

Kudzu

(*Pueraria lobata*)

An Alien Plant Report

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In cooperation with:
American Water Works Association Research Foundation
Maui County Board of Water Supply

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What is Kudzu? Why is it bad?

Kudzu is a climbing, semi-woody, vine with deciduous, lobed leaves. Kudzu covers more acreage in the southeast United States than any other plant species and forms a dense canopy, smothering vegetation, fences, forests, pastures, and farm land. On Maui, kudzu is currently found in Keanae, Wailua, and Nahiku, on the windward north shore.



What should you do if you see this plant?

1. Call the HEAR project at 572-4418.
2. Dig out the root of the vine, if possible. Otherwise, cut the vine near the root of the plant, and treat with an herbicide.
3. For more information or additional copies of this flyer, call 572-4418 or websurf to www.hear.org.



Kudzu smothering hau thicket in Keanae, Maui

You can help keep Maui no ka oi.



United States Geological Survey
Biological Resources Division



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Overview: Kudzu (*Pueraria lobata*) covers more area in the southeastern United States than any other plant species. A plant spread originally for its edible tuber roots, kudzu has a history of invasiveness that is hard to ignore. Kudzu was first collected on Hawai'i in 1915, however, Degener (1934) states that it probably was introduced to Hawai'i by the Chinese during the latter part of the 19th century. Today, kudzu is present on Kaua'i, O'ahu, Maui, and Hawai'i (Wagner et al. 1990). On Maui, kudzu can be seen along the Hana Highway in low elevation, wet areas in the Honomanu, Wailua, Keanae, and Nahiku areas. In these areas, kudzu threatens taro loi and natural areas. Despite its invasive history, there is very little being done about it on Maui, where it may still be a winnable battle due to its restricted distribution. To date, no seeds have been found. Kudzu may be locally controllable in Keanae and perhaps in Honomanu. It is probably not eradicable in Wailua, but it may be possible to knock it back to the road and prevent mauka spread. Additional mapping needs to be done to refine the upper border above the Hana highway. October may be the best time for mapping as it is easiest to see at this time. Phenology data needs to be taken as kudzu is very difficult to spot when deciduous. Control trials should be done. Stump / frill methods may work the best. Other infestations in the Hawaiian islands should be documented.

Potential for public involvement: The public can help prevent the spread of kudzu by not planting it, looking for new locations, and controlling small satellite populations. Areas of high agricultural, historical, and biological value should also be protected from infestations of kudzu. Residents in the watershed in Keanae, Wailua, and Nahiku areas may be most affected by kudzu as it can invade taro loi and farm sites. Public awareness efforts such as flyers should begin in these areas to help prevent future spread of kudzu into new areas.

Common name: Kudzu, kudsu, kudzu vine, Japanese arrowroot

Latin name: *Pueraria lobata* (Willd.) Ohwi (Wagner et al 1990)

Synonyms: *Dolichos lobatus* Willd.; *Pueraria hirsuta*; *P. thunbergiana* (Siebold & Zucc.) Benth. (Botanica, Wagner et al 1990).

Taxonomy: In the Fabaceae (pea) family, a cosmopolitan family, the third largest of the angiosperms, comprising about 650 genera and about 18,000 species (Wagner et al. 1990). *Pueraria* is a variable genus of about 17 species, all confined to southeastern Asia, Malesia, and the western Pacific. It belongs to tribe *Phaseoleae* with medium-sized to large leaves, unspecialized styles, and long, many-seeded pods. Two species, *Pueraria phaseoloides* (Roxb.) Benth. and *P. lobata*, are widely cultivated in many tropical countries; they tend to naturalize and sometimes become pests. Named in honor of Marc Nicolas Puerari (1766-1845), a Swiss botanist who spent most of his life as a professor at

Copenhagen (Wagner et al. 1990) Two of the three varieties distinguished by van der Maesen (1985) occur in the Hawaiian Islands: var. *lobata* [including *Pueraria thunbergiana*] and var *thomsoni*, weakly distinguished by its tendency to have larger flowers, stronger overlapping calyx lobes, the lower calyx lobes not much longer than the others, and subentire leaflets. Variety *thomsoni* is only on Kaua'i (Herbst 2219, BISH) (Wagner et al. 1990).

Description: Kudzu is a climbing, semi-woody, perennial vine. Deciduous leaves are alternate and compound, with three broad leaflets up to 4 inches across. Leaflets may be entire or deeply 2-3 lobed with hairy margins. Individual flowers, about 1/2 inch long, are purple, highly fragrant and borne in long hanging clusters. Flowering occurs in late summer and is soon followed by production of brown, hairy, flattened, seed pods, each of which contains three to ten hard seeds.

Twining or sprawling herbs; stems somewhat woody, appressed pubescent, tubers fusiform, 60-90 cm long. Leaflets ovate, the terminal one usually 3-lobed, the lateral ones similarly 2(3)-lobed, 8-20 cm long, 5-19 cm wide, pubescent, apex acuminate, stipules 2-2.5 cm long, produced above and below the point of insertion. Flowers in pseudoracemes 10-40 cm long; calyx with long, conspicuously imbricate lobes; corolla blue or purple to pink, standard with a yellow central patch, 15-25 mm long, keel darker in color. Pods 4-13 cm long, .6-1.3 cm wide, dehiscent, villous. Seeds (5-)10-15, reddish brown with black mosaic, ovoid to ellipsoid, slightly laterally flattened, 4-5 mm long, ca. 4 mm wide (Wagner et al. 1990).

Value to humans: Kudzu was introduced into the United States in 1876 at the Philadelphia Centennial Exposition, where it was promoted as a forage crop and an ornamental plant. From 1935 to the mid-1950's, farmers in the south were encouraged to plant kudzu to reduce soil erosion, and Franklin D. Roosevelt's Civilian Conservation Corps planted it widely for many years. It is suitable for growing as a groundcover, for screening an unsightly building, or for covering a tall tree stump. Where not hardy, it may also be grown as an annual (Turner and Wasson 1997). Kudzu can also be cultivated for the edible tubers, but largely replaced by *Ipomoea batatas* and *Manihot esculenta* (Wagner et al. 1990).

Noxious weed acts: Kudzu was recognized as a pest weed by the U.S. Department of Agriculture and, in 1953, was removed from its list of permissible cover plants. In 1970, the USDA began listing kudzu as a common weed in the south. The Florida Exotic Pest Plant Council featured kudzu in their list of Florida's most invasive species in 1997.

Problems: Kudzu grows rapidly, choking out competing vegetation in sunny areas. Climbing vines may completely cover and shade out trees, and may cover and damage buildings, overhead wires, and other structures. Kudzu kills or degrades other plants by smothering them under a solid blanket of leaves, by girdling woody stems and tree trunks, and by breaking branches or uprooting entire trees and shrubs through the sheer force of its weight. Once established, kudzu plants grow rapidly, extending as much as 60 feet per season at a rate of about one foot per day. This vigorous vine may extend 32-100

feet in length, with stems 1/2 - 4 inches in diameter. Kudzu roots are fleshy, with massive tap roots 7 inches or more in diameter, 6 feet or more in length, and weighing as much as 400 pounds. As many as thirty vines may grow from a single root crown (Cacek 1998). Kudzu is reported as one of the weeds of greatest concern in the Great Smoky Mountains National Park and is said to be capable of replacing native vegetation through rapid vegetative expansion (Loope 1992). In Maui, kudzu threatens nearby taro loi and natural areas.

Native range: Native to southeastern Asia from India, China, and Japan, perhaps also Malesia (Wagner et al. 1990).

Global range of invasion: Kudzu is common throughout most of the southeastern United States and has been found as far north as Pennsylvania, where it was first introduced in 1876. Today, kudzu is common in Alabama, Georgia, Mississippi, Tennessee, the Carolinas, Kentucky, Virginia, Maryland, and west to Texas and Oklahoma (Edwards 1982). Kudzu has been reported in New York, Illinois, Iowa, Nebraska, and Washington (Shurtleff and Aoyagi 1977). It has also been observed at Biscayne and Everglades national parks in Florida. Kudzu has also invaded eastern Australia (Lazarides et al. 1997).

Range of invasion in the State of Hawaii: In Hawai'i kudzu is naturalized in low elevation disturbed areas, at least up to 700 m (2,297 ft), on Kaua'i, O'ahu, Maui, and Hawai'i.

Range of invasion on Maui: On Maui, kudzu can be found in low elevation wet areas along the Hana Highway in Keanae, Wailua, and Nahiku. In Honomanu valley, at sea level, kudzu can be seen below the road, climbing the valley walls. At Keanae kudzu smothers hau thickets and is poised to invade taro loi. At Wailua, kudzu can be also be seen climbing the valley walls and other vegetation. In some areas near Wailua, kudzu is also above the road. Due to the rough terrain, it is not yet known how far above the road kudzu has reached and this warrants further investigation. At Nahiku, kudzu can be seen just below the road sprawling near a stream.

Climate where invading: Kudzu grows well under a wide range of conditions and in most soil types. Preferred habitats are forest edges, abandoned fields, roadsides, and disturbed areas, where sunlight is abundant. Kudzu grows best where winters are mild, summer temperatures are above 80 degrees Fahrenheit, and annual rainfall is 40 inches or more (Cacek 1998). In Hawai'i, kudzu is invading low elevation, wet, disturbed areas. On Maui, it appears to be persisting and spreading in areas with long histories of human occupation.

Biology and Ecology: The spread of kudzu in the United States is currently limited to vegetative expansion by runners and rhizomes and by vines that root at the nodes to form new plants. Kudzu also spreads somewhat through seeds, which are contained in pods, and which mature in the fall. However, only one or two viable seeds are produced per cluster of pods and these hard-coated seeds may not germinate for several years (Cacek

1998). Kudzu colonies in southern Illinois were found producing large quantities of viable seed in the summer of 1997, according to Bill McClain of the Illinois Division of Natural Heritage. The vines are deciduous but survive the winters even this far north. The fruits did not split open as readily as those of some other legumes, but when Dr. John Ebinger collected seeds, rinsed them in Clorox solution, scarified them, and put them in a petri dish on a damp paper towel, 100% germinated (The Nature Conservancy 1998).

There are also a few unverified reports that kudzu was found producing seed at a few sites in the southeast in the summer of 1997. It had been thought that kudzu rarely, if ever, produced seeds in North America, presumably because it requires a specific insect pollinator that had not become established here. Failure to produce seed was thought to prevent kudzu from becoming even more widespread and invasive. Apparently something has changed (The Nature Conservancy 1998).

Fujita et al. (1993) found that kudzu was the most shade tolerant legume among the species in their study. They felt this was mainly due to higher activities of dinitrogen fixation and shoot growth at the expense of root growth.

Physical control: For successful long term control of kudzu, the extensive root system must be destroyed. Any remaining root crowns can lead to reinfestation of an area. Mechanical methods involve cutting vines just above ground level and destroying all cut material. Close mowing every month for two growing seasons or repeated cultivation may be effective. Cut kudzu can be fed to livestock, burned or enclosed in plastic bags and sent to a landfill. If conducted in the spring, cutting must be repeated as regrowth appears to exhaust the plant's stored carbohydrate reserves. Kudzu has also been controlled by flaming. This process uses a kerosene torch which is placed over the foliage. This wilts the leaves and defoliates the plant. For flaming, follow the same schedule as cutting. Where all foliage can be reached, this process may be more successful than cutting (Cacek 1998). Grubbing plants out, tuberous root and all, is another way to physically remove kudzu. This is an effective, yet destructive and laborious control method. Tunison and Zimmer (1992) reported that digging up the root at Hawaii Volcanoes National Park was the most effective control method for localized populations and that the suggested 2% roundup treatment was only partially effective. Kudzu can also be controlled by grazing animals, such as cattle or goats, and is actually a favored food.

Chemical control: Late season cutting should be followed up with immediate application of a systemic herbicide (e.g., glyphosate) to cut stems, to encourage transport of the herbicide into the root system. Repeated applications of several soil-active herbicides have been used effectively on large infestations in forestry situations.

Biological control: Efforts are being organized by the U.S. Forest Service to begin a search for biological control agents for kudzu. In the United States, kudzu vines may be attacked by a root knot nematode (*Meloidogyne* sp.), a "blackleg" fungus disease, a viral mosaic disease, and a rust fungus (Shurtleff and Aoyagi 1977). These pests are not known to kill kudzu plants, but do cause mild injury.

Management recommendations: Kudzu is an invasive plant that is located at low elevations near the east Maui watershed. More refined mapping of the populations needs to occur. Though extremely invasive in the southeastern United States, there is not much awareness of its presence here on Maui. Kudzu threatens agricultural sites, such as taro loi or watercress farms. Localized populations could be controlled in these areas and the public can help by reporting new locations of kudzu, especially above the Hana Highway or in remote rainforest areas. Kudzu should not be spread further and public education as to the harmful attributes of kudzu should be publicized to prevent further spread. Monitoring should occur to gain better knowledge of how quickly kudzu spreads. Populations should be monitored for seed production. No seeds have been found to date on Maui but should kudzu begin to seed, kudzu could begin to spread much more rapidly.

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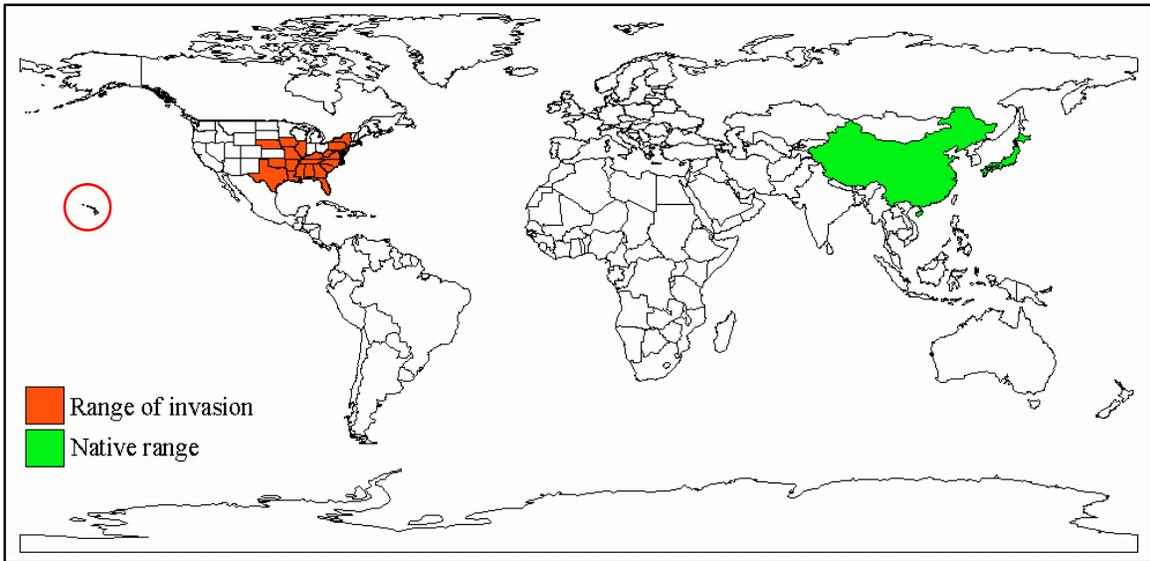
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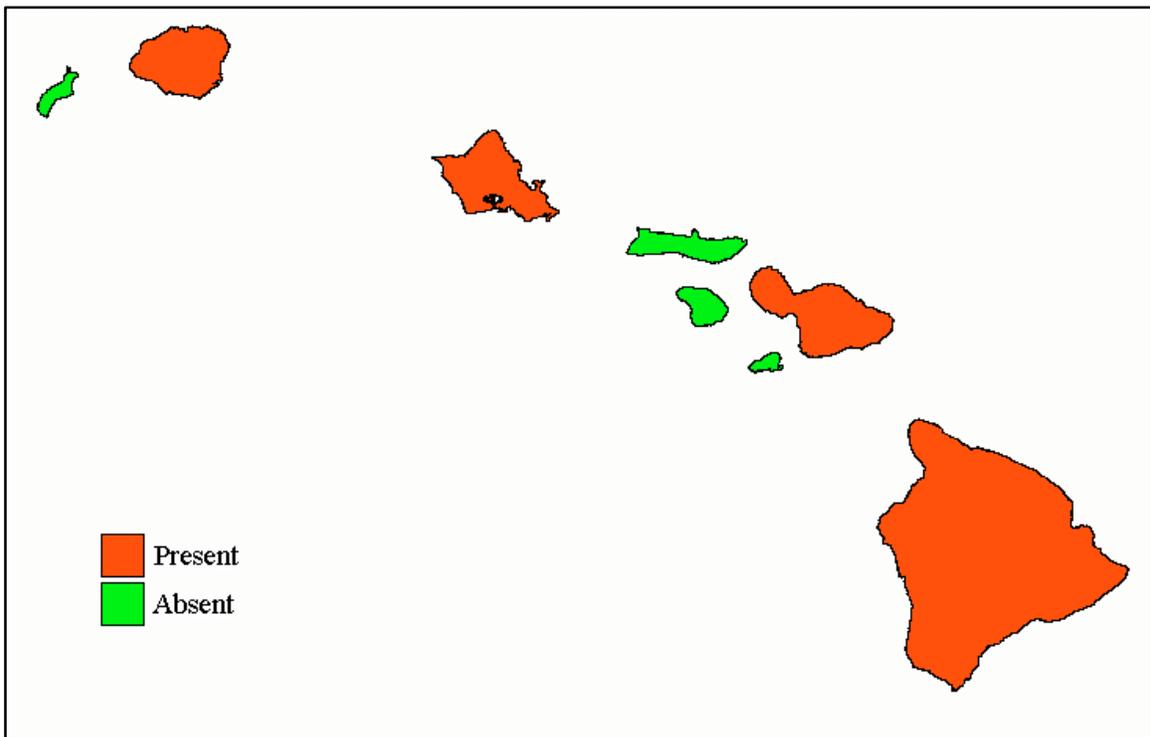
Kudzu root - Honomanu, Maui



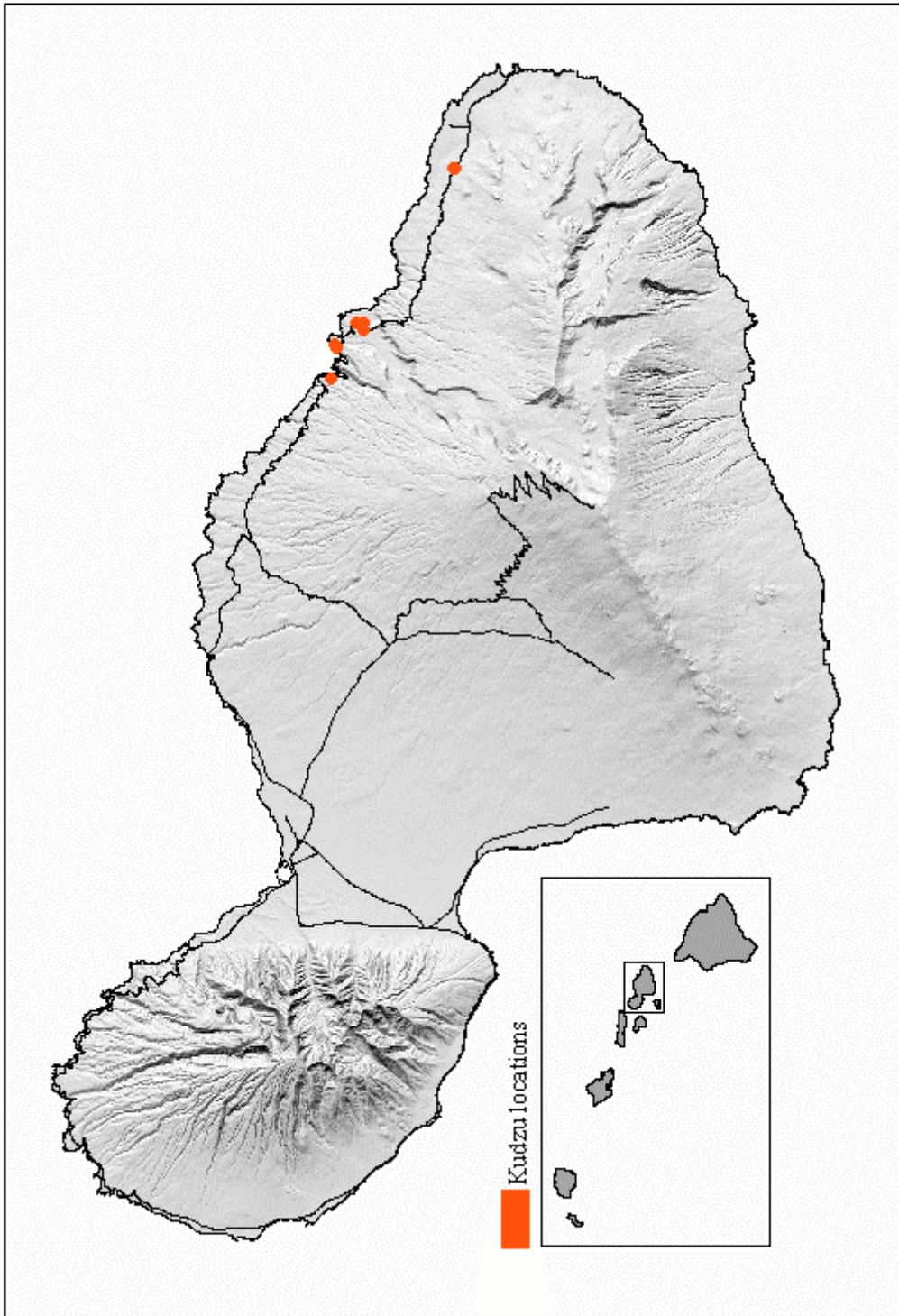
Kudzu (*Pueraria lobata*) leaf showing rust color before dropping for winter - Keanae, Maui



Known global distribution of kudzu



Known distribution of kudzu in the State of Hawai'i, U.S.A.



Known distribution of kudzu on the island of Maui, State of Hawai'i



Area of kudzu invasion - Honomanu, Maui



Area of kudzu invasion - Wailua, Maui