

Oregon Department of Agriculture  
Plant Pest Risk Assessment for  
Single-seed hawthorn (*Crataegus monogyna*) Jacq.  
Updated February 2020

Single seed hawthorn, One-seed hawthorn, English Hawthorn, Mayblossom,  
Common hawthorn: *Crataegus monogyna* Jacq.  
Family: Roseaceae

**Findings of this review and assessment:** *Crataegus monogyna*, has been determined to be a potential “B” listed noxious weed as defined in the ODA Noxious Weed Policy and Classification System. This determination is based on two independent risk assessments following a literature review. Using a rating system 3.8 adapted from USDA-APHIS Weed Risk Assessment Guidelines, *C. monogyna* scored 48 out of a potential score of 90. Using the ODA Noxious Weed Rating system, *C. monogyna* scored 13.

**Introduction:** Single-seed hawthorn is a European tree species, introduced as an ornamental and occasionally for livestock hedges. Naturalized throughout the east and west coast of North America, it forms dense thorny thickets in pastures, wildlife areas, and native oak forests. In the past, hawthorn had some economic value in the nursery trade as it was sold as a hedging plant<sup>1</sup> for ornamental trees or bred into dwarfing varieties. In the wild, hawthorn provides a late season food source for songbirds, which in return, aid in the rapid dispersal of the hawthorn seeds.

Invasive hawthorn very clearly degrades wildlife habitat in oak woodlands in our region forming very dense stands. Hawthorn is a nuisance in parks, fencerows, and fields. Hawthorn is costly to chainsaw, stump treat, chip, or remove from sites.



Photo: Piero Amorati, ICCroce –  
Casalecchio di Reno, Bugwood.org

**Biology and morphology:** *Crataegus monogyna* is a broadly spreading shrub or small tree growing up to 25’ tall. The trunk has pale, gray smooth bark and younger stems bear sharp thorns making the plant useful for natural fence plantings in pastures. The leaves are 1-2 inches long and deeply lobed, sometimes almost to the midrib, with the lobes

spreading out like a birds foot. Flowers are produced in showy white clumps from late spring to early summer in corymbs of 5-25 blossoms; each flower is about 1 cm diameter. Pollinated flowers produce a haw, which is a small, oval, dark red fruit about 1 cm long, berry-like, but structurally a pome containing a single seed<sup>2</sup>. The plant has many garden forms and is capable of hybridizing with other species of *Crataegus*, including the native *C. douglasii* (Love and Feigen 1978); thus variation in characters is possible with hybridizing populations (Bossard, 2000). The plant is highly tolerant of waterlogged heavy clay soils in the winter and seasonally dry conditions in the summer.

**Reproduction and dispersal:** *Crataegus* produces a pulpy haw containing a hard, non-digestible seed, readily consumed by birds<sup>2</sup>. The seed passes through the gut unharmed and is deposited well away from the parent plant. Humans historically have been responsible for introducing the species into new regions and this practice may be continuing today.

**Control:** Hawthorn Control Table from the IPM Guide for Common Weeds developed by the Western Invasives Network, revised winter of 2020.

Species	Mechanical	Chemical	IPM	Notes/Tips
<p><b>English Hawthorn</b></p> <p><b>Aka. single-seeded hawthorn</b></p>	<p>Pull small plants (1" diameter) when soil conditions allow.</p> <p>Mowing plants is effective for suppression only. Plants that have been repeatedly mowed tend to have a larger root system, decreasing success with pulling later.</p> <p>Winching of whole trees often needed if ground disturbance is not an issue.</p> <p>Girdling plants is typically not effective; plants resprout from the lateral root system.</p>	<p>Use Glyphosate (Round up) to paint cut stems of plants larger than 1" diameter in mid-late summer/dry season.</p> <p>Cut stump treatment using oil based Garlon or Vastlan at 30% mixed with oil carrier.*</p> <p>Basal bark spray all around the base of the tree using a 1-5% mixture with water.*</p> <p>August is a good time to spray the resprouts. Aminopyralid (Milestone)</p>		<p>Resprouting is the biggest challenge, so a well-timed integrated mechanical plus herbicide program is advised.</p> <p>Resprouting from stem or lateral roots is almost a given, regardless of the method you choose.</p> <p>Seed bank along fence rows may be a problem.</p> <p>Plan for multiple years of treatment (e.g., 3 years of spot spraying to control resprouts and new plants).(Aminopyralid)</p> <p>In addition to spraying, EZ ject lance applicators** with imazapyr shells have been used successfully.</p>

\* glyphosate, imazapyr and Krenite may also suffice. \*\* Arbor Systems Inc.

Hawthorn is well adapted to grazing pressure by forming dense multi-trunk shrubs after repeat browsing. Large woody spines offer some degree of protection to the plants as only the more outer leaves and buds may get consumed. Stems that escape browsers form a vertical trunk creating a full tree.

Small machinery with good mowing/mulching capabilities can be used to mow down dense stands of hawthorn to a thick mulch layer, which provides suppression; foliar applications address resprouts in the spring and fall months (C. Piroosko, ODA witnessed demonstration areas utilizing this method in Douglas County in 2020).

Root and trunk suckering is problematic in manual and mechanical control. Unless the roots are removed, an herbicide application is necessary. Cut stump has been shown to be effective (Doug McCutchen, pers. comm. 2015; Tim Steber pers. comm. 2010) in large scale treatments for oak restoration while foliar treatments or weed wrenching are effective on smaller diameter plants (Bossard et al. 2000; Jed Calqahoun per comm. 2006). Bulldozing and winching often are utilized on very dense stands where severe disturbance can be tolerated. Though expensive per acre, this may be the only practical means to restore heavily invaded habitats.



Mechanical control: before and after photos: Ed Alverson, Lane County Parks

**Economic impact:** Douglas county hillside sheep operations experience losses in forage production and control expenses due to dense hawthorn growth (Larry Williams, Douglas County Weed Advisory Board, per. comm. 2014). Steep slopes and the size of infestations render many control options uneconomical. Further expansion of the problem will occur without intervention.

Furhter impacts of one-seeded hawthorn are experienced in oak forest restoration projects. Dense stands of hawthorn inhabit thousands of acres of white oak habitat and must be removed to allow for continued survival of oak trees. Removal costs are well in excess of \$2,500-\$2,656 per acre (Pers. Comm. Matt Gibbons 2015; Per. comm., Ed Alverson 2009) excluding the expense of tree and brush disposal. Single-seeded hawthorn is not a problem in grass seed or grain production or other intensive agricultural systems.

**Positive economic attributes:** None identified. At one point, *Crataegun monogyna* was propagated extensively in the nursery production trade primarily for root stock material used in grafting. In the 2019 Oregon Association of Nurseries Guide, no nurseries were listed as producers or sellers of any single-seeded rootstock or cultivar.

**Environmental impact:** Thickets of single-seed hawthorn render rangeland and pasture ground in Douglas County useless (Douglas County Advisory Weed Board, 2014). “How do I get rid of single-seed hawthorn” is the number one question that the southwest ODA Noxious Weed Specialist receives when working with landowners in Douglas County (Pirosko, 2014). Single-seed forms dense thickets that alter the structure of the forest understory and make movement of large animals difficult. Some species of *Crataegus* contain hydrocyanic acid in the leaves, which is poisonous to cattle. However, the presence of this toxin in single-seed hawthorn is currently unknown (Parsons 1992).

In the San Juan Islands, hawthorn survives in a multitude of habitats, ranging from seasonally inundated wetlands to rocky, dry, sandy soils, to the middle of densely forested areas. It does best in open sunlight and deep soil areas. (pers. Comm. Doug McCutchen San Juan County Land Bank). Native Willamette Valley wetlands and oak groves are impacted from the invasion of woody understory trees including one-seeded hawthorn. Competition for available light, moisture, and space occur in oak forests, effecting survivability and reproduction of oaks. The removal of these understory trees favor the survival of older oaks and native forbs. In wetlands, hawthorns, wild pear, and Oregon ash convert open prairie to dense deciduous tree groves. Native prairie plants are often excluded from these forests.

One potential benefits of hawthorn is to songbirds. Ripe fruits (haws) hang on the tree well into winter providing a late season source of food for over-wintering birds. Birds may prefer its berries to those of native berried plants, including native hawthorn, and this may lead to local extirpation of the native species (Bossard, 2000).

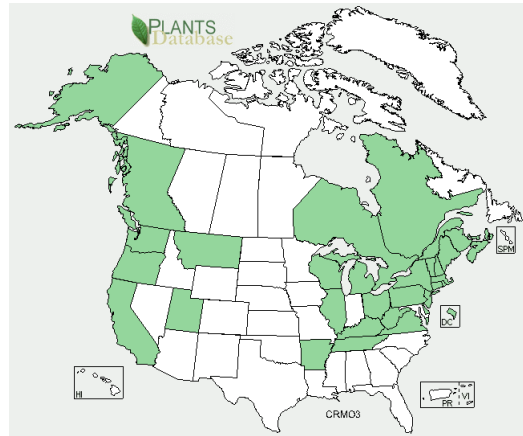
**Long-term population trends due to climate change:** The adaptability of one-seeded hawthorn to a variety of soil and moisture conditions in a warming climate may allow this species to increase its range further north and east. Hybridization with native hawthorns such as the *C. monogyna X C. suksdorfii* (Pers. Comm. Bruce Newhouse, 2009) cross in Oregon may enhance its capacity to handle colder winters throughout the west. In 2014, Bruce also shared the following: the introduced genes keep spreading in the population, and local native biodiversity is reduced and possibly lost. Native biodiversity occurs at the genetic level, as well as at the levels of individuals and populations. This is significant due to the loss of native plant genetics and potentially the loss of insects or fungi that have co-evolved with the plant over millennia. The hybrid *C. monogyna x suksdorfii* is so common that it has been named *C. x cogswellii*.

**Native range:** Europe, NW Africa and Western Asia<sup>2</sup>.

**Introduced range:** Australia, North America

**North American range:** see map

**Oregon Distribution:** In Western Oregon, the largest populations may be found in Douglas, Lane, Linn and Yamhill Counties (C. Pirosko, G. Miller ODA 2020). They are predominantly found in seasonally dry hillside pastures, seasonal wetland prairies and in oak forests. All other Western Oregon counties contain populations of single-seed hawthorn to some degree. It is feared that as the emerald ash borers kill off our native ash trees, single-seeded hawthorn may be the only species able to fill that wet/dry niche.



## Noxious Weed Qualitative Risk Assessment

### Oregon Department of Agriculture

#### Noxious Weed Qualitative Risk Assessment 3.8

### Oregon Department of Agriculture

Common Name: English hawthorn  
Scientific Name: *C. monogyna*  
Family: Rosaceae

For use with plant species that occur or may occur in Oregon to determine their potential to become serious noxious weeds. For each of the following categories, select the number that best applies. Numerical values are weighted to increase priority categories over less important ones. Choose the best number that applies, intermediate scores can be used.

Total Score: **48**      Risk Category: B

#### GEOGRAPHICAL INFORMATION

- 1) **4**      **Invasive in Other Areas**
- 0 Low- not known to be invasive elsewhere.
  - 2 Known to be invasive in climates dissimilar to Oregon's current climates.
  - 6 Known to be invasive in geographically similar areas.
- Comments: Known to be invasive in both similar and dissimilar climates nationwide.
- 2) **4**      **Habitat Availability:** Are there susceptible habitats for this species and how common or widespread are they in Oregon?
- 1 Low – Habitat is very limited, usually restricted to a small watershed or part of a watershed (e.g., tree fern in southern Curry County).
  - 3 Medium – Habitat encompasses 1/4 or less of Oregon (e.g., oak woodlands, coastal dunes, eastern Oregon wetlands, Columbia Gorge).

- 6 *High* – Habitat covers large regions or multiple counties, or is limited to a few locations of high economic or ecological value (e.g., threatened and endangered species habitat).

Comments: Typically invasive in seasonally wet/dry poor soils, hillside pastures, oak woodlands and seasonal wet prairies.

- 3) 0           **Proximity to Oregon:** What is the current distribution of the species?
- 0 *Present* – Occurs within Oregon.
  - 1 *Distant* – Occurs only in distant US regions or foreign countries.
  - 3 *Regional* – Occurs in Western regions of US but not adjacent to Oregon border.
  - 6 *Adjacent* – Weedy populations occur adjacent (<50 miles) to Oregon border.

Comments: Occurs in Western Oregon.

- 4) 5           **Current Distribution:** What is the current distribution of escaped populations in Oregon?
- 0 *Not present* – Not known to occur in Oregon.
  - 1 *Widespread* – Throughout much of Oregon (e.g., cheatgrass).
  - 5 *Regional* – Abundant (i.e., occurs in eastern, western, central, coastal, areas of Oregon) (e.g., gorse, tansy ragwort).
  - 10 *Limited* – Limited to one or a few infestations in state (e.g., kudzu).

Comments: Populations limited to western Oregon.

## BIOLOGICAL INFORMATION

- 5) 2           **Environmental Factors:** Do abiotic (non-living) factors in the environment effect establishment and spread of the species? (e.g., precipitation, drought, temperature, nutrient availability, soil type, slope, aspect, soil moisture, standing or moving water).
- 1 *Low* – Severely confined by abiotic factors.
  - 2 *Medium* – Moderately confined by environmental factors
  - 4 *High* – Highly adapted to a variety of environmental conditions (e.g., tansy ragwort, Scotch broom).

Comments: Generally abundant in thin, seasonally dry soils. Tolerant of saturated soils in winter.

- 6) 6           **Reproductive Traits:** How does this species reproduce? Traits that may allow rapid population increase both on and off site.
- 0 *Negligible* – Not self-fertile, or is dioecious and opposite sex not present.
  - 1 *Low* – Reproduction is only by seed, produces few seeds, or seed viability and longevity are low.
  - 3 *Medium* – Reproduction is vegetative (e.g., by root fragments, rhizomes, bulbs, stolons).
  - 3 *Medium* – Produces many seeds, and/or seeds of short longevity (< 5 years).
  - 5 *High* – Produces many seeds and/or seeds of moderate longevity (5-10 years) (e.g., tansy ragwort).
  - 6 *Very high* – Has two or more reproductive traits (e.g., seeds are long-lived >10 years and spreads by rhizomes).

Comments: Seed production is prolific and the hard seeds are long lived.

- 7) 4 **Biological Factors:** Do biotic (living) factors restrict or aid establishment and spread of the species? (What is the interaction of plant competition, natural enemies, native herbivores, pollinators, and pathogens with species?)
- 0 *Negligible* – Host plant not present for parasitic species.
  - 1 *Low* – Biotic factors highly suppress reproduction or heavily damage plant for an extended period (e.g., biocontrol agent on tansy ragwort).
  - 2 *Medium* – Biotic factors partially restrict or moderately impact growth and reproduction, impacts sporadic or short-lived.
  - 4 *High* – Few biotic interactions restrict growth and reproduction. Species expresses full growth and reproductive potential.

Comments: Plants are fairly resistant to grazing and insect attack.

- 8) 3 **Reproductive Potential and Spread After Establishment - Non-human Factors:** How well can the species spread by natural means?
- 0 *Negligible* – No potential for natural spread in Oregon (e.g., ornamental plants outside of climate zone).
  - 1 *Low* – Low potential for local spread within a year, has moderate reproductive potential or some mobility of propagules (e.g., propagules transported locally by animals, water movement in lakes or ponds, not wind blown).
  - 3 *Medium* - Moderate potential for natural spread with either high reproductive potential or highly mobile propagules (e.g., propagules spread by moving water, or dispersed over longer distances by animals) (e.g., perennial pepperweed).
  - 5 *High* – Potential for rapid natural spread throughout the susceptible range, high reproductive capacity and highly mobile propagules. Seeds are wind dispersed over large areas (e.g., rush skeletonweed).

Comments: Birds are the primary seed dispersal agent.

- 9) 1 **Potential of Species to be Spread by Humans.** What human activities contribute to spread of species? Examples include: interstate or international commerce; contaminated commodities; packing materials or products; vehicles, boats, or equipment movement; logging or farming; road maintenance; intentional introductions of ornamental and horticultural species, or biofuel production.
- 1 *Low* – Potential for introduction or movement minimal (e.g., species not traded or sold, or species not found in agricultural commodities, gravel or other commercial products).
  - 3 *Medium* – Potential for introduction or off-site movement moderate (e.g., not widely propagated, not highly popular, with limited market potential; may be a localized contaminant of gravel, landscape products, or other commercial products) (e.g., lesser celandine, Canada thistle).
  - 5 *High* – Potential to be introduced or moved within state high (e.g., species widely propagated and sold; propagules common contaminant of agricultural commodities or commercial products; high potential for movement by contaminated vehicles and equipment, or by recreational activities) (e.g., butterfly bush, spotted knapweed, Eurasian watermilfoil).

Comments: Humans are not a significant means of dispersal.

- 10) 5**      **Economic Impact:** What impact does/can the species have on Oregon's agriculture and economy?
- 0 *Negligible* – Causes few, if any, economic impacts.
  - 1 *Low* - Potential to, or causes low economic impact to agriculture; may impact urban areas (e.g., puncture vine, pokeweed).
  - 5 *Medium* – Potential to, or causes moderate impacts to urban areas, right-of-way maintenance, property values, recreational activities, reduces rangeland productivity (e.g., English ivy, Himalayan blackberry, cheatgrass).
  - 10 *High* – Potential to, or causes high impacts in agricultural, livestock, fisheries, or timber production by reducing yield, commodity value, or increasing production costs (e.g., gorse, rush skeleton weed, leafy spurge).

Comments: Plant causes moderate impacts to dryland pasture production. Localized infestations may cause higher financial impacts to grazing lands.

- 11) 4**      **Environmental Impact:** What risks or harm to the environment does this species pose? Plant may cause negative impacts on ecosystem function, structure, and biodiversity of plant or fish and wildlife habitat; may put desired species at risk.
- 0 *Negligible* – None of the above impacts probable.
  - 1 *Low* – Can or does cause few or minor environmental impacts, or impacts occur in degraded or highly disturbed habitats.
  - 4 *Medium* – Species can or does cause moderate impacts in less critical habitats (e.g., urban areas, sagebrush/ juniper stands).
  - 6 *High* – Species can or does cause significant impacts in several of the above categories. Plant causes severe impacts to limited or priority habitats (e.g., aquatic, riparian zones, salt marsh; or T&E species sites).

Comments: Plant can cause significant modification to seasonal prairie wetlands by converting them to dense tree thickets.

- 12) 1**      **Impact on Health:** What is the impact of this species on human, animal, and livestock health? (e.g., poisonous if ingested, contact dermatitis, acute and chronic toxicity to livestock, toxic sap, injurious spines or prickles, causes allergy symptoms).
- 0 *Negligible* – Has no impact on human or animal health.
  - 2 *Low* – May cause minor health problems of short duration, minor allergy symptoms (e.g., leafy spurge).
  - 4 *Medium* – May cause severe allergy problems, death or severe health problems through chronic toxicity, spines or toxic sap may cause significant injury. (e.g., giant hogweed, tansy ragwort).
  - 6 *High* – Causes death from ingestion of small amounts, acute toxicity (e.g. poison hemlock).

Comments: The spiny trees may cause physical injury to livestock that graze in highly infested pastures.

#### CONTROL INFORMATION

- 13) 5**      **Probability of Detection at Point of Introduction:** How likely is detection of species after introduction and naturalization in Oregon?
- 1 *Low* – Grows where probability of early detection is high, showy and easily recognized by public; access to habitat not restricted (e.g., giant hogweed).



- 5 *Medium* – Easily identified by weed professionals, ranchers, botanists; some survey and detection infrastructure in place. General public may not recognize or report species (e.g., leafy spurge).
- 10 *High* – Probability of initial detection by weed professionals low. Plant shape and form obscure, not showy for much of growing season, introduction probable at remote locations with limited access (e.g., weedy grasses, hawkweeds, skeletonweed).

Comments: Easily identified by weed professionals, ranchers, botanists. May be confused with native hawthorn species.

- 14) 4 Control Efficacy:** What level of control of this species can be expected with proper timing, herbicides, equipment, and biological control agents?
- 1 *Negligible* – Easily controlled by common non-chemical control measures (e.g., mowing, tillage, pulling, and cutting; biocontrol is very effective at reducing seed production and plant density) (e.g., tansy ragwort).
  - 2 *Low* – Somewhat difficult to control, generally requires herbicide treatment (e.g., mechanical control measures effective at preventing flowering and but not reducing plant density; herbicide applications provide a high rate of control in a single application; biocontrol provides partial control).
  - 4 *Medium* – Treatment options marginally effective or costly. Tillage and mowing increase plant density (e.g., causes tillering, rapid regrowth, spread from root fragments). Chemical control is marginally effective. Crop damage occurs or significant non-target impacts result from maximum control rates. Biocontrol agents ineffective.
  - 6 *High* – No effective treatments known or control costs very expensive. Species may occur in large water bodies or river systems where containment and complete control are not achievable. Political or legal issues may prevent effective control.

Comments: Control costs are generally high. Each tree must be treated individually. Mowing is not effective.

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Category Scores:

13 Geographic score (Add scores 1-4)

16 Biological Score (Add lines 5-9)

10 Impact Score (Add lines 10-12)

9 Control Score (Add Lines 13-14)

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48 Total Score (Add scores 1-14 and list on front of form)

Risk Category: 55-90 = A      24-54 = B      < 24 = unlisted.

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This Risk Assessment was modified by ODA from the USDA-APHIS Risk Assessment for the introduction of new plant species.

V3.8 2/19/2016

**OREGON DEPARTMENT OF AGRICULTURE  
NOXIOUS WEED RATING SYSTEM**

One-seeded hawthorn  
**Common Name**

Crataegus monogyna  
**Scientific Name**

**Points Category**

1.   2        **Detrimental Effects:** Circle *all* that apply, enter *number* of circles
1. **Health:** Causes poisoning or injury to humans or animals
  2. **Competition: strongly competitive with crops, forage, or native flora**
  3. **Host:** host of pathogens and/or pests of crops or forage
  4. **Contamination:** causes economic loss as a contaminate in seeds and/or feeds
  5. **Interference: interferes with recreation, transportation, harvest, land value, or wildlife and livestock movement**
2.   3        **Reproduction and Capacity for spread** Circle the number that best describes
1. Few seeds, not wind blown, spreads slowly
  2. Many seeds, slow spread
  3. **Many seeds, spreads quickly by vehicles or animals**
  4. Windblown seed, or spreading rhizomes, or water borne
  5. Many wind-blown seeds, high seed longevity, spreading rhizomes, perennials
3.   4        **Difficulty to Control** Circle the number that best describes, enter
1. Easily controlled with tillage or by competitive plants
  2. Requires moderate control, tillage, competition or herbicides
  3. Herbicides generally required, or intensive management practices
  4. **Intensive management generally gives marginal control**
  5. No management works well, spreading out of control
4.   2        **Distribution** Circle the number that best describes, enter
1. Widely distributed throughout the state in susceptible habitat
  2. **Regionally abundant in a part of the state, 5 or more counties, more than 1/2 of a county**
  3. Abundant throughout 1-4 counties, or 1/4 of a county, or several watersheds
  4. Contained in only 1 watershed, or less than 5 square miles gross infestation
  5. Isolated infestation less than 640 acres, more than 10 acres

6. Occurs in less than 10 acres, or not present, but imminent from adjacent state

5.   2          **Ecological Impact** Circle the number that best describes, enter
1. Occurs in most disturbed habitats with little competition
  2. **Occurs in disturbed habitats with competition**
  3. Invades undisturbed habitats and crowds out native species
  4. Invades restricted habitats (i.e., riparian) and crowds out native species

 13     **TOTAL POINTS**

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Note: Noxious weeds are those non-native plants with total scores of 11 points or higher. Any plants in 4.1, 4.2, and 4.3 should not be classified as “A” rated weeds. Ratings: 16+ = A, 15 – 11= B

#### References:

1. Crataegus monogyna. [Internet] [Cited 2009 December 30] Available from: [www.wikipedia.org/wiki/crataegus\\_monogyna](http://www.wikipedia.org/wiki/crataegus_monogyna).
2. Crataegus monogyna. Oregon Association of Nurseryman Buyers Guide. 2009. Available from: [www.nurseryguide.com/plantresults.lasso](http://www.nurseryguide.com/plantresults.lasso)
3. Crataegus monogyna. USDA Plants Profile Database. [Internet][Cited 2009 December 30]Available from [www.plants.usda.gov/java/profile?symbol=CRMO3](http://www.plants.usda.gov/java/profile?symbol=CRMO3)
4. Hedging UK [Internet] [Cited 2009 December 30] Available from: [www.hedginguk.com/hawthorn.html](http://www.hedginguk.com/hawthorn.html)
5. Invasive Plants of California’s Wildlands. 2000. Bossard, C. , J.M. Randall, M.C. Hoshovsky.
6. Love, R. and M. Feigen. 1978. Interspecific hybridization between native and naturalized Crataegus (Roseaceae) in western Oregon. Madrono 25:211-217.
7. Parsons, W.T. and Cuthbertson, E.G. 1992. Noxious weeds of Australia. (Inkata Press, Melbourne). P567-570.
8. Personal communication: Larry Williams, Chariman of the Douglas Weed Control Advisory Board, 2015.
9. Personal communication: Ed Alverson, Nature Conservancy, South Willamette Valley, 2010 currently City of Eugene Parks Department
10. Personal communication: Tim Steber, Yamhill Soil and Water Conservation District, 2010.
11. Personal Communication: Doug McCutchen, San Juan County Land Bank, 2015.
12. Personal Communication: Jed Calqahoun, OSU Extension Specialist, 2006.
13. Personal Communication: Bruce Newhouse, Salix Associates 2014.
14. Personal Communication: Matt Gibbons, The Nature Conservancy, 2015.
15. Title page photograph from [www.invasive.org/species/subject.cfm?sub=5392](http://www.invasive.org/species/subject.cfm?sub=5392)
16. Personal communication: Carrie Pirosko, Glenn Miller, Oregon Department of Agriculture 2020