WRITTEN FINDINGS OF THE
WASHINGTON STATE NOXIOUS WEED CONTROL BOARD
Updated 2014

Scientific Name: *Cytisus scoparius* (L.) Link.

Synonyms: *Cytisus scoparius* subsp. *andreanus* (Puiss.) Dippel, *Cytisus scoparius* var. *andreanus* (Puiss.) Dippel, *Cytisus scoparius* var. *prostratus* (C. Bailey) F. Hanb. ex A. K. Jacks., *Cytisus scoparius* f. *sulphureus* (Goldring) Rehder, *Cytisus scoparius* var. *sulphureus* Goldring, *Genista andreana* Puiss., *Genista scoparia* (L.) Lam., *Sarothamnus scoparius* (L.) Wimm. ex W. D. J. Koch, *Sarothamnus scoparius* var. *prostratus* C. Bailey, *Sarothamnus vulgaris* Wimm., *Spartium scoparium* L.

Common Name: Scotch broom, Scots broom, common broom, English broom

Family: Fabaceae

Legal Status: Class B noxious weed (1988)

Images: left, blooming infestation along I-5 in western Washington; center, individual plant in bloom; right, dense infestation with green stems, after seed pods opened; all images WSNWCB.

Description and Variation:

Overall habit:

Cytisus scoparius is a branching shrub, ranging in height from 3 feet to 10 feet tall. Young stems are dark green with ridges and leaves are simple or divided into three leaflets. Flowers are yellow, sometimes having red coloring, and bloom in the spring. Seed pods mature to dark brown to black and have hairy margins.

Roots:

Cytisus scoparius roots has have nitrogen-fixing bacteria (*Rhizobium* sp.) located in nodules on its roots, which are capable of fixing up to 111 kg N ha^{-1} yr^{-1} in aboveground tissues and returning 17 kg N ha^{-1} yr^{-1} to the soil by leaf and stem litter (Watt et al. 2003 in Harrington 2014).

Stems:

Young stems are dark green, stiff and angled, often star-shaped in cross-section, with young stems having five green ridges. Ridges have waxy hairs (DiTomaso et al. 2013). The green stems can photosynthesize all year (Nilsen et al. 1993). Older stems are glabrous and do not have distinct ridges (Bossard et al. 2000). Branches can be leafless, or have few leaves.

Leaves:

Leaves are alternately arranged and are simple or divided into three leaflets. Often the lower leaves are divided (compound) and have petioles, while upper leaves are simple and lack petioles. Leaflets are oblong, being widest towards the tip, and pointed at both ends, 5-20 mm long (DiTomaso et al. 2013, DiTomaso and Healy 2007). Their upper surface is glabrous or nearly glabrous while the undersides of the leaves are sparse to densely covered with flattened, short hairs (DiTomaso and Healy 2007). Leaves are deciduous and may drop early in the summer if the plant is under stress.

Images: left, three-parted leaves; center, blooming yellow flowers and flower buds; right, yellow flowers with orange-red markings, all images WSNWCB.

Flowers:

Flowers occur singly or in pairs in leaf axils on pedicels that are less than 12 mm (0.5 inches) (DiTomaso et al. 2013, Bossard et al. 2000). The calyx (sepals) is cup-shaped and bilabiate, with the upper lip two-lobed and the lower lip three-lobed (Hitchcock et al. 1961). The flowers have five petals and are pea-like—with a banner, wing and keel. Flowers are 2-3 cm long, bright yellow and occasionally with red-maroon markings. They have 10 stamens, with 4 longer than the other 6, and the style is strongly curved and longer than the keel (Hitchcock et al. 1961).

Fruit:

The mature fruit are dark brown to black pods, 2-5 cm long, and are glabrous except for hairs along the seams (Peterson and Prasad 1998). Each pod contains 3 to 12 dark, shiny seeds that are round or oval-shaped and have a cream to yellow eliaosome (Hickman 1993 in Bossard et al. 2000). When the pod is mature, the two halves audibly split apart, wrapping in alternate directions, and the seeds are catapulted (Peterson and Prasad 1998).

Images: left, immature seed pod with hairy margins; center, abundant immature seed pods on stems; right, spent seed pods with twisted halves, all images WSNWCB.

Similar species:

Other brooms are present and weedy in Washington and other states along the west coast. Key features differentiating some similar broom species are outlined in the table below (DiTomaso and Healy 2007, LeBlanc 2001, and Oneto et al. 2009).

Species	Stems	Leaves	Flowers	Fruit	Distribution
Scotch broom: *Cytisus scoparius* Class B noxious weed	Young stems prominently ridged, 5 angled in cross-section	Divided into 3 leaflets or simple; deciduous, may drop early in drought stress	Bright yellow; sometimes with red markings; in leaf axils, solitary or in pairs, ½-1 inch; calyx hairless	Mature pods 1 to 2.5 inches long; hairy only on the margins	All over western WA, limited areas in eastern WA
French broom: *Genista monspessulana* Class A noxious weed	Stems with 8-10 ridges, round in cross-section	All divided into 3 leaflets, more persistent on plant than Scotch broom, can be evergreen; usually dense	Yellow; in clusters of 4-10 at tips of short axillary branchlets; calyx covered in short hairs	Pods about 0.5 to 1.25 inches long; densely covered in long hairs	Only 1 escaped site documented in WA, in Seattle
Spanish broom: *Spartium junceum* Class A noxious weed	Stems finely ribbed, round in cross-section	All leaves simple; plants often appear leafless	Yellow; in clusters (racemes) at stem tips	Pods about 1.5 to 4.3 inches long; densely covered with long hairs	Limited plants found
Portuguese broom: *Cytisus striatus* Not listed as a noxious weed	Stems with 8-10 ridges, round in cross-section	Similar leaf pattern to Scotch broom	Yellow; single or in pairs in leaf axils; calyx covered with short hairs	Pods 0.5 to 2 inches long; densely covered with long hairs	Not documented in WA; a few herbarium records from OR, CA, and British Columbia

Image: gorse stem tip with spines.

Gorse, *Ulex europaeus*, is another invasive shrub in the Fabaceae family and is listed as a Class B noxious weed in Washington. It is easily distinguished from these other broom species by spines that occur along its branches, in leaf axils and at stem tips (see image).

Cultivars:

Cultivars of *Cytisus scoparius* have been sold in the nursery trade. The cultivar 'Moonlight' is compact, growing to 30 inches tall, with large, pale sulfur-yellow flowers, 0.5 inches long (Brickell and Zuk 1997).
This cultivar was planted in the past along some of western

Washington's highways. There are other cultivars of *C. scoparius* that can be found in the in the trade including 'Andreanus' and 'Firefly'.

Habitat:
Cytisus scoparius grows in a wide variety of habitats, from disturbed areas such as riverbanks, roadsides, forest clear cuts, power line right-of-ways and also in undisturbed habitats such as grasslands, shrublands, open canopy forests, prairies, and oak woodlands (Bossard 2000, Bossard and Rejmánek 1994 in Oento et al. 2010, LeBlanc 2001). It is more commonly found growing in open areas but can survive in low light conditions, such as in a forest understory (Harrington 2007 in Harrington 2009).

Cytisus scoparius grows successfully in a variety of soil types but does best in dry, sandy soils (Gill and Pogge 1974 in Leblanc 2001). Peterson and Prasad (1998) report that the distribution of *C. scoparius* in North America is limited in the north and inland by cold winter temperatures.

Geographic Distribution:
According to the USDA GRIN database, (USDA ARS 2014), *Cytisus scoparius* is native to:

- Europe: Denmark, Ireland, Norway, Sweden, United Kingdom, Austria, Belgium, Czechoslovakia, Germany, Hungary, Netherlands, Poland, Switzerland, Belarus, Lithuania, Moldova, Ukraine, Former Yugoslavia, Italy, Romania, France, Portugal, Spain
- Africa: Portugal's Madeira Islands, Spain's Canary Islands

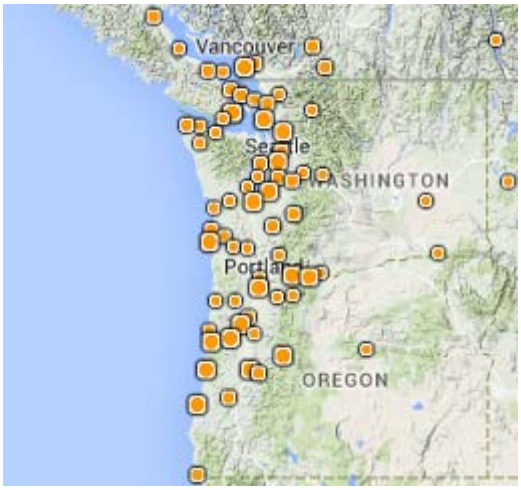
USDA GRIN database (USDA ARS 2014) lists *Cytisus scoparius* naturalized in:

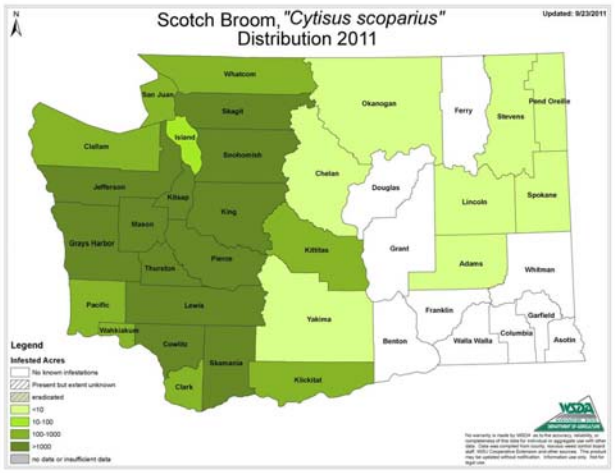
- Portugal (Azores), South Africa
- India
- Australia, New Zealand
- Canada, United States

Listings:
Cytisus scoparius is listed as a noxious weed or on a regulated list in Washington, Oregon, California, Idaho, Montana, Wisconsin, Georgia and South Carolina (EDDMapS 2014).

Cytisus scoparius is also listed on Washington State's Prohibited Plant List (also known as the quarantine list), WAC 16-752, and the sale, purchase, trade and transport of *C. scoparius* and its cultivars are prohibited in the state of Washington.

Washington:
Introduced to Washington in the 1800's as an ornamental plant, the earliest online herbarium record of *Cytisus scoparius* is from King County Washington in June, 1892 (WTU 110082). It was then noted on a specimen collected in 1929 from Thurston County as being "widely naturalized in the prairie and cut over country" (WTU 40935). It is currently widespread over western Washington and has sporadically occurred in many eastern Washington counties, with the most infested acres in eastern Washington being in Kittitas and Klickitat counties (WSDA 2011).





Images: left, map of *Cytisus scoparius* herbarium specimens in Washington, Oregon and southern British Columbia, map Consortium of PNW Herbaria 2014; right, WSDA map displaying county level distribution data in Washington from 2011.

Growth and Development:

Plants grow rapidly their first 3 to 4 years, growing as much as 3 to 4 feet their first year (Oneto et al. 2009). *Cytisus scoparius* then has a period of slower growth for the next 6 to 8 years, followed by a period of senescence with more dead, woody tissue than green (Oneto et al. 2009). Shrubs may live for up to 30 years old (DiTomaso et al. 2013), with the average lifespan typically from 10 to 15 years old, (Peterson and Prasad 1998).

Bud burst and leaf emergence may occur in early spring (February to March), depending on climate conditions (Peterson and Prasad 1998). Plants generally begin to flower when they are three years old but younger plants may flower under the right light and moisture conditions (DiTomaso et al. 2013, Oneto et al. 2009). Flowering each year is generally from April to June, though some flowering may occur at other times. Many insects visit the flowers to collect or feed on its pollen alone, as the flowers have no nectar (Parker 1997, Suzuki 2000 in Suzuki 2003). The first flower visitor must be an insect capable of tripping open a flower because the pollen is kept in the keel petals and flowers do not explode spontaneously. When an insect visits and trips open a flower, the stamens and a pistil protrude from the keel petals, scattering pollen in the air (Suzuki 2003). Bees such as honey bees, *Apis mellifera*, and bumble bees, *Bombus* spp. are effective pollinators of *C. scoparius*, though bumble bees are more common (Faegri and van der Pijl 1971, Proctor et *al*. 1996, Parker 1997 in Suzuki 2003). High fruit and seed sets can be attained by single flower visits of effective pollinators (Suzuki 2003).

Reproduction:

Cytisus scoparius spreads by seed. Seeds have a hard coat and can remain viable for many years in the soil, with estimates ranging from 5 to 20 to even as old as 80 years under ideal conditions (Bossard and Rejmánek 1994, Smith and Harlen 1991, Turner 1933). Seeds have a prolonged period of germination across a broad temperature range (Harrington 2009). Seed pods open explosively, propelling seeds some distance from the parent plant (Magda et al. 2013). In an experiment without branches to interfere, seeds were propelled a mean distance of 2.3 meters, with 10.2% of seeds traveling more than 5 meters (Malo 2004). A small percentage of seeds are not propelled and fall beneath the maternal plant (Malo 2004). Seeds have elaiosomes that attract ants and are responsible for secondary seed dispersal (Van der Pijl 1982; Parker 2000 in Malo 2004).

Shrubs produce an average of 9,650 seeds per year (Bossard and Rejmánek 1994). Seed production is lower by an order of magnitude during drought conditions (Bossard and Rejmánek 1993 in Peterson and Prasard 1998).

Before *Cytisus scoparius* was quarantined in Washington, plants were introduced in ornamental plantings. Seeds are also commonly dispersed by people, being transported on footwear and vehicle tires as well as being moved in seed-contaminated gravels in forest landscapes and highway graders (Boateng 1994 in Peterson and Prasad 1998). Grant County's first documented *C. scoparius* plants grew from seed that came in from soil from western Washington (Denielle Blevins pers. comm.).

Economic Importance:
Detrimental: *Cytisus scoparius* aggressively spreads to form monocultures, reducing native plant species richness and cover (Parker et al. 1997; Srinivasan et al. 2007, Wearne and Morgan 2004 in Herrera-Reddy et al. 2012). It interferes with re-establishment of conifer seedlings (Burrill 1994, Gaudio et al. 2008) and growth (Grove et al. 2012). Peterson and Prasad (1998) report that *C. scoparius* can quickly overtop young commercial crop trees (Zielke et al. 1992) and that Oregon and Washington have had stand failures of Douglas-fir seedlings because of *C. scoparius* infestations (G. Miller, Oregon Department of Agriculture, Salem, Oregon, pers. comm.). In some young conifer plantations, *C. scoparius* can occupy as much as 90% canopy cover and intercept 65% of the intermittent light (Prasad and Peterson 1997 in Peterson and Prasad 1998).

Cytisus scoparius invades many different habitats, including rare ecosystems such as the Garry oak (*Quercus garryana*) woodlands and prairies in southwestern British Columbia, Washington and Oregon (Haber 1996 in Peterson and Prasad 1998). These habitats are home to a number of rare and threatened species including the Taylor's checkerspot butterfly (*Euphydryas editha taylori*) and golden paintbrush (*Castilleja levisecta*).

Cytisus scoparius creates woody biomass that carries fires to tree canopies, which can change fire cycles to be more frequent and intense (DiTomaso et al. 2013, Parsons 1992 as cited in Bossard et al. 2000).

Cytisus scoparius can alter soil nutrient composition and may leave a legacy effect of altered soil nutrients even after plants are removed (Grove et al. 2012). Caldwell (2006) studied soil chemical and microbial impacts of *C. scoparius* in Pacific coastal prairie soils and found it alters soils chemistry, enzyme activity and potentially relationships between biogeochemical cycles. Caldwell found that soil under *C. scoparius*, compared to coastal prairie soil, was significantly more acidic and had greater accumulations of soil organic matter. Also, the activities of two soil enzymes responsible for processing major detrital carbon and phosphorus pools were significantly higher under *C. scoparius*. In another soil nutrient study, Shaben and Myers (2010) found that broom was associated with only a weak trend in increased soil nitrogen, though in a few studies significant differences in soil nitrogen have been found (Haubensak and Parker 2004, Haubensak et al. 2004 in Shaben and Myers 2010). They did find a significant decrease in soil phosphorus, and that *C. scoparius* may deplete soil phosphorus availability. Also *C. scoparius* may have some allelopathic properties that inhibit native plants in soils that had been invaded by *C. scoparius* (Haubensak and Parker 2004, Dougherty and Reichard 2004). Recent studies by Rook et al. (2011) in a south Puget Sound prairie suggest that soil legacy effects from broom infestations may affect subsequent native species plantings (Dennehy et al. 2011).

Toxicity:
Cytisus scoparius contains toxic quinolizidine alkaloids (Burrows and Tyrl 2013). Its seeds are toxic to ungulates, and mature plants are unpalatable and can cause digestive problems and neurologic dysfunction in horses (Parsons 1992 in Brossard et al. 2000, Burrows and Tyrl 2013). Reports of livestock loss have been made from the ingestion of the quinolizidine alkaloids sparteine and isoparteine (Peterson and Prasad 1998). Reproductive problems may also occur in livestock with long-term ingestion of *C. scoparius* (Burrows and Tyrl 2013). The alkaloids cause the plant to have a bitter taste and can make it unpalatable to animals, which may be why loss of livestock to *C. scoparius* is rare (Burrows and Tyrl 2013, Kingsbury 1964). Human consumption of flowers and seeds of *C. scoparius* can result in nausea, vomiting and abdominal pain (Parker et al. 1994 in Peterson and Prasad 1998, Burrows and Tyrl 2013).

Beneficial:
In its native range, in northwest Spain, it is being studied as a potential use as an arsenic accumulator, where it accumulates arsenic in its roots (Manzano et al 2013). *Cytisus scoparius*'s bright yellow flowers made it an attractive shrub, sold in the nursery industry (Schlosser et al. 1991 in Peterson and Prasad 1998). It was also historically planted to help prevent soil erosion and for stabilizing highway embankments (Boateng 1994 in Peterson and Prasad 1998).

Control:
Because of *Cytisus scoparius*'s high rate of seed production and the longevity of its seedbank, control work and monitoring will need to continue for a long time. It is important to control seedlings and young plants before they produce seeds (Oneto et al. 2009). Also, soil disturbance will result in seed germination from the seedbank, so minimize soil disturbance as much as possible. Planting or seeding native plants to areas under restoration is important to provide competition and diversity, as invaded sites can be seed-limited (Stanley et al. 2011).

When a few plants or a small infestation are present, mechanical control can be an effective control strategy. For large infestations, a combination of methods will likely be needed, targeting outlier plants with mechanical methods and main infestations with biological control, fire, mowing, herbicide use or a combination of these methods.

Cultural Control:
Mulching or covering the soil after control work can help reduce or suppress seed germination. Continue to monitor the area for seedlings though, and remove those found as soon as possible.

If it is an option, fire is the preferred management method of *Cytisus scoparius* on south Puget Sound prairies (Dennehy et al. 2011). Though plants can resprout after a fire, most fires are sufficiently hot enough to destroy *C. scoparius*'s cambium, thus killing the plant. In order to prevent fires from burning too hot and killing native plants, mow dense stands of *C. scoparius* prior to burning. One burn alone will not be enough to control broom (Oneto et al. 2009), it will take several cycles of prescribed burning to reduce *C. scoparius* invasions (Dennehy et al. 2011). Depending on the prairie and the species being managed, burning prairies every 2 to 3 years is adequate to kill *C. scoparius* germinants before seed development (Rod Gilbert pers. comm.). Waiting 4 years between burns will allow *C. scoparius* plants to go to seed (Rod Gilbert pers. comm.).

Many homeowners do not have the option of conducting controlled burns on their land, but mowing or cutting back the *Cytisus scoparius* and then using a weed torch could be an effective option (Rod Gilbert pers. comm.). Contact your County Noxious Weed Control Board for further information about burning *C. scoparius* on your property and what regulations may apply.

Mechanical Control:

Small to medium sized plants can be hand-pulled, making sure to remove the roots. Use a tool like a Weed Wrench, Extractigator, or Uprooter to leverage plants, along with their roots, out of the ground. When possible, time removal when soils are moist as roots will be easier to remove. Hand-pulling small plants will create less soil disturbance than removing the root system of large plants. Pulling out large plants causes soil disturbance that can hinder the recovery of the native herbaceous community (Dennehy et al. 2011).

Cytisus scoparius can resprout after cutting alone (Bravo 1980 in Bossard and Rejmánek 1994). If only cutting/mowing is possible, maximize damage and possible death to the plants by cutting when they are drought stressed, typically late summer to early fall, cutting plants back to the ground to minimize soil

Scotch broom removal using a Weed Wrench tool. Image by San Juan County NWCB.

disturbance (Bossard and Rejmánek 1994). Avoid cutting *C. scoparius* during the rainy season as the rate of resprouting will be the highest then (Bossard and Rejmánek 1994). This drought-stress cutting method will need to be repeated every few years, ideally before plants produced seed.

Mowing of broom may also need to be done multiple times throughout the growing season if it is not timed for when plants are drought-stressed. Even plants that are just a few months old may have developed large enough roots to recover from one mowing (Oneto et al. 2009).

Biocontrol Control:

The Scotch broom seed weevil, *Exapion fuscirostre*, larvae feed on seeds of Scotch broom in developing seed pods. The adults also feed on flowers and stem tips, though their damage is not significant. The Scotch broom bruchid, *Bruchidius villosus*, larvae feed on developing seeds and impact the plant's reproduction. While these biological control agents will not kill the Scotch broom plants, they will reduce seed production. Combing the use of biological control with other control methods, such as mowing or fire, can have a significant reduction on the seed production and the seedbank (Herrera-Reddy et al. 2012). For additional information about the biological control of *C. scoparius* in Washington State and how to acquire biological control agents, please contact the WSU Extension Integrated Weed Control Project at http://invasives.wsu.edu/index.htm and 253-445-4657.

Grazing is generally not considered an effective control option (DiTomaso et al. 2013). *Cytisus scoparius* flowers and seeds contain quinolizidine alkaloids and can be toxic to livestock. The foliage is also mildly toxic and is unpalatable to most livestock except goats (DiTomaso et al. 2013). Goats, confined to a small area, can help control resprouts after cutting or burning plants, though any desirable plants present can be overgrazed (DiTomaso et al. 2013).

Herbicide Control:

Different herbicides and herbicide treatment applications can be used to control *Cytisus scoparius*. Please refer to The Pacific Northwest Weed Management Handbook for information on timing, herbicides and herbicide rates to use for *C. scoparius* control. http://pnwhandbooks.org/weed/control-problem-weeds

In general, use herbicide control in combination with other control methods to reduce usage when possible. If using a foliar spray, treat plants when pollinators are not present or are the least active. Also, aim to apply herbicide when beneficial plants have already senesced for the year to prevent damage. For example, on prairies, use glyphosate on *C. scoparius* in the early fall when most of the native plants have already gone dormant (Rod Gilbert pers. comm.). Herbicide application methods include foliar, basal, and cut stump. Cut stump treatments can provide effective control of plants and minimize herbicide use. After stems are cut, apply the herbicide immediately to the freshly-cut surface. Cut stump treatments can take place in late summer, early fall or dormant season (DiTomaso et al. 2013). Depending on the treatment, it may take more than one herbicide treatment to kill *C. scoparius* (Oneto et al. 2009).

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