

DRAFT WRITTEN FINDINGS OF THE WASHINGTON STATE NOXIOUS WEED CONTROL BOARD

SCIENTIFIC NAME: *Ilex aquifolium*

COMMON NAMES: Feral holly, English holly, European holly, common holly, holly

FAMILY: Holly Family, Aquifoliaceae

LEGAL STATUS: Monitor list since 2012. Proposed feral holly for Class C noxious weed (with exemptions for where and when English holly is commercially grown)



Feral holly stand in Lattawood Park, by Elliot Church

DESCRIPTION AND VARIATION:

Can grow up to 85 feet tall and has been recorded as living to 500 years old, but usually does not reach 100 (Rushforth, 1999). There are many varieties and cultivars, though only a feral type has been found escaping into parks, wild areas, and forests (Washington State Noxious Weed Control Board, 2010).

OVERALL HABIT:

I. aquifolium is a shrub or small tree with glossy, evergreen leaves and bright red or reddish-orange berries when ripe (Washington State Noxious Weed Control Board, 2010).



Large feral holly in St. Edward State Park, by Dr. Dave Stokes



STEMS:

Bark is typically smooth and gray. Holly height ranges between six to seventy-five feet for mature, horticultural trees. DBH (diameter at breast height) of mature trees is noted as falling between 40-80 cm (Washington State Noxious Weed Control Board, 2010).

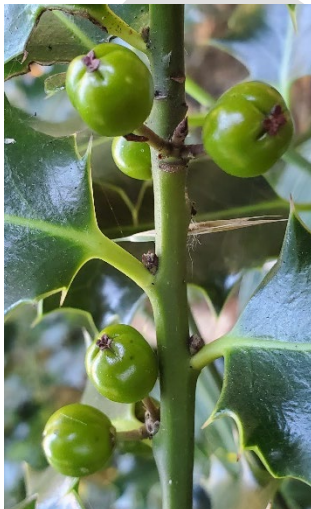


LEAVES:

Elliptic, ovate, or obovate, 2.5-6 cm long and 2-6 cm wide, with 3-5 sharp spine-like teeth along each side, alternating between pointing upward and downward; leaf margins thickened and somewhat undulating. Leaf surface covered in thick cuticle, dark-green, and glossy. Alternately arranged on stem. The more herbivory a stem of holly receives, the more spines will develop on the leaf margins (Washington State Noxious Weed Control Board, 2010).

FLOWERS:

Dioecious, dull white, small, and arranged in fasciculate cymes. Both calyx and corolla four-lobed. Ovary four-celled. Pollinated by bees. Blooms in western WA between April and June (Washington State Noxious Weed Control Board, 2010).



FRUITS/SEEDS:

Fruits are 6-10 mm in diameter, pulpy, start green and ripen to range from bright red to reddish orange. Each drupe consists of four stones and contains four seeds. T (Washington State Noxious Weed Control Board, 2010).

ROOTS:

Very deep reaching roots (Rushforth, 1999).

SIMILAR SPECIES:

There are species in the genus *Ilex*, which are native to North America, though none have been recorded in Washington State (Burke Herbarium).

Native Oregon grapes, in the genus *Mahonia*, especially *M. nervosa* (tall Oregon grape) can look like holly. None of our *Mahonia* species get nearly as tall as holly, with tall Oregon grape topping out around 6 feet tall. None of them have quite as thick, waxy, or smooth leaves as holly. The spines on Oregon

grapes simply radiate and point out along the leaf margin, with not a lot of variation in pointing up or down, while holly spines can curve to point very far up and down from the leaf surface. Our native Oregon grape only make yellow flowers which will eventually mature into blue fruits, which grow on stems at the top of the shrubs (Burke Herbarium).

There are many varieties of *Ilex opaca*, a holly which is native to North America (Darrow, 2020), though none have been found growing in the wild in Washington (Burke Herbarium).

HABITAT:

Lowland mesic forests and disturbed areas. Peterken and Lloyd (1967) reported *I. aquifolium* up to 550 m (1800 ft) in Britain and up to 1500 m (4900 ft) in the Alps, although it also has been found up to 2300 m (7550 ft) in the warmer and drier regions of Northern Africa. Iversen (1944) calculated the minimum mean daily temperature for *I. aquifolium* survival in Europe as -0.5 C (31 F) (Washington State Noxious Weed Control Board, 2010).



Large feral holly stand at Lake Youngs Reserve, by Sally Nickelson

BIOLOGY

GROWTH AND DEVELOPMENT:

Ilex aquifolium is a long-lived woody species. Its bark contains anti-herbivory methanol extracts that inhibit herbivory by the pine weevil, *Hylobius abietis* (Eriksson *et al.*, 2008). Seedlings grow slowly during first four years (e.g., 1 cm/year) followed by accelerated growth (e.g., 50 cm/year) during active growth

period (Peterken and Lloyd, 1967). Peterken and Lloyd (1967) note that holly trees growing in closed canopy reach 5 meters after 30-40 years (Washington State Noxious Weed Control Board, 2010).

REPRODUCTION:

Ilex aquifolium reproduces both sexually and vegetatively. Trees may start flowering when about ten years old (Peterken and Lloyd, 1967). According to Sadhu (1989) embryonic development within the seed can be prolonged, resulting in a dormant stage lasting eighteen months to three years before germination can occur.

Peterken and Lloyd (1967) also note a three-year dormancy before germination begins, though seeds passing through birds' digestive tracts germinate faster. A germination trial in Seattle revealed that seeds produced in this region took almost two and a half years to germinate (Zika, 2010).

Fruit of *I. aquifolium* is the primary food source of the redwing blackbird during the winter months in Spain, making this bird the primary disperser of this plant in montane woodlands (Gutián and Bermejo, 2006). Migrant thrushes also disperse *I. aquifolium* fruit in its native range, and germination of holly seedlings was greater under tree canopy than open grassland, presumably due to perching preferences of the birds (Obeso and Fernández-Calvo, 2002). In Washington, seeds are dispersed by several species of frugivorous birds, who eat the fruit and then regurgitate the seeds in new locations (Zika, 2010). *I.*

aquifolium also reproduces vegetatively by suckering and layering when cut at ground level or when extensively pruned. Additionally, adventitious roots can form on branches that have fallen to or touch the substrate surface (Peterken and Lloyd, 1967) (Washington State Noxious Weed Control Board, 2010). Birds, frequently robins, spread holly seed 10-50 meters and up to 500 meters (Zika, 2010). Feral holly has established on very remote and rarely visited islands in the San Juans and arrived there by bird-spread seed (Bennet, *et al.*, 2011).

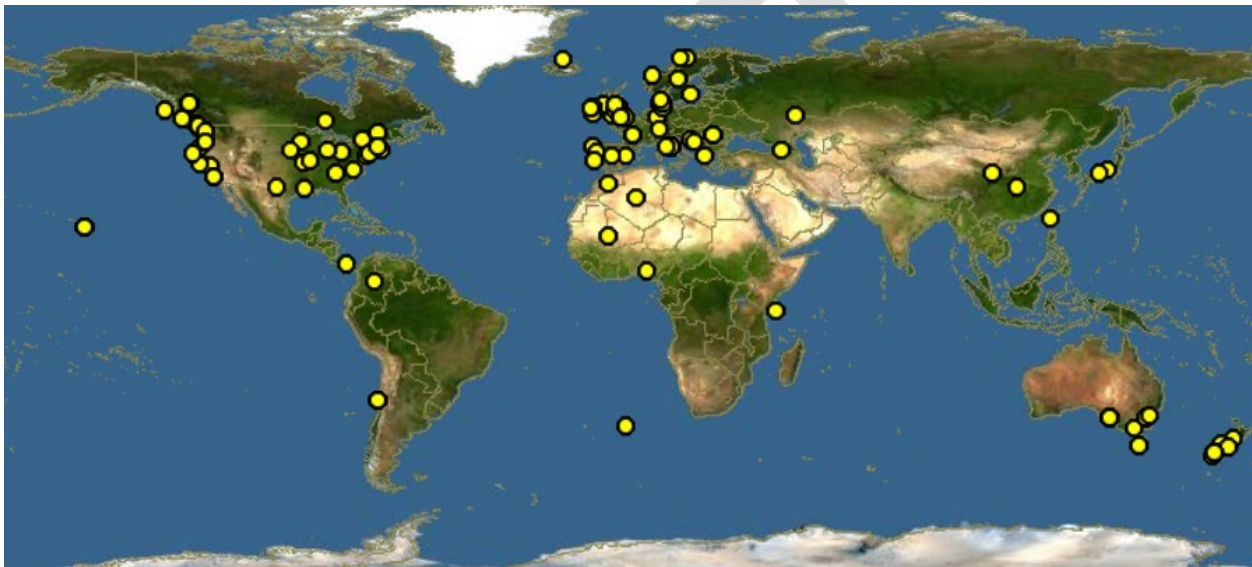


GEOGRAPHIC DISTRIBUTION:

NATIVE DISTRIBUTION

Ilex aquifolium is native to northern Africa (Algeria, Morocco, Tunisia), temperate regions of western Asia (Iran, Syria, Turkey), and Europe (United Kingdom, Albania, Bulgaria, Former Yugoslavia, Italy, France, Portugal, and Spain). GRIN also notes that *I. aquifolium* has also established in Australia (Australia, New Zealand), North America (United States, including Hawaii) (Washington State Noxious Weed Control Board, 2010).

Even in its native range, feral varieties of holly are invading and pushing out stands of native varieties of holly (Skou, *et al.*, 2012).



Holly observation global map, Discover Life.

NON-NATIVE DISTRIBUTION

Has been found escaped and in the wild of many countries around the world, including Central China, Japan, Southeastern Australia, across New Zealand, Chile, Panama, Venezuela, a few populations around Africa, and many of the Hawaiian Islands (Discover Life).

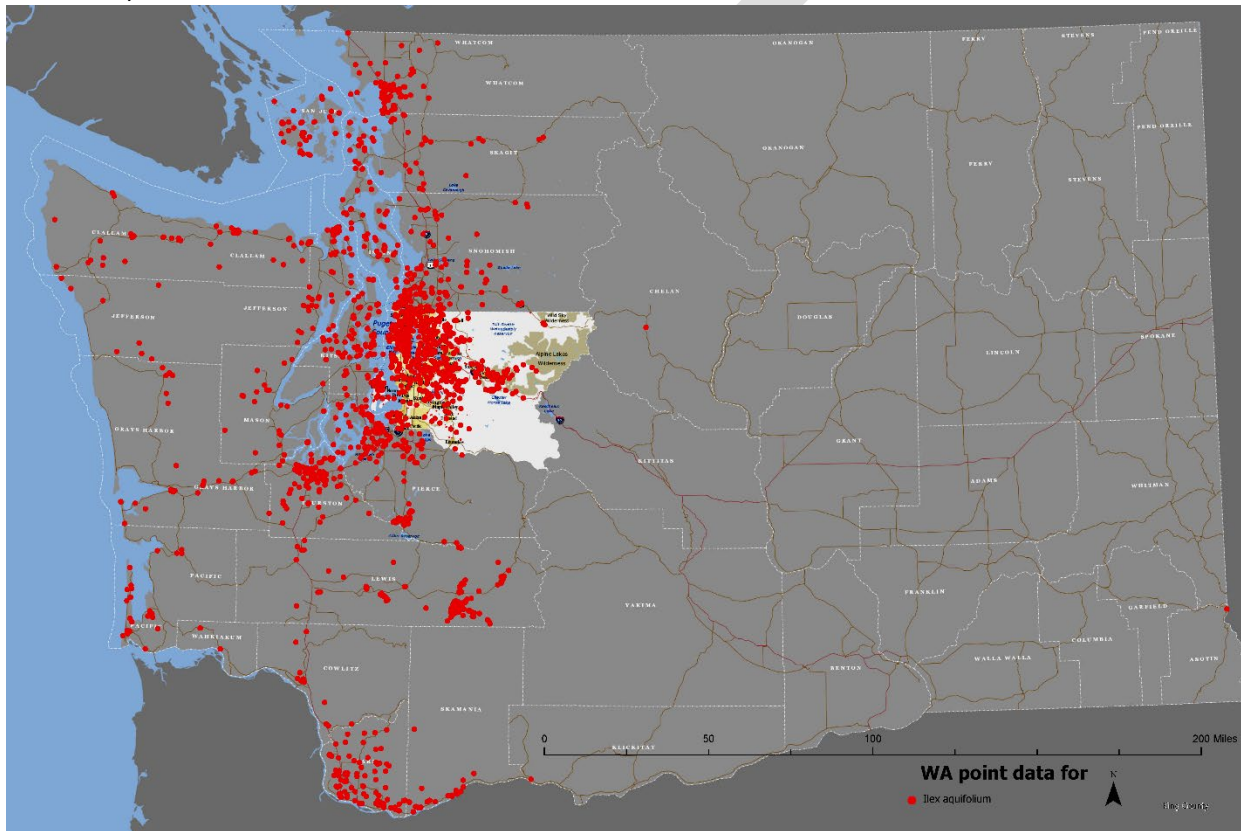
HISTORY:

Zika (2010) provides a comprehensive history of *I. aquifolium* in the Pacific Northwest, from its first recorded introduction as an ornamental in 1869, to the establishment of commercial holly production in 1891, to the first observations of naturalized *I. aquifolium* in 1960 and 1977, to Zika's own current surveys in western Washington. According to the Burke Museum Herbarium at the University of Washington, *I. aquifolium* has been sampled in every county west of the Cascades, and Zika (2010) noted the presence of this species in every urban setting he sampled in western Washington (Washington State Noxious Weed Control Board, 2010).

There are 3 to 5 known holly farms in Washington State, as of 2022, but in the 1940s and 1950s there were over 200 holly farms in the state. In 1937 30,000 hollies were planted in parks and gardens around Washington, and on Arbor Day in 1928, 1,500 holly trees were planted at Seward Park in Seattle. As of 2005, holly was the third most common tree at Seward Park (Smith, 2013). At a slightly larger scale, in Seattle's urban forests, holly was the 4th most common invasive plant species found and made up 3% of Seattle's plant species (Yadrick, 2014).

WASHINGTON:

Found in and around forests throughout Western Washington, and as far East as Klickitat County (Burke Herbarium).



Burke Herbarium, EDDMapS, and iNaturalist holly observation and specimen datapoints combined by Tom Erler.

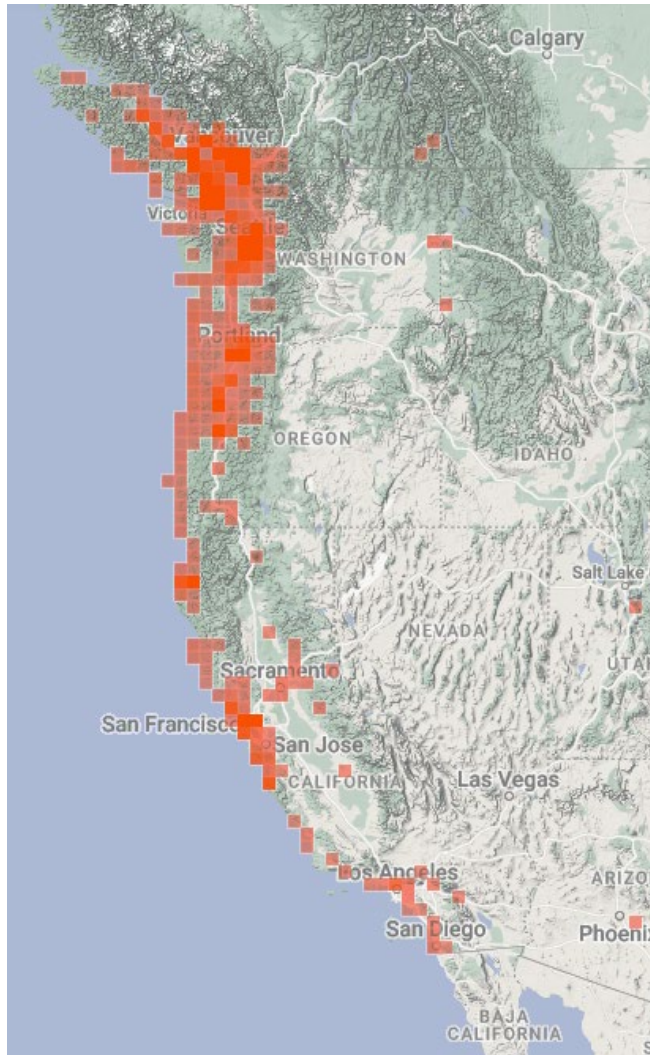
NEARBY TO WASHINGTON:

OREGON:

Throughout Western Oregon, throughout and near forests (Consortium of Pacific Northwest Herbaria).

IDAHO:

A few observations in the forested and low mountainous regions of Northern Idaho (iNaturalist).



Holly observations, iNaturalist.

BRITISH COLUMBIA:

Across Western British Columbia, especially around Vancouver Island and near the coast, all the way up into Alaska (EddMapS, iNaturalist, Consortium of Pacific Northwest Herbaria).

CALIFORNIA

Along the Western coast of California, all the way down to Mexico, and inland as far as Fresno, Sacramento, and Mt. Shasta (EddMapS, iNaturalist).

LISTINGS:

Oregon considers holly invasive, though has not listed it as noxious, due to cultural importance. The City of Portland and a few other municipalities around Washington and Oregon have added it to special weeds of concern lists, to facilitate control. Also considered invasive in Alaska (where it is in their “top 10 worst invasive species”), California, Hawaii, Virginia, and British Columbia. North Cascades, Redwood, and Yosemite National Parks, and Monocacy National Battlefield Park, all consider it invasive in their habitat plans. Has a legal listing as an invasive plant in Australia, New Zealand, and Chile (Invasive Plant Atlas).

ECONOMIC AND ECOLOGICAL IMPORTANCE:

DETRIMENTAL:

Feral holly poses a threat to timber and forestry production, undeveloped or undisturbed forested areas, and forest edge habitats through its invasion and establishment (Church, 2016, Watts, 2013). It poses a threat to both shaded and unshaded habitats (Stokes, *et al.*, 2017, Watts 2013). It can become dominant in a forest understory where it impacts native species through competition for nutrients and shade. It greatly reduces native species diversity under its canopy, and its population and impacts will only grow in the coming years and decades (Stokes, *et al.*, 2014, Stokes & Campbell, 2011). In clear cuts, there were 7 times more hollies with berries than in the forested areas, and other studies have shown that holly in the sun will produce more berries (Church, 2016).

Holly can be fast growing and spreading, with Stokes & Campbell finding a doubling of population size every 14 years, while the canopy can increase 10 times over 25 years. Even faster than that, Stokes *et al.*, 2014 found the population doubled every 5 to 6 years, creating exponential population growth, as seed and vegetative spread are both accelerating. Because of the bird dispersal of hollies, it has been “off the radar” of many land managers. These remote holly populations reproduce by berries and vegetatively and are difficult to find (Church 2016). The seeds can remain dormant in the soil for three years before germination (Watts, 2013).



Lack of understory diversity after holly control in St Edward's State Park, Dr. Dave Stokes.

English holly can increase wildfire risk in forests: “by acting as an accelerant for fire (when extremely flammable) and/or by acting as ladder fuels that carry a fire from ground level to the crown of trees... English holly (*Ilex aquifolium*), a flammable thicket-forming understory shrub, can also function as a ladder fuel.” (King County, 2022)

I. aquifolium can impact nutrient cycling and ecosystem diversity by causing a 15% increase in sulfur beneath its canopy and can decrease soil pH by ten times over many decades (Berger, 2016).

Holly is a host for pathogen that causes sudden oak death, *Phytophthora ramorum*, which also causes damage to several other native species (EPPO).

Holly berries are toxic to humans (Smith, 2013).

It is expensive and physically difficult to fully control adult and mature holly trees and shrubs. At one site, between 2007 and 2009, Seattle Public Utilities spent almost \$90,000 to control feral holly (Watts, 2013).

BENEFICIAL:

Ilex aquifolium is commercially grown in for its foliage, used in wreaths and boughs – especially popular at Christmastime - and in floral arrangements. Because the Pacific Northwest climate is favorable to *I.*

aquifolium, its cultivation as a crop is primarily limited to this area of the country. As of 1986, *I. aquifolium* grown in this region has accounted for about 85% of the world's commercially harvested foliage (Ticknor, 1986 in Zika, 2010).

As of 2012, 90% of English holly sold around the United States comes from the Pacific Northwest. The farms in Washington generated 5 million dollars each year, as well as employment and tax revenue (Watts, 2012).

The fruits provide a winter food source for songbirds, particular robins (Zika, 2010, Washington State Noxious Weed Control Board, 2010).



Ken Bajema's holly farm in Skamania County.

CONTROL:

MECHANICAL:

Small plants and seedlings can be hand-pulled, which results in good control provided roots are removed. Mature trees can be cut at ground level, but the site must be monitored to be sure subsequent sprouts do not re-establish. Removal of flowers/fruits is recommended to prevent seed spread (Washington State Noxious Weed Control Board, 2010).

Stokes & Campbell (2011) found that it took almost 40 person-hours to chainsaw and clear holly from almost 16 acres at St. Edward parkland. Though, unless follow up chemical treatments are completed, stumps and mature roots left behind will sucker and regrow (Stokes & Williams, 2014).



CULTURAL:

None at the time of the previous written findings of the Washington State Noxious Weed Control Board (2010)

BIOLOGICAL:

There are no known efforts investigating biocontrol of *I. aquifolium*, as of 2010 (Washington State Noxious Weed Control Board, 2010).

CHEMICAL:

Ilex aquifolium has been reported to be sensitive to picloram used as a cut-stem, bore-and-fill, or frill application. An anecdotal report of *I. aquifolium* being controlled with triclopyr or imazapyr applied either as a foliar spray or a cut-stem treatment has also been reported

(Washington State Noxious Weed Control Board, 2010).

Foliar application of herbicide is not effective, due to the leaves' thick waxy coating. Frilling with glyphosate in the spring and again in fall is only 65% effective, while using triclopyr killed 99% of trees if used over two seasons. Injection of imazapyr is the most effective and time-efficient way to control adult and mature trees (Salisbury, 2013). The cost of an EZ-ject system plus the canisters are likely to be exorbitant for many citizens. Information on rate and cost can be found at Forestrydistributing.com.

RATIONALE FOR LISTING:

In Washington State, a noxious weed is defined as: A plant that when established is: highly destructive, competitive, or difficult to control by cultural or chemical practices (RCW 17.10.010). English holly has demonstrated a negative impact on forests and forest health in multiple ways (as described in the Ecological Importance section,) lowers species diversity, and is impossible to control within one (or multiple) years (Pacific Northwest Weed Management Handbook, 2019).

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