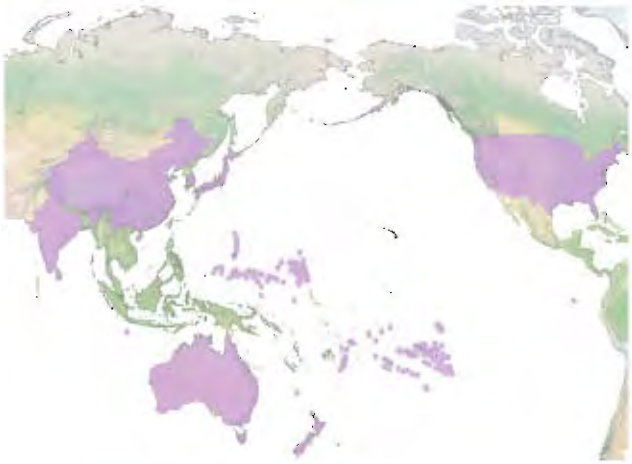
Asparagus is both drought and salt-tolerant and can invade a variety of habitats. It is used as a garden plant or for cut foliage. Though known as asparagus fern, the plant is not a true fern and reproduces by seed. It has an extensive root system with fairly large tubers, which are a source of food during long periods of drought. Seed dispersal is mainly through fruit-eating birds. Seeds may germinate through out the year provided moisture is available, but there is a major flush in spring and a smaller one in autumn. Growth rate is slow until the root system is well established and then it increases rapidly.

Description : Climbing subshrubs, perennial, branches distinctly striate-ridged. Cladodes in fascicles of 1 - 5, linear, 1 - 3 x 0.15 - 0.25 cm, flat. Leaf spur spinescent, spine slightly hooked, 3 -5 mm, sharp on main stems, short and blunt on branches. Inflorescences develop after cladodes, solitary or paired, axillary, each a many-flowered raceme or panicle, 2 - 2.5 cm. Flowers small, white or pinkish, fragrant. Fruit a berry, red, 8 - 10 mm in diameter, 1 or 2 -seeded. Tubers with white flesh, 25 - 40 x 8 - 20 mm. Rhizomes white when young, brown with age, 5 mm thick. Fibrous roots anchor rhizome and tubers.

Habitat : Invades roadsides, dry to moist forests, planted forests and coastlands. In Australia, it has invaded rain forests, frontal dunes, sclerophyll forests and coastal heathland. It is also a persistent weed of urban bushland. The plant is shade-tolerant and grows best in shaded areas where other vegetation has been removed.

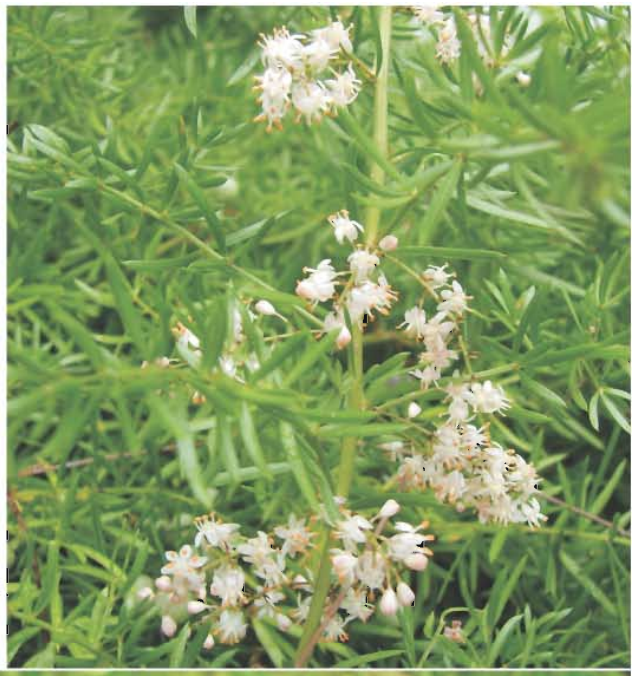
Threat and damage : Has the potential to smother the forest understorey to a height of 2.5-5 metres. It can also smother ground cover and prevent regeneration of canopy species.

Uses : Used as a ground cover ornamental. Tubers are used to cure stomach ache in children. The leaves when mashed have the property of healing wounds.



Distribution : Australia, China, Christmas Island, Cook Islands, Fiji, French Polynesia, Guam, India, Japan, Marshall Islands, Nauru, New Caledonia, New Zealand, Niue, Norfolk Island, Northern Mariana Islands, Palau, Republic of Korea, Samoa, Singapore, Tonga, United States.

Management : Control should aim at removing the crowns of plants and all fruits. Seedlings are hand-pulled. A follow-up programme is necessary to control regrowth. Regrowth and seedlings can be effectively controlled with the herbicide dicamba. The 'crowning' technique is often practised to control it where the aboveground part of the plant is cut off from the root system and hung up off the ground. Foliar sprays with glyphosate or metsulfuron methyl are effective. Tubers can be painted with glyphosate to avoid sprouting. *A. densiflorus* is attacked by several pests (a chalcid wasp, a moth larva, a thrip, a geometrid wasp and two other chalcid species) and a rust fungus. Each of these species may have the potential as a biocontrol agent, but further research is needed to prove this. *Crioceris* sp., a potential biological control agent for *Asparagus* spp., can be effective on *A. densiflorus*.



Bambusa vulgaris Schrad. ex J.C. Wendl.

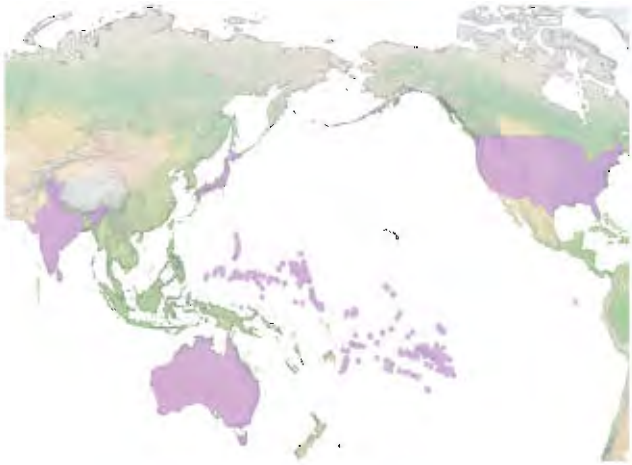
Native : Tropical Asia

Family : Poaceae

Synonyms : *Arundarbor blancoi* (Steud.) Kuntze
A. fera (Miquel) Kuntze

Common names : Feathery bamboo, golden bamboo, soft bamboo, yellow bamboo

Bambusa vulgaris is an ornamental bamboo widespread in the tropics and subtropics. It tolerates a wide range of climatic conditions and thrives under varied soil conditions. *B. vulgaris* grows as monospecific stands along riverbanks, roadsides and open ground. The tender shoots of the plant are edible. The plant reproduces mainly by vegetative means.



Distribution : American Samoa, Australia, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, India, Japan, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Northern Mariana Islands, Palau, Samoa, Solomon Islands, Sri Lanka, Tonga, United States.

Description : Clump bamboo with short rhizomes, stem yellow with thin green stripes, to 20 m tall, 4 - 10 cm in diameter with leafy branches at nodes. Culm-sheaths 15 - 25 cm long, 25 - 35 cm broad, rounded and truncate at top, beautifully streaked in green and yellow; ligule 5 - 8 mm tall. Leaves narrowly or broadly lanceolate, to 25 x 6 cm, acuminate, rough beneath. Inflorescence a large leafy compound panicle, bearing spicate branches with heads of spikelets in bracteate clusters of 3 - 10, clusters larger at the nodes, rachis rounded or somewhat furrowed, scurfy, end segments hairy; spikelets 1.5-2 cm long, oblong, acute, compressed, bearing one to two empty glumes. Flowers 6-10, one imperfect, rachillae cuneate, glabrous.

Habitat : Grows mostly near riverbanks, roadsides, planted forests and in wastelands. It thrives best under humid conditions up to 1, 000 metres elevation and can tolerate dry conditions.

Threat and damage : It can exclude nearby plants by forming monospecific stands.

Uses : Used for construction of houses, huts, boats, furniture and as pulp and fodder. It is also used for ornamental purposes and for making baskets and musical instruments. The leaves are used as sudorific and febrifuge agents. The plant helps to reduce soil erosion.

Management : Digging the rhizomes out is the most common method used. Cutting at the top and spraying herbicides such as glyphosate and amitrole are effective. Biological control is unknown.

Berberis thunbergii DC.

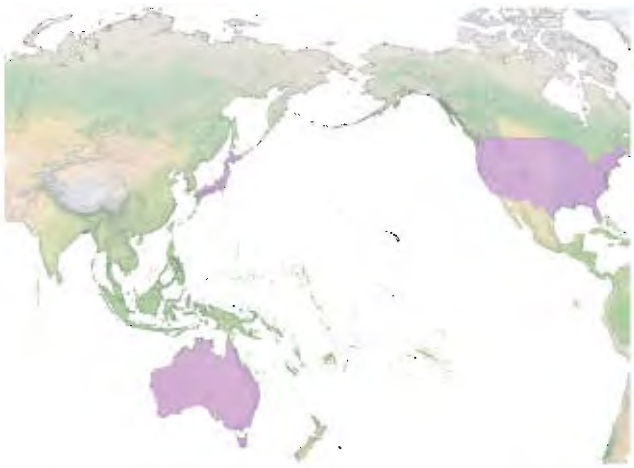
Native : Japan

Family : Berberidaceae

Synonyms : *Berberis thunbergii* var. *minor* Rehder
B. thunbergii var. *uniflora* Koehne

Common names : Crimson pygmy, Japanese barberry

Berberis thunbergii is an ornamental shrub that can invade a variety of habitats such as damp lowlands, dry roadsides and wasteland. The plant is highly shade-tolerant and displaces native plant species wherever it gets established. Roots are shallow but tough. Spread is through seeds and by sprouting from root crown and rhizomes.



Distribution : Australia, Japan, United States.

Description : Deciduous shrubs, to 3 m in height, branchlets angulate, dark red, shoot reddish-green, glabrous; spines simple, occasionally 3-fid, 5 - 15 mm, internodes 1-1.5 cm. Leaves simple, verticillate, subsessile, blade abaxially greyish-green, adaxially green, obovate, spatulate, or rhombic-ovate, 1 - 2 x 0.5 - 1.2 cm, thinly papery, abaxially with slightly raised mid-vein, both surfaces glabrous, with indistinct reticulate veins, base attenuate, cuneate, margin entire, apex mucronate or obtuse. Inflorescence an umbel with subfascicled flowers, yellow, 2-5 flowered, 1 - 2 cm; pedicels 5 - 10 mm, glabrous. Fruit a berry, shiny red, ellipsoid, approximately 8 × 4 mm. Seeds 1 or 2, brown.

Habitat : The plant is shade-tolerant and drought-resistant and adaptable to a range of habitats. It prefers to grow in direct sunlight to partly-shaded areas but will flower and fruit even in heavy shade. It commonly occurs in natural forests, planted forests, ruderal/disturbed/scrub/shrublands, wetlands, along roadsides, open fields and open woods.

Threat and damage : The highly shade-tolerant nature of the plant helps it to form dense stands in sunny as well as shady areas displacing native herb and shrub species.

Uses : Used as an ornamental and landscaping species. In Northern Japan, *Macaca fuscata* Blyth (the Japanese macaque) prefers the plant as a food source. The plant is known to stimulate earthworm populations. The root bark is anthelmintic, antiseptic and febrifuge. Berberine, present in the rhizomes, has marked antibacterial and antitumour effects. The plant can be grown as a hedge because it is very tolerant of trimming and has prickles which make it an effective barrier to larger creatures.

Management : Hand-pulling is an extremely effective method of reducing population and seed productivity of *Berberis*. Mowing or cutting will control spread but will not eradicate it. Use of glyphosate and triclopyr is effective. The cut stump method should be used when treating individual bushes or where the presence of desirable species precludes foliar application of herbicides. Biological control is unknown.

Bidens pilosa L.

Native : Temperate and tropical America

Family : Asteraceae

Synonyms : *Bidens africana* Klatt, *B. arenaria* Gand. *B. aurantiaca* Colenso

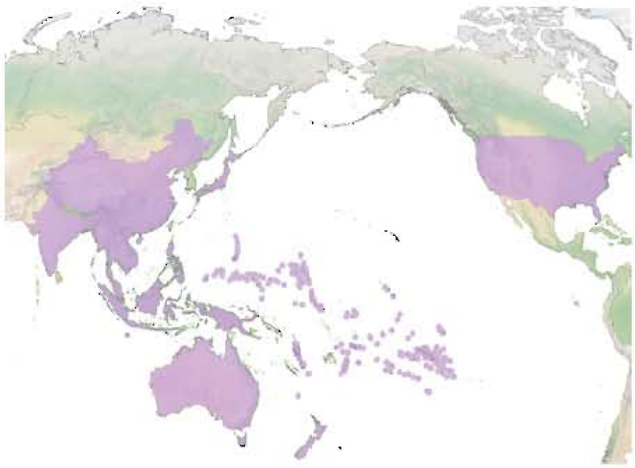
Common names : Beggar's tick, black fellows, black jack, broom stick, Spanish needle

Bidens pilosa is widely distributed in more than 40 countries. Its high reproductive potential and fast growth rate enabled such wide distribution. In its non-native ranges, the plant was introduced for agricultural and ornamental purposes and eventually became a major crop weed. A single plant can produce up to 6, 000 seeds per year and dispersal is mainly by attachment to animals, birds or by wind and water. Seeds are known to remain viable for 5 - 6 years.

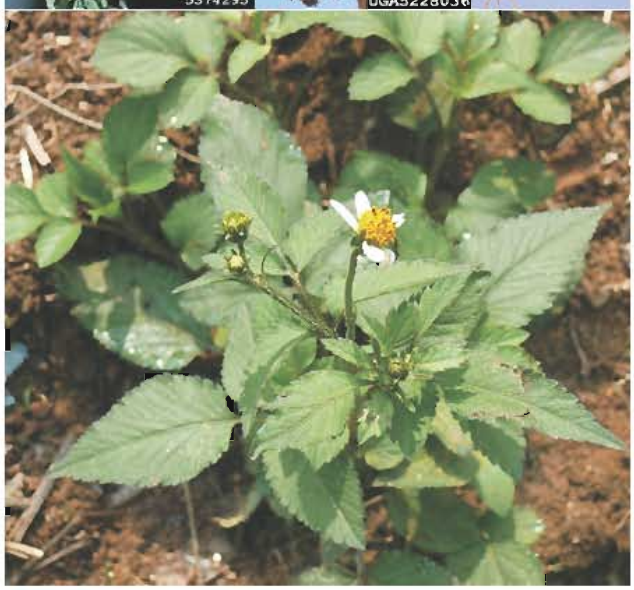
Description : Annual herbs or subshrubs, to 1 m tall, stems reddish-tinged, 4-angled. Leaves simple, blades either ovate to lanceolate, 3 - 7 × 1 - 2 cm, or one pinnately-lobed, primary lobes 3-7, ovate to lanceolate, 2.5 - 8 × 1-4 cm, base truncate to cuneate, ultimate margin serrate or entire, usually ciliate, apex acute to attenuate, faces pilosulous to sparsely hirtellous or glabrate; petiole 1 - 3 cm. Inflorescence of a head usually borne singly, sometimes in open, corymbiform arrays; peduncle 1-2 cm, calyculi appressed, spatulate to linear, bractlets 4 - 5 mm, margin ciliate, abaxial faces usually hispidulous to puberulent. Involucre turbinate to campanulate; ray florets to eight; laminae whitish to pinkish, 2 - 7 x 3 - 15 mm; disc florets 20 - 40, yellowish, 3 - 5 mm. Fruit cypselae, reddish-brown, flat, linear to narrowly cuneate, 4 - 5 mm, margins antrorsely hispidulous, apex truncate, face obscurely two-grooved, inner blackish, equally four-angled, linear-fusiform, apex truncate or attenuate, pappi to 3, erect to divergent, retrorsely barbed awns 2 - 4 mm long.

Habitat : Commonly seen in grasslands, agricultural areas, natural forests, planted forests and wetlands. It can grow from low to high elevations up to 3, 600 metres. The plant is tolerant to acidic and alkaline soils and prefers temperatures between 15 and 45°C.

Threat and damage : *Bidens* can form dense stands that can compete, outgrow and eliminate crops and native vegetation. It is a threat to at least 30 crops in different countries. The leaf and root extracts of *Bidens*



Distribution : American Samoa, Australia, Bangladesh, Cambodia, China, Christmas Island, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Hong Kong S.A.R., India, Indonesia, Japan, Kiribati, Lao PDR, Malaysia, Marshall Islands, Myanmar, Nauru, New Caledonia, New Zealand, Niue, Norfolk Island, Northern Mariana Islands, Palau, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Tonga, United States, Vanuatu, Viet Nam, Wallis and Futuna Islands.



suppress germination and seedling growth of native plants. The thickets that affect road, rail and recreation areas are a nuisance to travellers and tourists. Its burrs irritate people, sheep and other livestock and they can also be a seed contaminant. The roots, leaves and flowers are strongly phytotoxic and poisonous. The plant also acts as a host and vector to harmful parasites such as root knot nematode and tomato spotted wilt virus.

Uses : The leaves, roots and seeds are antidysentric and antimicrobial. In Africa, it is used to treat headaches, ear infections, diarrhoea, kidney problems, malaria and dysentery. Fresh and dried shoots and young leaves are used as vegetables.

Management : Hand-weeding is effective. The weed is susceptible to herbicides such as diuron, bromacil, atrazine, oryzalin, 2,4-D, glyphosate, diquat and paraquat. Biological control is unknown.

Brassica tournefortii Gouan

Native : South Europe, North Africa and West Asia

Family : Brassicaceae

Synonyms : *Brassica amblyorhyncha* Coustur. & Gand.
B. mesopotamica (Spreng.) Bernh.

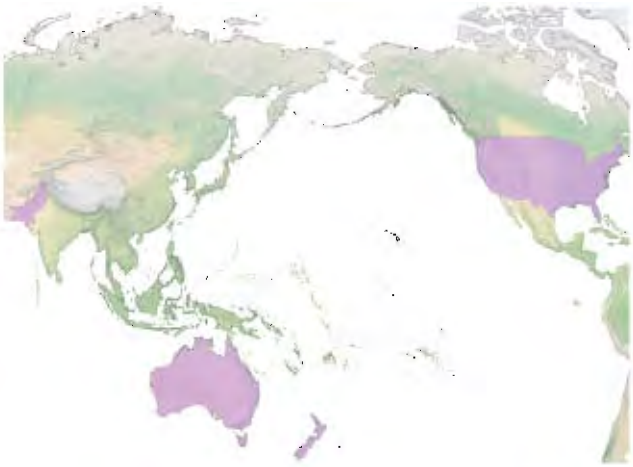
Common names : African mustard, Asian mustard, Mediterranean turnip, Sahara mustard

Brassica tournefortii is common in disturbed sites such as roadsides, abandoned fields and in areas with wind-blown sediments. It is rare on alluvial deposits and rocky hill slopes. It suppresses native species by monopolizing available soil moisture, building canopy and producing mature seeds long before many native species have begun to flower. The plant also increases fuel load and is a fire hazard in desert scrub and coastal sage scrub. It shows variability in size depending on the availability of soil moisture. During rainfall, a sticky gel forms over the seed case that permits seeds to disperse long distances by adhering to animals. A mature mustard plant produces 750 - 9, 000 seeds.

Description : Annual herbs, stem erect, hairy below with long ciliate white hairs, branches almost aphyllous. Basal leaves rosulate, runcinate-pinnatifid, 4 - 12 jugate, shortly petioled, hispid, terminal lobe often small, obliquely cordate, trilobate, sinuate-dentate, 7 - 30 cm long, lateral lobes narrow, oblong, often subrecurved; upper leaves much smaller, few, oblong or linear, 1-3 cm long, 4-8 mm broad, dentate or entire, acute, hairy. Inflorescence of 10 - 20 flowered raceme, enlarging to 30 cm in fruit, flowers 4 - 7 mm across, pale yellow; pedicel 2 - 6 mm long, enlarging to 20 mm and slightly thickened in fruit, spreading. Fruit a capsule, linear, edges rounded, tip beaked, slightly constricted between seeds, 3 - 7 x 2 - 3 mm. Seeds uniseriate, many, ca. 1 mm in diameter, globose, dark brown, finely tuberculate, mucilaginous when wet.

Habitat : Invades annual grasslands, coastal sage scrub, rocky slopes and abandoned sandy fields where it forms pure stands within a short period. It prefers sandy, loamy or heavy clay soils and can thrive on acid, neutral and alkaline soils. It cannot grow in the shade.

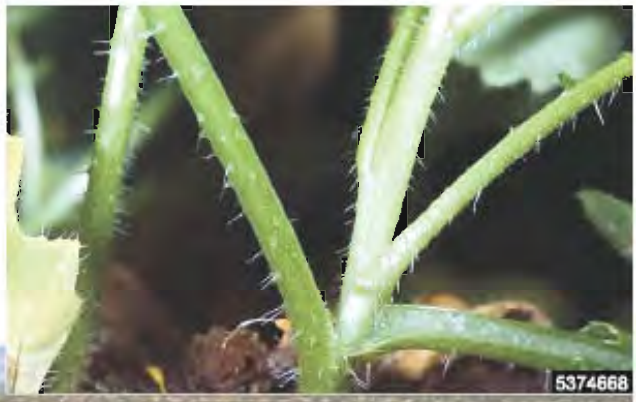
Threat and damage : Suppresses native vegetation by forming dense stands. It dominates grasslands in dry, open sites, especially disturbed areas. The plant can re-establish easily from a soil seed bank after fire.



Distribution : Australia, New Zealand, Pakistan, United States.

Uses : Leaves are a source of various oils; an edible oil can be obtained from the seed. The leaves and young shoots can be cooked and the plant is widely used as a source of food in Libya. The plant contains 3-methylsulfinylpropyl glucosinolate, which reduces the risk of cancer.

Management: The spread of the weed can be reduced by controlling it along roads, which provide corridors for rapid invasion into new habitats. Hand-pulling might be effective if done before seed setting. Early herbicidal treatment may reduce weed abundance and allow later-germinating natives to establish. Biological control is unknown.



Bromus inermis Leyss.

Native : France to Siberia

Family : Poaceae

Synonyms : *Bromopsis inermis* (Leyss.) Holub
B. inermis var. *aristata* (Schur) Tzvelev

Common names : Awnless brome, Hungarian brome, smooth brome, smooth bromegrass

Bromus inermis is an invasive cool season grass which has negatively impacted grasslands of North America. It has also affected population dynamics and movement behaviour of several native arthropod species in North American prairies. Seeds of the grass remain viable for two to ten years.

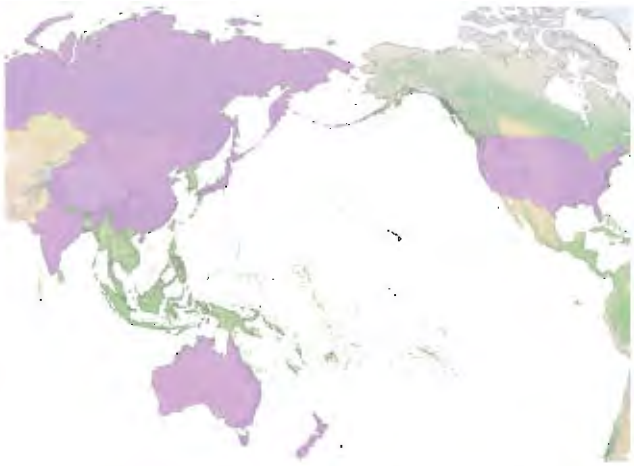
Description : Rhizomatous perennial grass, culms solitary or loosely tufted, to 1.2 m tall. Leaf blade to 35 x 0.8 cm, glabrous or sparsely ciliate on the margins, greyish-blue ventrally and green dorsally. Sheaths glabrous or thinly pubescent. Panicle 10 - 20 cm long, usually rather dense, occasionally loose and open. Spikelets narrowly oblong, 8 - 13 flowered, 15 - 30 mm long, pallid or slightly purple-tinged; glumes narrowly lanceolate, glabrous, the lower 3.5 - 8 mm long, 1 - nerved, the upper 6 - 11 mm long, 3 - nerved. Seeds elliptic, pale yellow to dark brown.

Habitat : Occurs in a wide range of soils but prefers deep, fertile, well-drained silt loam or clay loam soils with a pH from 5.5 - 8. *Bromus* grows widely in natural forests, grasslands, roadsides, riverbanks and disturbed sites. It is drought-resistant, can tolerate spring flood conditions and temperatures as low as -38°C but cannot tolerate shade and anaerobic, calcareous or salty conditions.

Threat and damage : An aggressive, competitive species that can smother other species and exclude native vegetation. It is widely grown as a forage or cover crop and has become invasive inhibiting natural succession processes. The grass alters the population dynamics of the cord grass, *Spartina pectinata* Bosc ex Link.

Uses : Usually planted to increase forage or for erosion control.

Management : Cutting at the boot stage (while the flower head is still enclosed with in the sheath) may be effective. Application of herbicides such as picloram, dicamba and glyphosate has been successful. Biological control is unknown.



Distribution : Australia, China, India, Japan, Mongolia, New Zealand, Russian Federation, United States.

Bromus rubens L.

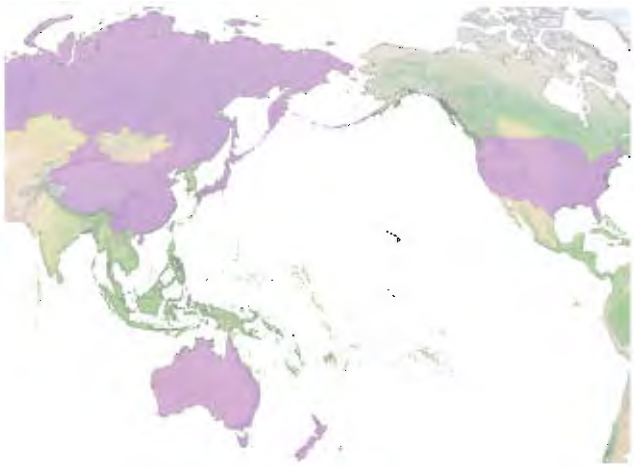
Native : Africa, Asia and Europe

Family : Poaceae

Synonyms : *Anisantha rubens* (L.) Nevski
Bromus madritensis ssp. *rubens* (L.) Hus.

Common names : Foxtail brome, foxtail chess, red brome

Bromus rubens is a cool season tufted bunch grass that grows profusely on shallow dry soil or poor textured clayey soil. It is highly competitive, produces huge biomass and displaces native species. The plant is drought resistant with high water use efficiency.



Distribution : Australia, China, Japan, New Zealand, Russian Federation, United States.

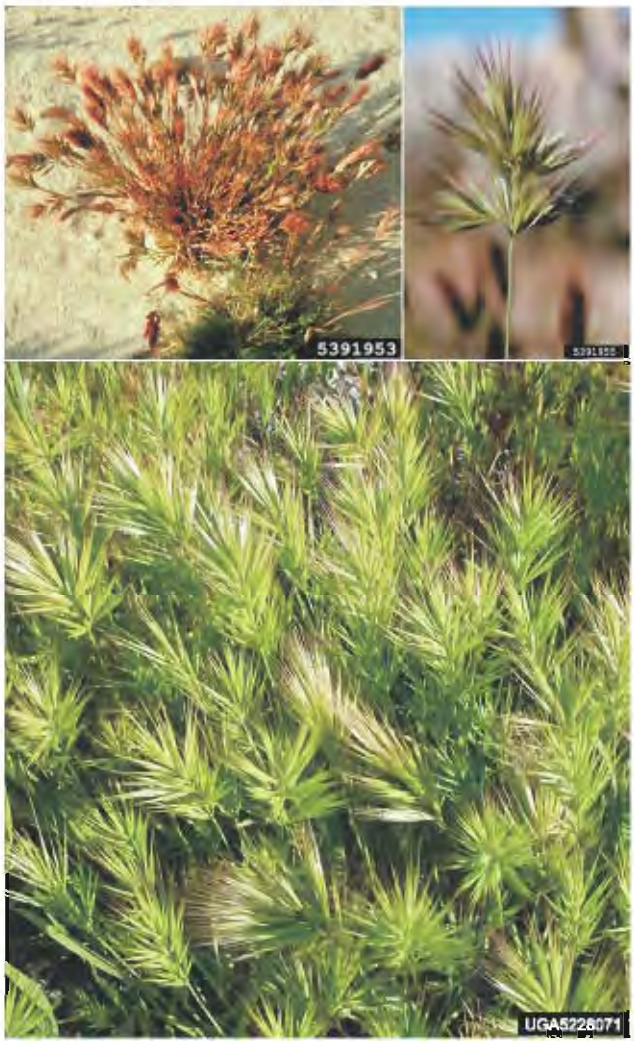
Description : Annuals, culms tufted, erect or ascending, 15-35 cm tall. Leaf sheath pubescent, blade 5-10 × 0.3-0.5 cm, both surfaces pubescent. Panicle densely contracted, narrowly elliptic in outline, stiffly erect, 4-7 x 2 cm, often tinged with purple; branches 2-5 mm, much shorter than spikelets, branches and pedicels pubescent. Spikelets 15 - 25 mm, 4 - 9 florets, upper florets sterile, reduced. Fruit a caryopsis.

Habitat : Common along roadsides, wasteland, agricultural areas, deserts, disturbed areas, rangelands, cultivated fields and steppe regions. It prefers low to medium elevations below 1, 500 metres whenever competition from established herbaceous plants is minimal.

Threat and damage : In the North American region, the plant grows as an invasive since competition from herbaceous plants is low. Once established, it has the potential to compete with other grasses. The accumulation of litter and necromass from the plant increases fire hazards, which cause loss of native perennial species in invaded areas. Nitrogen additions increase plant yield and lead to competitive suppression of native bunchgrass *Pseudoroegneria spicata* (Pursh) A. Love. The awns and florets are a direct threat to livestock and native fauna. The vegetation change from perennial grasses to this and other introduced species influences the density of rabbits, grasshoppers and kangaroo rats.

Uses : A source of forage for livestock though not a preferred one. Desert cottontail rabbits feed on this weed with the heaviest use occurring in winter.

Management : Hoeing and uprooting of the plants are practised during spring. Application of pre-emergence or soil-active herbicides is effective in controlling the grass. Biological control is unknown.



Bromus tectorum L.

Native : South Europe and Southwest Asia

Family : Poaceae

Synonyms : *Anisantha pontica* K. Koch
A. tectorum (L.) Nevski

Common names : Bronco grass, cheat grass brome, cheat grass, downy brome

Bromus tectorum usually thrives in disturbed areas preventing growth of native species. Disturbances such as overgrazing, cultivation and frequent fires encourage invasion. Once established, it forms pure stands out-competing native plants. The seedlings are bright green but the foliage and seed heads often become purplish before drying. It is a prolific seed producer and produces an average of 70.8 million seeds per acre. Long-distance dispersal is facilitated by humans and wild and domestic animals. The plant has a finely divided fibrous root system with an average of seven main roots that grow rapidly, spreading laterally and vertically.

Description : Annuals, culms erect, to 70 cm tall. Leaf blade to 18 x 0.4 cm, sheath pubescent. Inflorescence a panicle, to 18 cm long, loose or dense, erect or nodding; branches filiform, flexuous, bearing parallel clusters of spikelets, usually turned to one side; spikelets narrowly wedge-shaped, very fragile, 4 - 8 flowered, the upper 1-3 florets much reduced or aborted, 25 - 40 mm long including awns. Fruit is a caryopsis with a tuft of hair at apex.

Habitat : Common in agricultural areas, grasslands, ruderal/disturbed, scrub/shrublands, urban areas and intermountain ranges from sea level to 1, 500 metres. It prefers areas that receive good sunlight and 15-56 cm of precipitation and does not grow well under the forest canopy. The plant will grow in almost all types of soil and is most often found on coarse-textured soils. It does not grow well on heavy, dry or saline soils.

Threat and damage : Increases the frequency, extent and timing of fires. The early-maturing, fine-textured herbage of the weed increases the chance of combustion. Such frequent fires lead to loss of topsoil and nutrients, which alters the makeup of the soil and therefore the ecosystem. The plant can rapidly and completely dominate disturbed sites by competing with native shrubs and perennial grasses.

Distribution : Australia, China, India, Japan, New Zealand, Pakistan, Russian Federation, United States.

Uses : Used as fodder for many kinds of livestock in the early spring. Mule deer, pronghorn, elk, small mammals and certain birds also feed on this grass. It provides habitat for several small mammals and birds and is planted to decrease erosion in some countries. The small seeds of the plant can be cooked into gruel in times of food shortage. A coffee is made from the roasted seed. A paste made from seeds can be applied as a poultice to relieve chest pain.

Management : Hand-pulling before seed setting is an effective control method. While pulling, the root should also be removed or the plant will grow back. Tillage is effective after the plant is established. Application of glyphosate controls the weed, but its effectiveness is limited by the environmental conditions prevailing at the time of the application. Several new herbicides are being tested for selective control. In North America, planting of grasses, such as crested wheatgrass, have been attempted to compete with *B. tectorum*. Pink snow mould (*Microdochium nivale* [Fr.] Samuels & I.C. Hallett) has been attempted as a biological control agent, but information on its efficacy is unknown. Grazing is an excellent tool for suppressing the weed.

Buddleja davidii Franch.

Native : Western and Central China

Family : Buddlejaceae

Synonyms : *Buddleja davidii* var. *alba* Rehder & E.H. Wilson
B. variabilis Hemsley

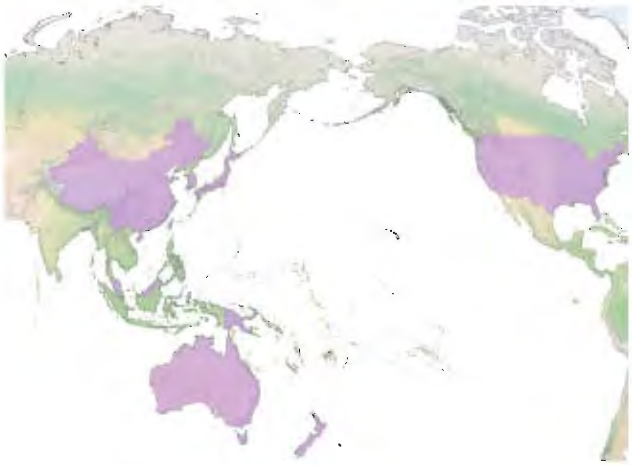
Common names : Butterfly bush, orange eye, summer lilac

Buddleja davidii, a shade intolerant shrub, is often cultivated for its beautiful flowers and ability to attract butterflies. It takes hold as an invasive plant in disturbed areas, riparian zones or open woodlands and is considered as one of the worst weeds in New Zealand, where it out-competes *Pinus radiata* seedlings. The small, wind dispersed seeds can remain dormant in the ground for many years. The plant can colonize a new area in 1 - 2 years from seeding.

Description : Shrubs, 1 - 5 m tall, young parts white tomentose or pubescent with stellate hairs, branchlets 4-angled, stipules often present, suborbicular to ovate. Leaves simple, opposite, subsessile, blade narrowly ovate-elliptic, 4 - 20 x 0.3 - 7.5 cm, adaxially dark green, glabrous or subglabrous, base cuneate, margin serrate, apex acuminate, lateral veins 9 - 14 pairs. Inflorescence of terminal, racemose or thyrsoid cymes, 4 - 30 x 2 - 5 cm, pubescent. Flowers violet to dark purple, sometimes white, with an orange-yellow throat, 0.8 - 1.4 cm, outside glabrous or stellately pubescent or with glandular hairs, tube narrowly cylindrical or subcylindrical, 6 - 11.5 x 1 - 1.5 mm. Fruit a capsule, brown, narrowly ellipsoid to narrowly ovoid, 5 - 9 x 1.5 - 2 mm, glabrous or sparsely stellate pubescent. Seeds ellipsoid, 2-4 x 0.5 mm, long-winged at both ends.

Habitat : Usually occurs in open and disturbed sites like riverbanks, edges of roads, along railway lines, walls, cliffs, building sites, wastelands and ruins. Its occurrence in natural forests is also reported.

Threat and damage : Dense infestations of the weed compete with indigenous vegetation of rivers and impede the growth and reproduction of other species of trees and shrubs. Monospecific stands of *Buddleja* impede access to rivers. Seedlings, which have superficial rooting, are easily carried away in floods and may form blockages, causing erosion of banks.



Distribution : Australia, China, Fiji, Japan, Malaysia, New Caledonia, New Zealand, Papua New Guinea, Republic of Korea, Singapore, United States.

Uses : Widely planted as an ornamental in hedges and other borders. It is the perfect foundation plant for a butterfly garden.

Management : Plants that are merely cut, buried by river sediment or knocked down by wind storms will continue to grow or will resprout. Hand-picking of seedlings may be successful when followed by establishing ground cover of a desired species which will inhibit resprouting of *B. davidii*. It may be possible to dig plants up, but again, disturbance encourages seedling growth and should be avoided. Uprooted plants should be removed from sites to avoid resprouting. Cutting the plant down and treating the stump with herbicides such as triclopyr or glyphosate is reported to be effective. A weevil, *Cleopus japonicus* Wingelmuller, and a stem boring beetle, *Mecyslobus erro* Pascoe, were tested as potential biological control agents for *B. davidii* in New Zealand.

Caesalpinia decapetala (Roth) Alston

Native : Tropical Asia

Family : Fabaceae

Synonyms : *Biancaea decapetela* (Roth) O. Deg.
B. scandens Tod.
Reichardia decapetala Roth

Common names : Cat's claw, Mauritius thorn, Mysore thorn, shoofly

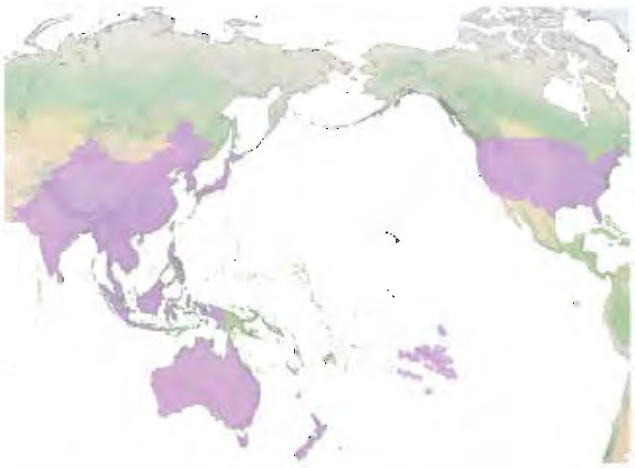
Caesalpinia decapetala has been introduced to many different tropical locations as a hedge or ornamental plant. It is a major invasive plant in South Africa and Hawaii, where it covers large areas of land forming dense thickets prohibiting animal movement. Trailing branches root where they touch the ground. Seeds are dispersed mainly by rodents and birds.

Description : Woody climbers, bark dull red; branches, rachis and inflorescence with recurved prickles. Leaves 20-30 cm, pinnae 3-10 pairs, opposite, with prickles in pairs at the base. Stipules obliquely ovate, apex acuminate, caducous. Leaflets 8 - 12 pairs, oblong, 1-2.5 x 0.6-1.2 cm, membranous, both surfaces puberulent, glabrescent when old, apex and base obtuse-rounded. Inflorescence of terminal raceme, 15 - 30 cm, flowers dark yellow; rachis densely prickly, pedicels 3 - 4 cm, hairy, jointed at apex. Fruit a pod, 6 - 12 x 2.5 - 3 cm, oblong ligular, beaked at both ends, splitting along the ventral suture at maturity, smooth, brown, leathery. Seeds 6 - 9, black, ellipsoid, laterally flattened, 8 - 12 x 6 - 8 mm.

Habitat : In the Pacific, the plant is confined to dry to mesic lowland habitats. However, in South Africa it is found throughout the eastern seaboard in areas that experience high summer rainfall. Altitudinal range varies from sea level to 1, 500 metres. It is common in agricultural areas, natural forests, planted forests, range/grasslands, ruderal/disturbed lands and watercourses.

Threat and damage : Invades forest margins and gaps, plantations, roadsides and watercourses. It scrambles over and smothers other species, including tall forest trees and hinders access to plantations and riverbanks. It can retard growth of saplings in newly established plantations. Furthermore, infestations along riverbanks are likely to affect stream flow.

Uses : Used as a security hedge or a barrier plant. Sometimes used as an ornamental. The plant is anthelmintic, antiperiodic, astringent and febrifuge.



Distribution : Australia, Bangladesh, Bhutan, Cambodia, China, Democratic People's Republic of Korea, Fiji, French Polynesia, Hong Kong S.A.R., India, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Nepal, New Caledonia, New Zealand, Norfolk Island, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand, United States, Viet Nam.

The leaves are emmenagogues and laxative. They are applied externally to burns. The root is a purgative and the bark is a rich source of tannin.

Management : Foliar applications of glyphosate and triclopyr, and soil applications of tebuthiuron are effective. Adequate coverage of the foliage in dense infestations is difficult. Timely and repeated applications (three to nine months) of triclopyr ester allow gradual reductions and opening of the canopy and eventual control. The treatment also controls seedlings. Basal bark of accessible stems may be treated with triclopyr ester in diesel or crop oil in very low volume applications. Two species of insects have been evaluated for its biological control. Of these, the leaf-mining moth, *Acrocercops hyphantica* Meyrick, is host-specific and the impact of the seed-feeding weevil, *Sulcobruchus subsuturalis* Pic is unknown.

Canna indica L.

Native : Tropical America

Family : Cannaceae

Synonyms : *Canna achiras* Gill., *C. aurantica* Roscoe

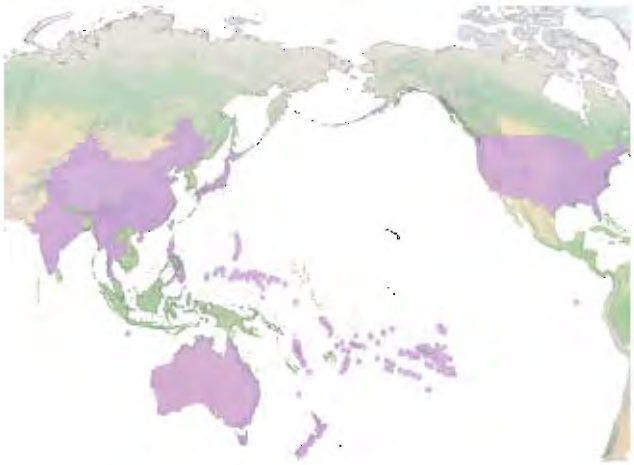
Common names : African arrowroot, canna, canna lily, gwangwa, Indian shot

Canna indica is a very popular ornamental plant commonly distributed in the tropics. It is invasive in several countries in the Asia-Pacific region where it grows in thickets displacing other plants. Physical control is difficult since the main mode of spread is through rhizomes.

Description : Rhizomatous subshrubs, many branched, stem stout, to 2.5 m tall. Leaf sheath green or purple, petiole short, blade adaxially green, abaxially and at margin green or purple, ovate-oblong to oblong, 30 - 60 × 10 - 20 cm. Inflorescence a raceme of cincinni, bracts light purple, ovate, approximately 8 mm, flowers pinkish-red, yellow, yellow with red spots or vice-versa, 3-4 cm across, 1 or 2 per cincinnus. Fruit a broadly ovoid capsule, 1.2-1.8 cm. Seeds globose, black, 5 - 8 x 4 - 7 mm.

Habitat : Often found as secondary growth in open wastelands. It also occurs in wetland habitats, disturbed sites, waste areas and old gardens. *Canna* is shade-intolerant and prefers moist and well-drained sandy, loamy or clayey soil. The plant is naturalized in Fiji, frequently around villages, along roadsides, in coconut plantations, in clearings and in forests near streams, at elevations from sea level to 450 metres.

Threat and damage : *Canna* can grow in thickets and suppress growth of other plants. Its dense clumps in water ways results in flooding and limits access to these areas. In Hawaii, *Canna* is naturalized in disturbed mesic and rain forest.



Distribution : American Samoa, Australia, China, Christmas Island, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, India, Japan, Kiribati, Marshall Islands, Myanmar, Nauru, New Zealand, Niue, Norfolk Island, Northern Mariana Islands, Palau, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Tonga, Tuvalu, United States, Vanuatu, Wallis and Futuna Islands.

Uses : Grown widely as an ornamental. The rhizome is used in traditional medicine and food.

Management : Dig out rhizomes and roots and dispose. Application of a combination of metsulfuron methyl and glyphosate on cut stems is effective. Biological control is unknown.

Cardiospermum grandiflorum Sw.

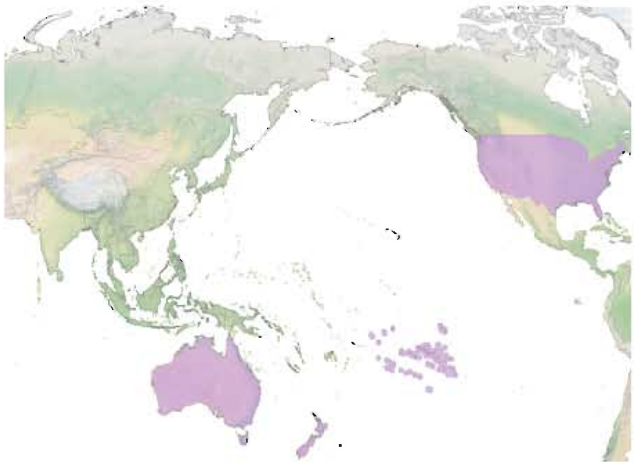
Native : North and South America and Africa

Family : Sapindaceae

Synonyms : *Cardiospermum barbicaule* Baker
C. coluteoides Kunth

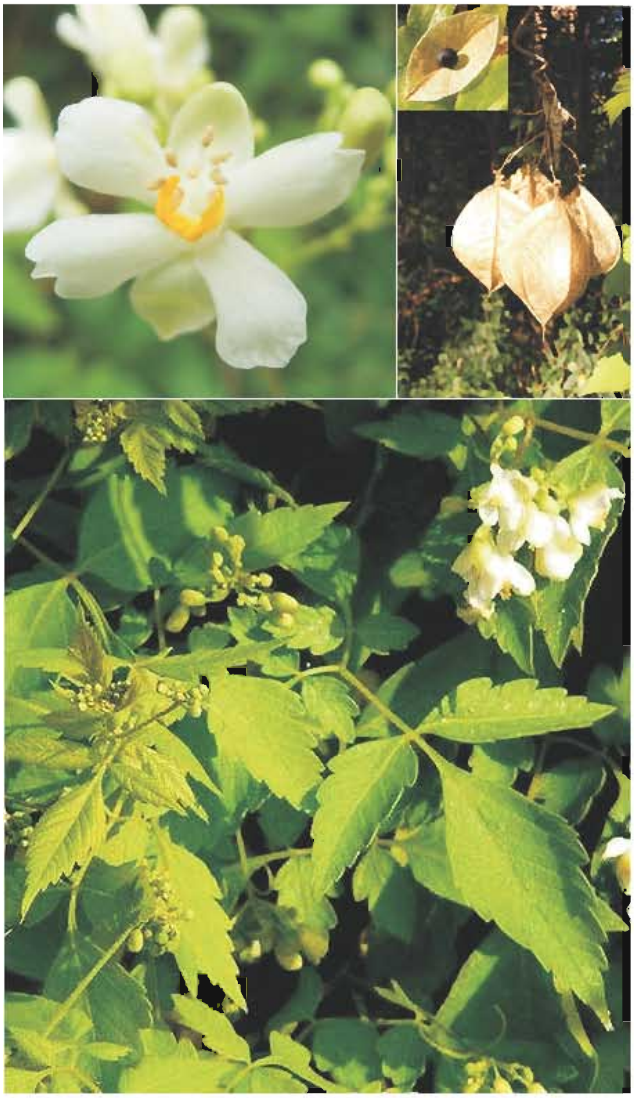
Common names : Balloon vine, heart seed

Cardiospermum grandiflorum is a rapidly growing invasive climber which forms large and dense smothering curtains of tangled stems that hamper the growth of supporting vegetation. It grows well in damp situations, especially near riverbanks. The light papery capsules float in water, which helps dispersal. They are also transported by wind. Seed longevity is around two years.



Distribution : Australia, Cook Islands, French Polynesia, New Caledonia, New Zealand, United States.

Description : Perennial vines, stem ribbed, branched, shortly villous. Leaves biternate, leaflets rhombic-ovate or lanceolate, 2.5-10 x 2.5 cm, terminal one larger, lateral pair small, sparsely to moderately yellowish pilose, densely along veins on the lower surface, margin irregularly lobed. Flowers in many flowered axillary heads, greenish-white, fragrant; peduncles 7-14.5 cm long, tendrillate at base of each flower cluster. Fruit a capsule, ellipsoid to ellipsoid-ovoid, membranous, strongly inflated, three-angled, 4.5-6.5 cm long, glabrous or nearly so. Seeds subglobose, 6-7 mm in diameter, aril suborbicular.



Habitat : Common in natural forests, riparian zones and urban areas; the vine prefers moist soils and can tolerate occasional flooding. It can withstand some shade but growth is vigorous in full sunlight.

Threat and damage : Forms dense but localized infestation. However, it can grow to enormous lengths and is capable of smothering even a 10-metre-tall tree. Seedlings of native shrubs and trees are unable to establish under the stands of the plant. In Australia, the plant tolerates periodic inundation and its vigorous growth destroys riparian forests. It smothers indigenous plant species by preventing their ability to effectively photosynthesize.

Uses : Grown as an ornamental. The derivatives of the root have laxative, emetic and diuretic effects. The leaves can cure swellings, oedema and pulmonary complications.

Management : Hand-pull or dig out smaller plants. Glyphosate is effective if sprayed on the resprouting foliage. Biological control is unknown.

Carduus nutans L.

Native : Asia and Europe

Family : Asteraceae

Synonyms : *Carduus armenus* Boiss.
C. attenuatus Klokov

Common names : Musk thistle, nodding plumeless thistle, nodding thistle, plumeless thistle

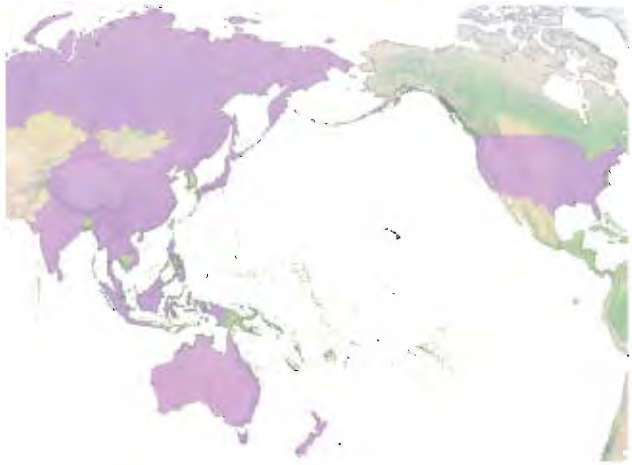
The stem and leaf margins of *Carduus nutans* are densely covered by sharp spines. The plant readily invades disturbed areas outcompeting native plants. Keeping the pastures competitive is the best way to prevent establishment of seedlings. Flower heads of the plant will drop to a 90-degree angle from the stem when mature and hence it is called nodding thistle. A single flower head may produce 1, 200 seeds and a single plant up to 120, 000 seeds, which are wind-dispersed. The seeds may remain viable in the soil for over ten years.

Description : Annual or biennial subshrubs, stem glabrous to tomentose, winged, wing spines 2-10 mm. Basal leaves tapering to winged petioles, blade 10-40 cm, pinnately lobed; cauline sessile, shorter, margin less divided. Inflorescence a head, borne singly or in corymbiform arrays, sometimes a few, axillary, at least terminal head conspicuously pedunculate, often nodding, red to purple, 2 - 4 cm; peduncle 2 - 30 cm, unwinged distally or throughout, finely tomentose, involucres hemispheric, 2-6 × 2-7 cm, phyllaries lanceolate to ovate, outer and middle with appressed bases, 2 - 4 mm, appendages 2 - 7 mm, purple, 15 - 28 mm. Fruit a cypselae, golden to brown, 4 - 5 mm, pappus bristles 13 - 25 mm.

Habitat : Grows in open disturbed soil, heavily grazed land, agricultural areas, grasslands, shrub lands, urban areas and near roadsides up to an elevation of about 2, 500 metres. It does not grow well in excessively wet, dry or shady conditions but spreads rapidly in areas subjected to disturbance.

Threat and damage : A perpetual problem on farmland because it out-competes native forage plants, crops and hinders the movement of livestock. It also reduces the amount of pasture available to livestock. The spiny vegetation catches in the wool of sheep, which reduces the value of the wool.

Uses : Used in traditional medicine for stimulating liver function. The flowers are a febrifuge and are used to purify the blood.



Distribution : Australia, Bhutan, China, Democratic People's Republic of Korea, India, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Nepal, New Zealand, Philippines, Russian Federation, Sri Lanka, Thailand, United States, Viet Nam.

Management : Hand-pulling is very effective. Minimizing disturbance to the soil during removal activities will help reduce the chance of germination of seeds stored in the soil. Foliar sprays with glyphosate or triclopyr is effective. Treatments should be made during the rosette stage or prior to flowering. Two weevils have been introduced from Europe and released in the United States as biological control agents, the thistle head-feeding weevil (*Rhinocyllus conicus* Frolich) and the rosette weevil, *Trichosirocalus horridus* (Panzer). Reports indicate that the releases were successful in managing musk thistle.

Casuarina equisetifolia L.

Native : Australia and Southeast Asia

Family : Casuarinaceae

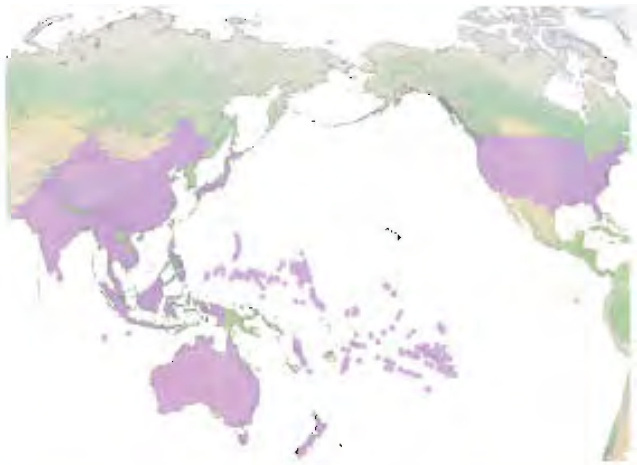
Synonyms : *Casuarina africana* Lour.
C. brunoniana Miq.

Common names : Australian beefwood, Australian-pine, beach she-oak, beef wood-tree

Casuarina equisetifolia is a deciduous tree with a soft, wispy, pine-like appearance. It resembles *Pinus* because of its small, round, cone-like fruits and scale-like leaves. This tree has been introduced worldwide for coastal landscaping. A single four- or five-year-old tree can produce thousands of winged seeds that are carried by wind to new colonization sites. Seeds remain fertile for a few months to a year and germinate under conditions of adequate moisture in four to eight days. Maximum growth is reached in 20 years with a maximum life span of 40 to 50 years. The tree is supported by a dense, spreading, fibrous root system.

Description : Tall trees, monoecious, trunk straight, crown conical, bark scaly, adaxially reddish brown on old trees, ultimate branchlets usually pendulous, greyish-green, 10 - 27 x 0.08 - 0.09 cm; articles 0.4 - 0.9 cm. Leaves scaly, appressed to branchlets, 6 - 8 per whorl, lanceolate or triangular, 1-3 mm. Male inflorescence 1-4 cm, cones ellipsoid, 1.2-2.5 cm, greyish-green or yellowish-brown, tomentose when young, glabrous at maturity, base and apex truncate to obtuse, apex of bracteoles slightly obtuse or acute. Female inflorescence 1-3 x 1-1.5 cm, short, cylindrical, conical or globose. Fruit a samara, grey or yellow, winged, 5 - 8 mm.

Habitat : Occurs in coastland, estuarine habitats, riparian zones, disturbed lands, rocky coasts, sand dunes and sandbars in tropical and subtropical climates. The tree frequently colonizes disturbed sites and its roots are capable of fixing nitrogen through microbial association. It is particularly common on alkaline, limestone-derived soils and nutrient-poor soils. The tree is tolerant of very saline conditions but grows best in slightly acidic sandy soils. It reaches maximum development in slightly depressional topography where adequate moisture is nearly always available. The tree can tolerate annual rain fall of 640 to 4 300 mm, temperatures of 22.1 to 26.9°C, and pH of 5.0 to 7.7.



Distribution : American Samoa, Australia, Bangladesh, Brunei, Cambodia, China, Christmas Island, Coco (Keeling) Islands, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Hong Kong S.A.R., India, Indonesia, Japan, Kiribati, Malaysia, Marshall Islands, Myanmar, Nauru, New Caledonia, New Zealand, Niue, Northern Mariana Islands, Pakistan, Palau, Philippines, Samoa, Singapore, Solomon Islands, Sri Lanka, Thailand, Tonga, United States, Vanuatu, Viet Nam.

Threat and damage : *Casuarina* produces dense shade and a thick blanket of leaves and hard, pointed fruits that completely cover the ground beneath it. Dense thickets displace native dune and beach vegetation, including mangroves and others. Once established, it radically alters the light, temperature and soil chemistry regimes of beach habitats as it outcompetes and displaces native plant species and destroys the habitat of native insects and other wildlife. The ground below the tree becomes ecologically sterile, reducing the food value for native wildlife. *Casuarina* is a source of respiratory irritation in men. Also, its pollen can cause allergic reactions symptomized by eye irritation, runny nose and hoarseness or sore throat.

Uses : Widely planted for coastal reclamation, erosion control, tannin, pulp, timber and fuel. The wood is used for beams, boat building, electric poles, fences, furniture, tool handles and oars. The astringent bark extract is used as a remedy for diarrohoea and sore throat.

Management : Seedlings, saplings and young trees are best removed manually. Fire is effective only in dense stands with sufficient dry fuel on the ground. Prescribed fire has been used for large infestations in fire-tolerant communities. Raking and removal of leaf litter, cones and seeds should be done whenever possible. For heavier infestations, application of a systemic herbicide to bark, cut stumps or foliage is probably the most effective management tool. Triclopyr in diesel oil applied using the basal bark method or the hack-and-squirt method is most commonly used. Several pests such as *Lymantria xylina* Swinhoe and a root rot fungus, *Clitocybe tabescens* (Scop.) Bres. have potential for biocontrol but their efficacy is not clearly known.

Cedrela odorata L.

Native : West Indies South to the Amazon Basin

Family : Meliaceae

Synonyms : *Cedrela brachystachya* (C.DC.) C.DC.
C. brownii Loefl. ex Kuntze

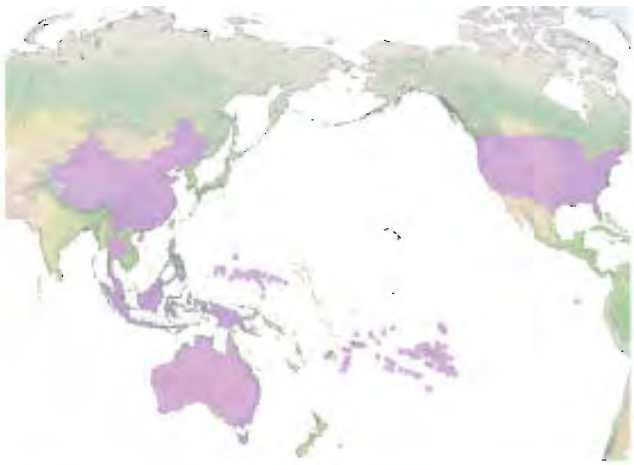
Common names : Barbados cedar, cigar box cedar, Mexican cedar, Spanish cedar

Cedrela is a plantation tree species widely cultivated in the tropics. It has been introduced into Indonesia, Peninsular Malaysia, Philippines, Singapore, Thailand, Pacific Islands and South Africa for the last several years. The tree has become invasive in some areas, especially where they are disturbed by cutting. Seed germination is vigorous and viability is up to 90 percent.

Description : Large trees, to 40 m tall, deciduous, monoecious, bole straight, cylindrical, bark fissured, reddish-brown especially near the base, greyish higher up, blaze purplish-red, branchlets finely to conspicuously lenticellate. Leaves alternate, paripinnate, leaflets 6-12 pairs, opposite to alternate, entire, ovate to oblong-lanceolate, 5 - 16 cm long, glabrous, base oblique, apex acute to shortly acuminate. Inflorescence a terminal panicle, flowers unisexual, white or cream tinged, red near the margin with well-developed vestiges of the opposite sex, subsessile, 6-9 mm long, garlic scented. Fruit a pendulous, reddish-brown capsule with five thin, woody valves, oblong-ellipsoid to obovoid, 2 - 3.5 cm long. Seed sharply angled or winged columella, 2 - 2.5 cm long.

Habitat : The tree tolerates a mean annual temperature of 22 - 26° C and rainfall of 1, 000 - 3, 700 mm. It can grow profusely from sea level to 1, 900 metres. It prefers fertile, free-draining, weakly acidic soil but tolerates heavy soil and soils with high calcium. *Cedrela* is common along roadsides and disturbed areas; it cannot grow in waterlogged or flooded areas. It is also found in primary and secondary evergreen to semi-deciduous lowland forests and lower montane rain forests.

Uses : Grown as a timber species for making furniture, doors and windows. The bark is used for medicinal purposes. The tree is resistant to insect attack due to the presence of a volatile oil in the wood. It makes excellent plywood and veneer and can be more widely used as a shade tree.



Distribution : American Samoa, Australia, China, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Indonesia, Malaysia, New Caledonia, Papua New Guinea, Philippines, Samoa, Singapore, Solomon Islands, Thailand, Tonga, United States.

Management : In the Galapagos Islands, application of 50 percent picloram has been successful. Biological control is unknown.

Cenchrus clandestinus (Hochst. ex Chiov.) Morrone

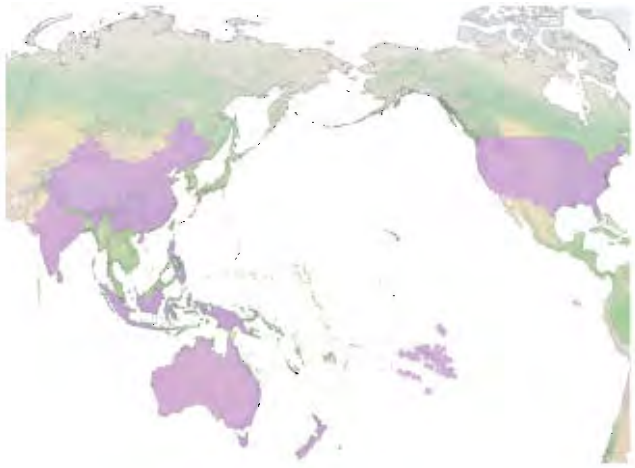
Native : Tropical East Africa

Family : Poaceae

Synonyms : *Pennisetum clandestinum* Hoechst. ex Chiov.
P. inclusum Pilg.

Common names : Kikuyo grass, kikuyu grass, West African pennisetum

Cenchrus clandestinus is a creeping grass which can be distinguished from other grasses by its extensively creeping rhizomes and stolons that form a dense mat. It is known as Kikuyu grass because the Kikuyu tribes live in its native area. It has no clearly visible inflorescence, only the white filaments and feathery stigmas are visible.



Distribution : Australia, China, French Polynesia, India, Indonesia, New Caledonia, New Zealand, Papua New Guinea, Philippines, Sri Lanka, United States.

Description : Low, mat-forming, perennial grass, creeping by stout rhizomes, culms 30 - 120 cm tall, prostrate and rooting from nodes; internode short, profuse vertical leafy branches arise from stolon and rhizome. Leaf sheath overlapping, membranous to papery, pale brown, ligule a hairy rim, blades narrow, spreading, blunt to pointed, 1.25 - 5 x 0.3 - 0.4 cm, folded at first, later flat, margins rough. Panicle small, white or tawny, enclosed within short leaf sheaths resembling regular vegetative shoots. Spikelets in clusters of 2- 4, enclosed in the uppermost leaf sheath, terminal spikelet shortly stalked, others stalkless, spikelet surrounded by delicate bristles, unequal in length, inner bristles plumose, spikelets with two florets, slender, narrow, 1-2 cm long, whitish below, greenish above. Grain oblong, brown, 1.5-2.5 mm long. Seeds enclosed by leaf sheath.

Habitat : Grows well in moist, humid conditions and can withstand dry weather, frost and floods. It is common in open scrub land and on forest margins especially were the forest is disturbed. The plant grows up to 2, 700 m elevation in Eastern Africa.

Threat and damage : *Cenchrus* forms a dense mat through the thick network of rhizomatous roots and stolons. It thus prevents germination and growth of other species. The basal layer of dead leaves may support fires in fire-prone regions. The plant can kill small trees by smothering them and can choke ponds and waterways. Allelopathic toxins contained in the plant also affect the growth of native flora. The grass spreads vegetatively from pieces of rhizome. It also spreads through seeds.

Uses : Kikuyu grass is widely used for dairying in high altitude areas. It is also used as a lawn grass and for erosion control.

Management : Digging out may be effective but all rhizomes need to be removed. Glyphosate in water applied to wet the green foliage will give short-term control. The efficacy of the biocontrol agent viz., *Phakospora aroda* (Har. and Pat.) Mains, a rust fungus, released and established in Hawaii, is not yet known.

Cestrum parqui (Lam.) L'Hér.

Native : Central and South America

Family : Solanaceae

Synonyms : *Cestrum campestre* Griseb.
C. foetidissimum Jacq.

Common names : Green cestrum, green poison berry, willow-leafed jessamine

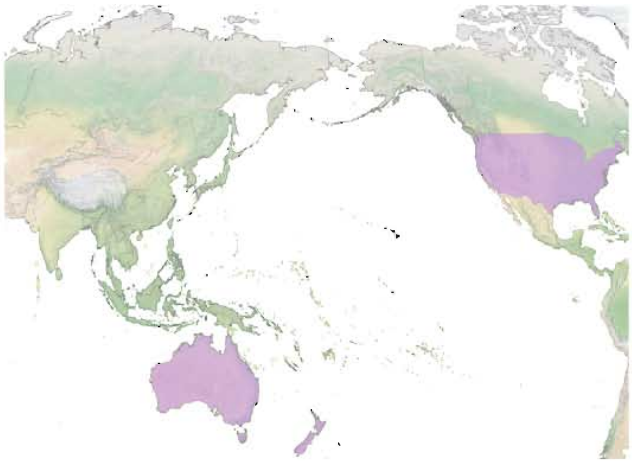
Cestrum parqui prefers moist habitats but is commonly found along roadsides and neglected, disturbed and abandoned sites. All parts of the plant are toxic and is responsible for the death of cattle, other animals and poultry around the world. It is also toxic to humans. The plant is long-lived and usually produces new growth in the spring. Seeds, which are generally dispersed by birds, will remain dormant in the soil for many years. The plant can regrow from cut root pieces. Its leaves emit a strong unpleasant smell when crushed.

Description : Perennial shrubs, to 2 - 3 m tall. Stem light green, brittle. Leaves simple, alternate, lamina 2 - 12 x 0.5 - 3 cm, lanceolate to narrow-ovate, minutely puberulent when young, glabrous at maturity, base attenuate or cuneate, apex acute to short-acuminate; petiole to 1 cm long. Inflorescence paniculate, dense, branches more or less puberulent. Flowers greenish-yellow or pale brownish-yellow, funnel-shaped, subsessile or shortly pedicellate, to 25 mm long, fragrant nocturnally. Fruit 7 - 10 x 6 - 8 mm, broad-ovoid to broad-ellipsoid (egg-shaped), glossy, black or purplish-black. Seeds, 1 - 2 per fruit, irregular in shape with sharp angles, 3 - 4 mm.

Habitat : Common in alluvial river flats, riverbanks and remnant bushland on both shale and sandstone soils and anywhere with warm atmospheric temperature and high rainfall. In its introduced range, the plant invades moist habitats along drainage lines and bushland pockets where thickets dominate preventing growth and regeneration of native species.

Threat and damage : It competes strongly with bush and pasture for living space. Because of its extensive shallow root system, vigorous regrowth and long life span of seeds, the plant is extremely difficult to control. On alluvial flats it is known to outcompete most native vegetation. The plant may cause contact dermatitis in some people.

Uses : Grown as an ornamental hedge plant.



Distribution : Australia, New Zealand, United States.

Management : Repeated cutting or digging up and removing all plant parts including roots are useful. Use of mulch to cover and suppress seedlings has also been successfully tried. Spot spray and basal bark application using picloram and triclopyr during late spring to early autumn is effective. Biological control is unknown.

Chromolaena odorata (L.) King & H. Rob.

Native : Tropical America

Family : Asteraceae

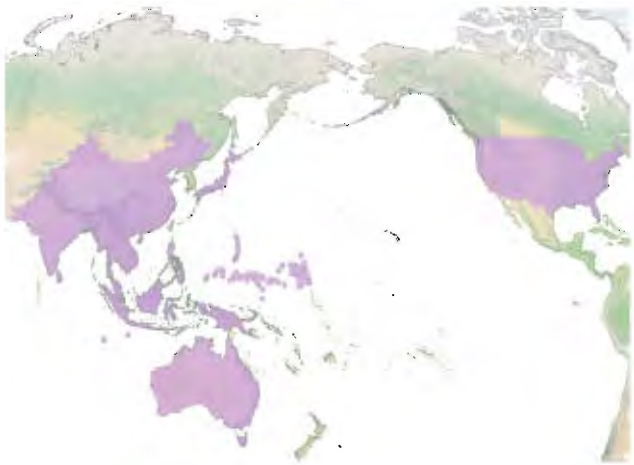
Synonyms : *Eupatorium clematitis* DC.
E. conyzoides Vahl., *E. odoratum* L.

Common names : Bitter bush, chromolaena, jack in the bush, Siam weed, triffid weed

Chromolaena odorata, a fast growing invasive shrub, was introduced inadvertently into the tropical regions of Asia, Africa and the Pacific. It can form dense stands that prevent the establishment of native plants. *Chromolaena* is one among the top 100 of the world's worst invaders. The plants can set seed within a year of growth. Seed production is prolific but the viability is only 20 - 46 percent. Seeds can survive up to five years, whether on the surface of the soil or buried. The root system is fibrous and does not penetrate beyond 20 - 30 cm in most soils.

Description : Perennial shrubs, 1.5 - 6 m tall, branches and branchlets glandular hairy. Leaves opposite, to 12 x 8 cm, ovate, acute at apex, cuneate at base, crenate, hispid, basally 2 or 3 nerved; petiole 2-3 cm long. Inflorescence heads to 1 cm in length, in terminal corymbose cymes; bracts 3 - 5, seriate, up to 8 mm long, ovate, obtuse, outer smaller, inner linear, acute, three-ribbed. Flowers few to many, similar, bisexual, ca. 5 mm long, white, tubular, five-lobed, pubescent at apex. Fruit an achene, ca. 4 mm long, linear, five-angled, scabrous, black; pappus many, 4 - 7 mm long, setaceous, yellowish. Seeds small, dark coloured, narrow, oblong, 3 - 5 x 1 mm.

Habitat : Grows on a wide range of soils and vegetation types. It is of common occurrence around peripheries of natural forests, in cultivated lands, abandoned or neglected fields, wastelands, grasslands, arid lands (with annual rainfall less than 500 mm), pastures, plantations, clearings, shrub jungles, nurseries, roadsides, riverbanks, thatched roofs, rocky areas, and slash and burnt areas. It has a negative relationship with tree canopy cover and appears to be most abundant on the edge of forested areas. In Northeastern India, the weed is regarded as a nutrient-demanding early successional species. It takes advantage of the flush of soil nitrogen that becomes available after a disturbance like fire or land clearing for agriculture and exhibits relatively high foliar nitrogen, phosphorus and potassium content.



Distribution : Australia, Bangladesh, Bhutan, Brunei, Cambodia, China, Christmas Island, Coco (Keeling) Islands, Federated States of Micronesia, Fiji, Guam, India, Indonesia, Japan, Lao PDR, Malaysia, Marshall Islands, Myanmar, Nepal, Northern Mariana Islands, Pakistan, Palau, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand, Timor-Leste, United States, Viet Nam.

Threat and damage : As a major weed in fallow lands, plantations and croplands, chromolaena prevents establishment of native species due to competition and allelopathic effects. It is also a fire hazard in summer when the plants dry up. The plant can cause

asthma in allergy-prone people. Chromolaena shades and overtakes nesting sites creating fibrous root mats unsuitable for egg chamber and nest construction.

Uses : The plant is sometimes used in slash-and-burn agriculture to compete with *Imperata cylindrica* (L.) P. Beauv., which is harder to control. It is used in traditional medicine in countries like Indonesia. In India, young leaves of the plant are crushed, and the resulting liquid is used to treat skin wounds.

Management : Manual slashing and use of bush-cutter are common methods of physical control. Chemical control using herbicides applied at the seedling stage or on regrowth has given encouraging results. Triclopyr has proven to be the most effective among the herbicides. *Pareuchaetes pseudoinsulata* Rego Barros, a leaf-feeding insect, introduced into Guam and elsewhere, has been effective in controlling the weed. The stem gall fly *Cecidochares connexa* Macquart is also a suitable biological control agent and is released widely.