redroot pigweed
Amaranthus retroflexus L.

Synonyms: *Amaranthus retroflexus* var. *salicifolius* I. M. Johnston
Other common names: careless weed, common amaranth, green amaranth, pigweed, pigweed amaranth, redroot amaranth, rough pigweed, wild-beet amaranth
Family: Amaranthaceae

Invasiveness Rank: **45** The invasiveness rank is calculated based on a species' ecological impacts, biological attributes, distribution, and response to control measures. The ranks are scaled from 0 to 100, with 0 representing a plant that poses no threat to native ecosystems and 100 representing a plant that poses a major threat to native ecosystems.

Description
Redroot pigweed is an annual plant that grows 20 to 150 cm tall from a taproot. Taproots can penetrate up to 1 m deep. Plants are densely to moderately hairy. Stems are round to angled, erect, single or branched, and reddish near the base. Leaves are gray-green, petiolated, ovate to rhombic-ovate, pointed at the tips, 2 to 15 cm long, and 1 to 7 cm wide with entire margins and hairs on the veins on the lower surfaces. Petioles are 1.5 to 6 cm long. Flowers are small and are arranged in short-branched, axillary and terminal inflorescences. Bracts are needle-shaped or spiny. Inflorescences are green to silver-green and erect or reflexed at the tip. The perianth is composed of five segments. Capsules are obovoid to nearly spherical and 1.5 to 2.5 mm long with a single seed each and tops that open circumferentially. Seeds are black to red-brown, lenticular, smooth, shiny, and 1 to 1.3 mm long (Hultén 1968, Mosyakin and Robertson 2003, eFloras 2008, Sokolova 2009).

Amaranthus retroflexus L. Photo by R. Vidéki.

Similar species: Redroot pigweed is an extremely variable species; however, no other species in Alaska are expected to be confused with redroot pigweed (Hulten 1968).

Inflorescence of *Amaranthus retroflexus* L. Photo by R. Vidéki.

Ecological Impact
Impact on community composition, structure, and interactions: Redroot pigweed rapidly colonizes disturbed areas and can grow at high densities in agricultural fields, significantly reducing crop yields (Costea et al. 2004); it may therefore increase the density of vegetation and reduce native plant populations in disturbed areas in Alaska. However,

populations are not likely to persist more than one or two years when natural successional processes are allowed to proceed (Hultén 1968, Costea et al. 2004). Redroot pigweed contains toxic oxalates, which can form precipitates with metallic cations when ingested. High nitrogen levels in the soil, partial drought, and low light levels favor the accumulation of toxic nitrates in this species. Illness or death can result when animals ingest plants with high nitrate concentrations (Walsh 1993, Herbarium of the University of Georgia 2002, Costea et al. 2004). Wind-borne pollen can cause allergic reactions in people. Domestic herbivores are known to consume young plants, and insects, small mammals, and birds commonly consume seeds. Although insect pollination has been recorded for redroot pigweed, flowers are most often pollinated by wind (Costea et al. 2004); therefore, the presence of this species is unlikely to have major impacts on native plant-pollinator interactions. This species is a known host for many nematodes, fungi, and plant diseases (Costea et al. 2004).

Impact on ecosystem processes: Redroot pigweed reduces the availability of light, moisture, and nutrients for surrounding plants in agricultural fields. It is a pioneer species and likely reduces nutrients and moisture in disturbed areas as well. However, this species is often replaced by other vegetation in one to two years if natural successional processes are allowed to proceed (Costea et al. 2004).

Biology and Invasive Potential

Reproductive potential: Redroot pigweed reproduces by seed only. It is able to self fertilize, and seed production is prolific; figures of up to 1,900,000 seeds per plant have been reported. Plants that emerge late in the growing season are still able to produce seeds (Costea et al. 2004). Seeds often remain viable in the soil for 6 to 10 years. In Michigan, 2% of seeds germinated after being buried in soil for 40 years. Seed longevity increases as the depth at which seeds are buried increases (Costea et al. 2004).

Role of disturbance in establishment: Redroot pigweed rapidly colonizes open disturbed areas but does not invade closed plant communities unless gaps are created by disturbances (Costea et al. 2004). Plant height, vegetation biomass, and reproductive biomass increase significantly as the size of gaps increases (McConnaughay and Bazzaz 1987). This species only persists in regularly disturbed areas (Hultén 1968, Costea et al. 2004). In Canada and Alaska, it grows in agricultural fields, gardens, abandoned fields, waste places, and disturbed areas, and populations are often located near places of human habitation (Costea et al. 2004, Klinkenberg 2010, AKEPIC 2011).

Potential for long-distance dispersal: Most seeds land within 2 m of the parent plant; however, seeds are small and can be dispersed short distances by wind. They can also be transported when dried inflorescences are blown across snow during winter. Seeds float and can be dispersed in runoff and other moving water. Birds and small mammals commonly consume the seeds; seeds can survive ingestion and are dispersed in excrement (Costea et al. 2004).

Potential to be spread by human activity: Seeds can be dispersed by farm machinery, livestock, and the spreading of manure (Costea et al. 2004). Redroot pigweed has been identified as a contaminant in hay and straw imported from Washington and Oregon (Conn et al. 2010).

Germination requirements: Plants growing in nutrient-poor soils produce more dormant seeds than plants growing in nutrient-rich soils. Germination is favored by light, alternating temperatures, high temperatures, sufficient soil moisture, and scarification. Non-dormant seeds can germinate at temperatures as low as 8°C; however, the optimal temperature range for germination is 25°C to 40°C (Costea et al. 2004).

Growth requirements: Redroot pigweed tolerates a broad range of soil types, textures, and pH levels. In Nebraska, it was most often associated with sites that had higher soil pH, organic matter content, and nitrogen-nitrate content, and lower phosphate and extractable potassium contents. Seeds require at least 30 days to reach maturity after flowers are fertilized. Redroot pigweed has a C_4 photosynthetic pathway and therefore has reduced photosynthetic capacity at lower temperatures; the base temperature necessary for seedling shoot elongation is 14.4°C, and the optimal temperature is 32.9°C (Costea el al. 2004).

Congeneric weeds: *Amaranthus* species are considered noxious in Alaska. Tumbleweed amaranth (*A. albus*) is considered a noxious weed in Manitoba, and prostrate pigweed (*A. blitoides*) is considered a noxious weed in Minnesota (Invaders 2011). Several *Amaranthus* species are known to occur as non-native weeds in the western U.S. (DiTomaso and Healy 2007).

Legal Listings

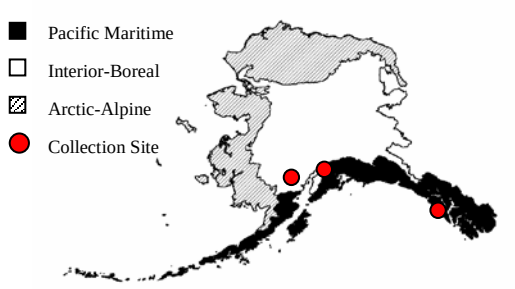
- ☐ Has not been declared noxious
- ☐ Listed noxious in Alaska
- ☒ Listed noxious by other states (MN)
- ☐ Federal noxious weed
- ☒ Listed noxious in Canada or other countries (MB, QC; nuisance weed in AB)

Distribution and Abundance

Redroot pigweed is a weed of 60 crops in 70 countries, including Pakistan, Russia, China, Canada, and the U.S. (Costea et al. 2004, eFloras 2008, Sokolova 2009). Infestations in agricultural fields reduce crop yield and quality (Costea et al. 2004). Redroot pigweed grows in stream valleys in North America (Walsh 1993) and has been documented invading disturbed riparian

communities along the Adour River in southwestern France (Planty-Tabacchi et al. 1996) and in the Rio Grande Valley in New Mexico (Battacharjee et al. 2008).

Native and current distribution: Redroot pigweed is native to eastern and central North America. It has been introduced to all inhabited continents (Mosyakin and Robertson 2003) and has been documented from arctic regions in central Russia (Sokolova and Budrevskaya 2003). It grows in all states of the U.S. and most of Canada (USDA 2011). Redroot pigweed has been documented from the Pacific Maritime and Interior-Boreal ecogeographic regions of Alaska (Hultén 1968, AKEPIC 2011, UAM 2011).



Distribution of redroot pigweed in Alaska

Management

Control of redroot pigweed may not be necessary in some cases because populations in disturbed areas are displaced by other vegetation after one to two years of natural succession. Most control methods documented are specific to agricultural systems. Populations can be contained by mowing before flowering and seed set. Emergence can be reduced by applying a layer of mulch. New shoot buds cannot develop from the roots. *Amaranthus* species are susceptible to most herbicides. However, some strains of redroot pigweed associated with agriculture have developed resistance to the following herbicides: atrazine, simazine, imazethapyr, thifensulfuron, and linuron. Several insect species have been tested as prospective biological control agents, but none have provided effective control (Costea et al. 2004). *Phomopsis amaranthicola*, a fungus specific to the *Amaranthus* genus, has proven effective in controlling several *Amaranthus* species under field conditions (Rosskopf et al. 2000).

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