

DRAFT WRITTEN FINDINGS OF THE WASHINGTON STATE NOXIOUS WEED CONTROL BOARD

SCIENTIFIC NAME: *Ilex species*

COMMON NAMES: Holly

FAMILY: Holly Family, Aquifoliaceae

LEGAL STATUS: Recommended for Class C listing non-native *Ilex species*, not including holly found in managed landscapes or where commercially or agriculturally grown.

Ilex aquifolium has been on Washington's monitor list since 2012.

DESCRIPTION AND VARIATION

There are more than 664 species, sub-species, and varieties in the genus *Ilex* (Yao *et al.*, 2020), none of which are native to the Pacific Northwest or Washington, though there are a few species native to other regions of North America (Burke Herbarium; Darrow, 2020; Hitchcock & Cronquist, 2018; Zika 2010). *Ilex aquifolium* is the most common holly species found in the Pacific Northwest (Hitchcock & Cronquist, 2018; Zika, 2010), and is the primary *Ilex species* with studies, research, or data available on ecology, morphology, genetics, invasiveness, or management.



I. aquifolium in St. Edward State Park, by Dr. Dave Stokes

There is information in these findings are composed of the 6 species or hybrids of *Ilex* which have ever been recorded or observed (with data and samples kept in herbariums), outside of their desired and managed landscapes, in the Pacific Northwest:

- *Ilex aquifolium*: 187 records in the Consortium of Pacific Northwest Herbaria in just Washington, British Columbia, and Oregon (August 23rd, 2024, data).
- *Ilex crenata*: 4 records, 3 of which are in Washington, and one in British Columbia (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).
- *Ilex opaca*: 1 record, only in Washington (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).

- *Ilex x altaclerensis*, hybrid of *I. aquifolium* and *I. perado*: 2 records, both in British Columbia (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).
- *Ilex cornuta*: 1 record, only in Oregon (DiscoverLife, August 23rd, 2024, data).
- *Ilex x attenuata*, hybrid of *I. cassine* and *I. opaca*: 1 record, only from Northern California in 1977, but grown commercially in Western Washington (Zika, 2010).



I. aquifolium stand in Lattawood Park, by Elliot Church

OVERALL HABIT:

The *Ilex* genus is the only genus in the family Aquifoliaceae. Broadly, *Ilex species* are shrubs or small trees, which live for many decades. They have glossy, evergreen (but sometimes deciduous) leaves and grow colorful berries when ripe (Loizeau *et al.*, 2005; Yao *et al.*, 2020).

- *I. aquifolium* height ranges between six to seventy-five feet for mature, horticultural trees. They can live for many decades (Washington State Noxious Weed Control Board, 2010).
- *I. crenata* usually grows to 1-4 meters (3-13 feet) tall, though rarely as tall as 10 meters (33 feet). When kept trim, the compact growth form and leaf texture can give the appearance of a box shrub (NC State Extension).
- *I. opaca* can grow 10 to 20 meters (30-60 feet) wide and almost 30 meters (98 feet) tall (USDA).
- *Ilex x altaclerensis* were originally hybridized when flowers of *I. perado* were pollinated by *I. aquifolium* individuals. Generally, this hybrid shows greater vigor and robustness than either parent species (International Dendrology Society).
- *I. cornuta* can generally grow to 3 meters (10 feet) tall (NC State Extension).
- *Ilex x attenuata* can grow 3.5-7.5 meters (12 to 25 feet) tall, and generally grows in a cone shape (NC State Extension).

STEMS:

The bark of holly species are typically smooth and shades of gray. The internal wood is very similar between *Ilex species* (Loizeau *et al.*, 2005).

- The DBH (diameter at breast height) of mature *I. aquifolium* trees is noted as falling between 40-80 cm. The fairly smooth bark color ranges from green-gray to brown-gray (Washington State Noxious Weed Control Board, 2010).
- *I. crenata* have green to light gray or light brown smooth bark (NC State Extension).
- *I. opaca* diameter can reach 50-120 cm (20 to 47 inches) wide. The bark is smooth and gray to brown to green, with occasional red, burgundy, and white coloration depending on nutrients and sunlight (NC State Extension).
- *I. cornuta* has smooth bark, which is a light gray in color. The bark can age to have a finely flaky texture and appearance. The branches may turn slightly red in the winter (NC State Extension).



I. aquifolium bark.



I. cornuta bark, photo from KENPEI.



I. aquifolium leaves (above).



I. crenata leaves (above). Photo by Will Cook.

LEAVES:

Leaves vary from species to species, and between varieties in the genus *Ilex*. Many species have evergreen leaves (Loizeau *et al.*, 2005).

- *I. aquifolium* has 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. Leaves are evergreen deciduous. 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).
- *I. crenata* has bright green, evergreen leaves, with very short spines on the end, which give the



Variegated *Ilex x altaclerensis* leaves (above).



I. cornuta leaves (above), photo by Zhang Zhuangang.



Ilex x attenuata leaves (above), photo by David J. Stang.

appearance of serration, rather than spines. Some cultivars are variegated. The leaves grow alternately up the stems (NC State Extension).

- *I. opaca* have a variable amount and size of leaf spines across and within its native range, along the East coast of the United States (Supnick, 1983). The evergreen leaves grow alternately from the stems, are oval shaped, with generally stout spines. The leaves are distinctly less glossy than *I. aquifolium* (NC State Extension).

- *Ilex x altaclerensis* leaves are easily distinguished from *I. aquifolium*, by its larger, more robust leaves. Many varieties show variegation (International Dendrology Society).

- *I. cornuta* frequently has distinctive rectangular leaves, with spines that grow near the “corners” of the rectangular shape. The leaves can be oval-shaped with few spines, however. The leaves are evergreen and grow alternately up the stems (NC State Extension).

- *Ilex x attenuata* leaves are evergreen, elliptic to oval-lanceolate shaped, green leaves, with light spines along the margins, especially near the tip of the leaf (NC State Extension).

FLOWERS:

Ilex flowers are largely uniform over the genus. Dioecious, dull white, small, and arranged in fasciculate cymes. Both calyx and corolla four-lobed. Ovary is four-celled (Loizeau *et al.*, 2005).

- *I. aquifolium* blooms in western WA between April and June and are pollinated by bees (Washington State Noxious Weed Control Board, 2010).

- *I. crenata* flowers are small, have 4 white-ish petals and a green-ish center, and bloom in the spring (NC State Extension).



Female *I. aquifolium* flowers (left).

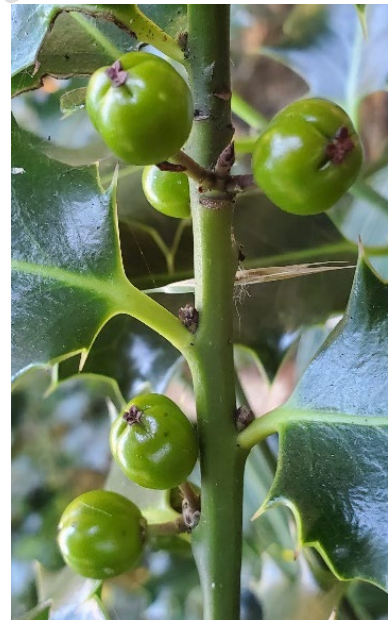


Male *I. crenata* flowers (right). Photo by Will Cook.

- *I. opaca* flower, in their native range in the Eastern U.S., around April (Ives, 1923). Male *I. opaca* trees produce over 7 times more flowers than female trees, and the flowers open over a wider period of time (Carr, 1991).
- *Ilex x altaclerensis* flowers are distinguished from *I. aquifolium*, by its larger, more robust flowers (International Dendrology Society).
- *I. cornuta* flowers have four white petals around a green center (NC State Extension).
- *Ilex x attenuata* flowers are made of 4 white to green petals with a green center and appear in the spring (NC State Extension).

FRUITS/SEEDS:

Ilex berries vary in color and size, though many ripen to shades of red or orange. Each drupe consists of four stones and contains four seeds (Loizeau *et al.*, 2005).



Immature *I. aquifolium* berries (above, right).

Ripe *I. opaca* berries and leaves (bottom, left.) Photo from PA Natural Heritage Program.

- *I. aquifolium* fruits are 6-10 mm in diameter, pulpy, start green and ripen to range from bright red to reddish orange. (Washington State Noxious Weed Control Board, 2010).
- *I. crenata* fruit are black berries around four small seeds, which ripen in the fall (NC State Extension; Zika, 2010).
- *I. opaca*, in their native range of the Eastern U.S. have fully formed berries in the middle of June (Ives, 1923). The berries are red to red orange (NC State Extension).
- *Ilex x altaclerensis* berries are easily distinguished from *I. aquifolium*, by its larger, more robust berries (International Dendrology Society).
- *I. cornuta* makes red berries, which are generally larger than *I. aquifolium* (NC State Extension).
- *Ilex x attenuata* pea-sized red fruits persist through winter (NC State Extension).

ROOTS:

- *I. aquifolium* has a very extensive root system (Rushforth, 1999).
- *I. crenata* has no research or data on their roots.
- *opaca* have a very prolific lateral root system, which can resprout after cutting, mowing, or burning (USDA).



Robust and woody *I. aquifolium* root system connecting multiple saplings, from Loutos, 2024.

- *Ilex x altaclerensis* has no research or data on their roots.
- *I. cornuta* has no research or data on their roots.
- *Ilex x attenuata* has no research or data on their roots.

SIMILAR SPECIES:

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 the species of holly which have been found in the Pacific Northwest, 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 in clusters on stems at the top of the shrubs (Burke Herbarium).



Tall Oregon grape, *Mahonia nervosa*, in bloom.

HABITAT:

The genus *Ilex* generally prefer wet and moist areas, but can occasionally grow in dryer areas, like the tops of hills in the centers of primary forests, and in grasslands (Loizeau *et al.*, 2005). Within the right conditions, *Ilex* species frequently become the major plant component within habitats (Yao *et al.*, 2020).

- *I. aquifolium* is found in lowland mesic forests and disturbed areas (Washington State Noxious Weed Control Board, 2010). 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).
- *I. crenata* grows in full sun to partial shade, and prefers acidic, well-drained soil. It thrives in warm, humid areas (NC State Extension).
- *I. opaca* is a very shade tolerant understory tree (Forrester & Leopold, 2005). In their native habitat, they are found in sunny woodlands and dry forests (Supnick, 1983). They can grow in dry and wet soil (NC State Extension).

- *Ilex x altaclerensis* can grow in shade and full sun and prefers moist soil. They can tolerate salt exposure from growing near the coast (Plants for a Future).
- *I. cornuta* can survive in sun or shade and can grow in a variety of soil types. It is heat, humidity, and drought tolerant, once it is established (NC State Extension).
- *Ilex x attenuata* can grow in full sun to partial shade, and does best in acidic, well-drained soil, with some moisture available (NC State Extension).



Large *I. aquifolium* stand at Lake Youngs Reserve, by Sally Nickelson.

BIOLOGY

GROWTH AND DEVELOPMENT:

Ilex species have seeds which usually take from 2 to 8 years to germinate (Loizeau *et al.*, 2005).

- *I. aquifolium* 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 & Lloyd, 1967). Peterken and Lloyd (1967) note that holly trees growing in closed canopy reach 5 meters after 30-40 years. *I. aquifolium* show exponential population growth, as they can double in population size every 5 to 6 years Stokes *et al.*, 2014).
- *I. crenata* is a slow growing tree (NC State Extension).

- *I. opaca* berries can after-ripen, especially when exposed to moisture, if the branch or berries are removed from the tree. The seeds will go into dormancy until exposed to water (Ives, 1923).
- *Ilex x altaclerensis* has no research or data on their growth or development.
- *I. cornuta* is a slow growing plant (NC State Extension).
- *Ilex x attenuata* has a medium growth rate (NC State Extension).

REPRODUCTION:

Ilex species' fruit are adapted to bird dispersal, which lead to successful long-distance dispersal and establishment in short periods of time (Loizeau *et al.*, 2005).

Ilex aquifolium reproduces both sexually and vegetatively. Trees may start flowering when about ten years old (Peterken & 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.



Holly tree, which has been cut and is resprouting from below the cuts.

I. aquifolium reproduces vegetatively by suckering and layering when cut at ground level or when extensively pruned. Additionally, adventitious roots can form. Freshly cut branches and live stakes can re-root when they fall onto or touch a moist substrate surface (Peterken & Lloyd, 1967; Washington State Noxious Weed Control Board, 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). Birds, frequently robins, spread holly seed 10-50 meters and up to 500 meters (Zika, 2010). 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 & 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). Peterken & 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). *I. aquifolium* has established on very remote and rarely visited islands in the San Juans and arrived there by bird-spread seed (Bennet, *et al.*, 2011). Birds are also suspected to have spread holly into remote watersheds of Western Washington (Loutos, 2024).

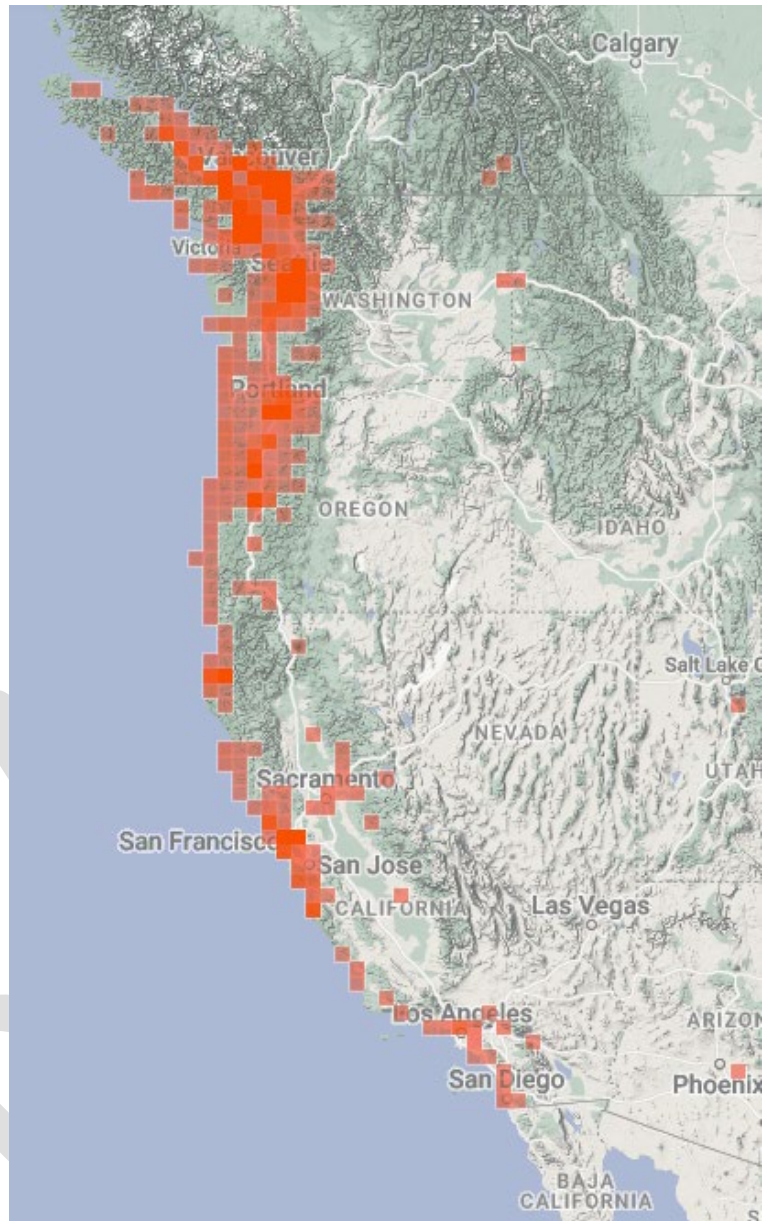
I. crenata reproduces by seed and can reproduce vegetatively when freshly cut branches and live stakes are put in contact with moist soil (NC State Extension).

I. opaca reproduce very well by seed (Ives, 1923). They can also reproduce vegetatively from their prolific lateral root system, and when freshly cut branches and live stakes are put in contact with moist soil (USDA).

Ilex x altaclerensis reproduces by seed and can reproduce vegetatively when freshly cut branches and live stakes are put in contact with moist soil (Plants for a Future).

I. cornuta reproduces by seed and can reproduce vegetatively when freshly cut branches and live stakes are put in contact with moist soil (NC State Extension).

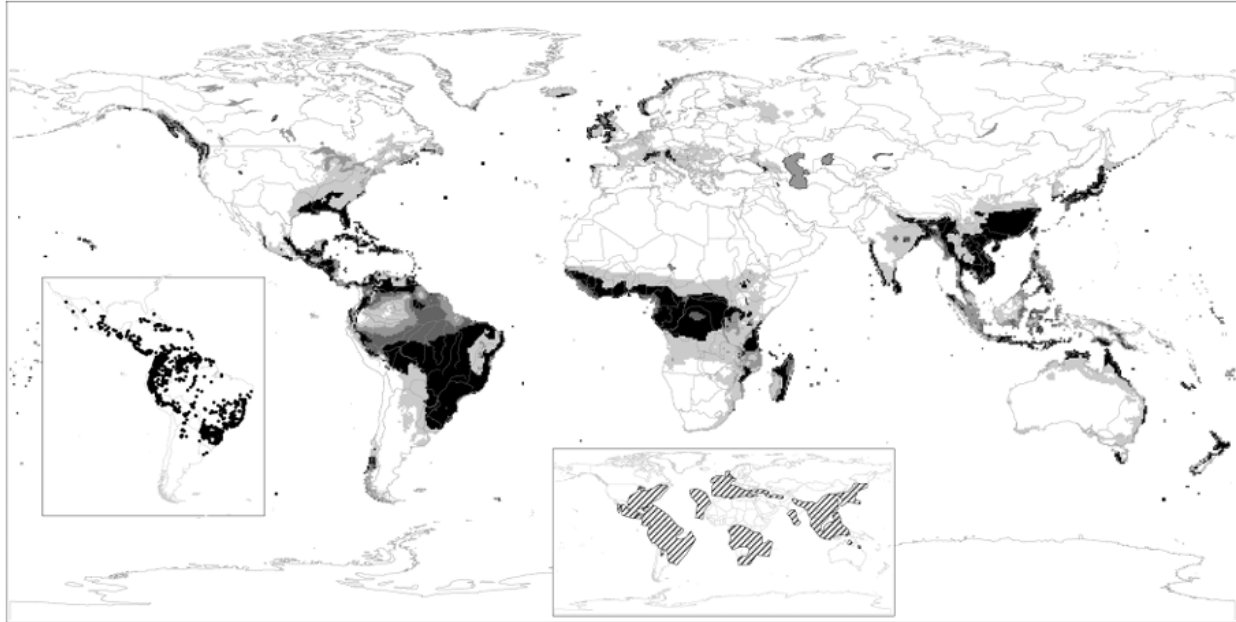
Ilex x attenuata reproduces by seed and can reproduce vegetatively when freshly cut branches and live stakes are put in contact with moist soil (NC State Extension).



I. aquifolium observations, iNaturalist, in 2022.

GEOGRAPHIC DISTRIBUTION:

NATIVE DISTRIBUTION



Ilex genus habitat suitability map, from Loizeau *et al.*, 2005

The highest diversities of *Ilex* are in Asia and the montane areas of South America (Loizeau *et al.*, 2005). There are over 664 species, subspecies, and hybrids in the genus *Ilex* (Yao *et al.*, 2020), and there are species native to every continent, except for Antarctica (Cuenoud *et al.*, 2000). However, no species are native to the Pacific Northwest (Burke Herbarium; Consortium of Pacific Northwest Herbaria; Hitchcock & Cronquist, 2018). Even in their native ranges, some cultivated varieties of holly are invading and pushing out stands of native populations of holly (Skou *et al.*, 2012).

- *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) (Washington State Noxious Weed Control Board, 2010).
- *I. crenata* is native to temperate regions of East Asia, from Nepal to Japan and Korea (NC State Extension).
- *I. opaca* is native to the SE United States, from Massachusetts, South to Florida, along the Gulf of Mexico to Texas, and inland to Oklahoma, Arkansas, Missouri, Kentucky, and Ohio (USDA).
- *Ilex x altaclerensis* was first hybridized in the United Kingdom, where it was a hybrid of *I. aquifolium* and *I. perado* (International Dendrology Society).
- *I. cornuta* is native to China and Korea (NC State Extension).
- *Ilex x attenuata* grows along the SE United States Coast, from Louisiana to Florida to North Carolina (NC State Extension).



I. aquifolium global observations, DiscoverLife

NON-NATIVE DISTRIBUTION

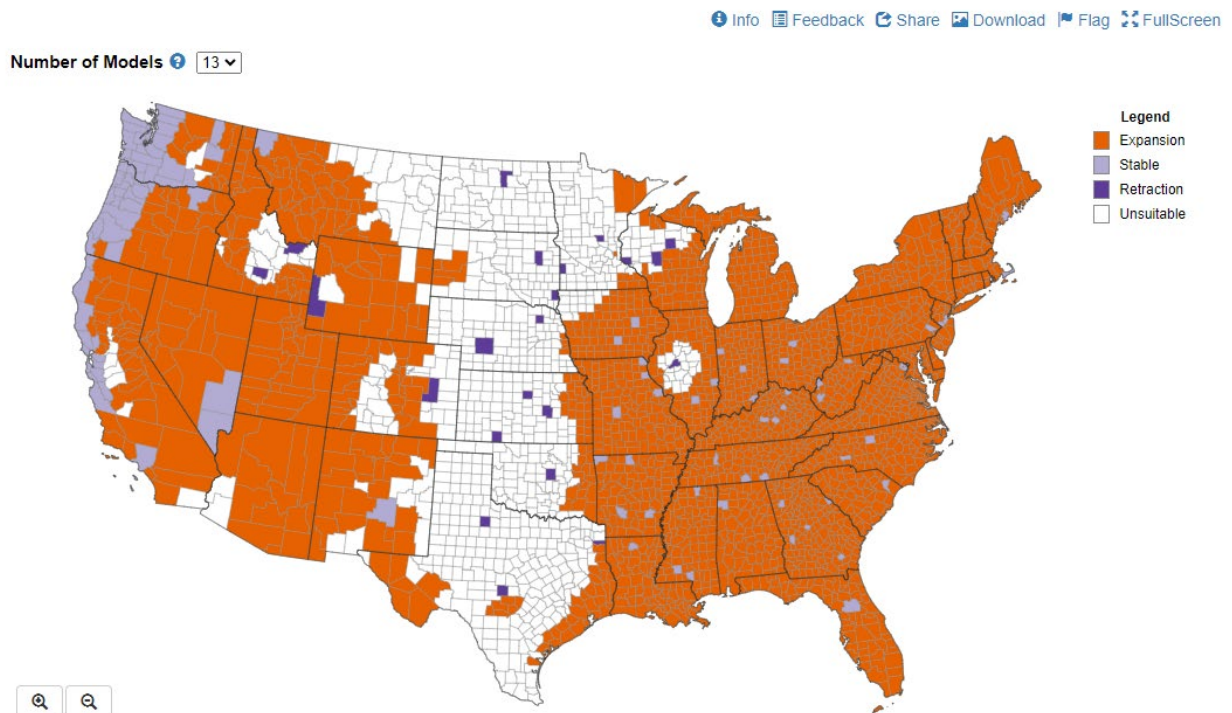
Several holly species been found escaped and in the wild of many countries around the world, including Central China, Japan, Southeastern Australia, across New Zealand, Chile, Panama, Venezuela, a few populations around Africa, and many of the Hawaiian Islands (Discover Life; Washington State Noxious Weed Control Board, 2010).

- *I. aquifolium* has the widest global distribution (DiscoverLife; Invasive Plant Atlas; Agriculture Victoria; Department of Natural Resources and Environment Tasmania; Flora of Australia; New Zealand Plant Conservation Network; Weedbusters). *I. aquifolium* is the most documented in research and has the most records from natural areas (EddMaps; Invasive Plant Atlas; Washington State Noxious Weed Control Board, 2010; Zika, 2010).
- *I. crenata* may be invasive in some situations (The Spruce, 2024) however, the source for that statement, the NC State Extension does not mention *I. crenata*'s invasiveness (NC State Extension). There are observations of *I. crenata* in Western Australia, in the middle east, in Europe, and throughout the Eastern United States (DiscoverLife).
- *I. opaca* have been recorded in Australia, Japan, Korea, a few parts of Europe, and Hawaii (DiscoverLife).
- *Ilex x altaclerensis* has no research or data on its non-native distribution.
- *I. cornuta* has been recorded as invasive in New Zealand but is not on any conservation lists (Weedbusters). *I. cornuta* has been recorded in Australia, Europe, and in many places throughout the SE United States (DiscoverLife).
- *Ilex x attenuata* has no research or data on its non-native distribution.

HISTORY:

Today, there are around 8 holly farms in Washington State, of varying size, though there may be more unknown to the Northwest Holly Growers Association (John Rummel, personal communication, August 23rd, 2024). In the 1940s and 1950s there were over 200 holly farms in the state and still may be others not listed. From 1927-1930, school children, boy and girl scouts, and others planted thousands of holly seeds and seedling in parks and forest area in Seattle and King County. 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 (Smith, 2013).

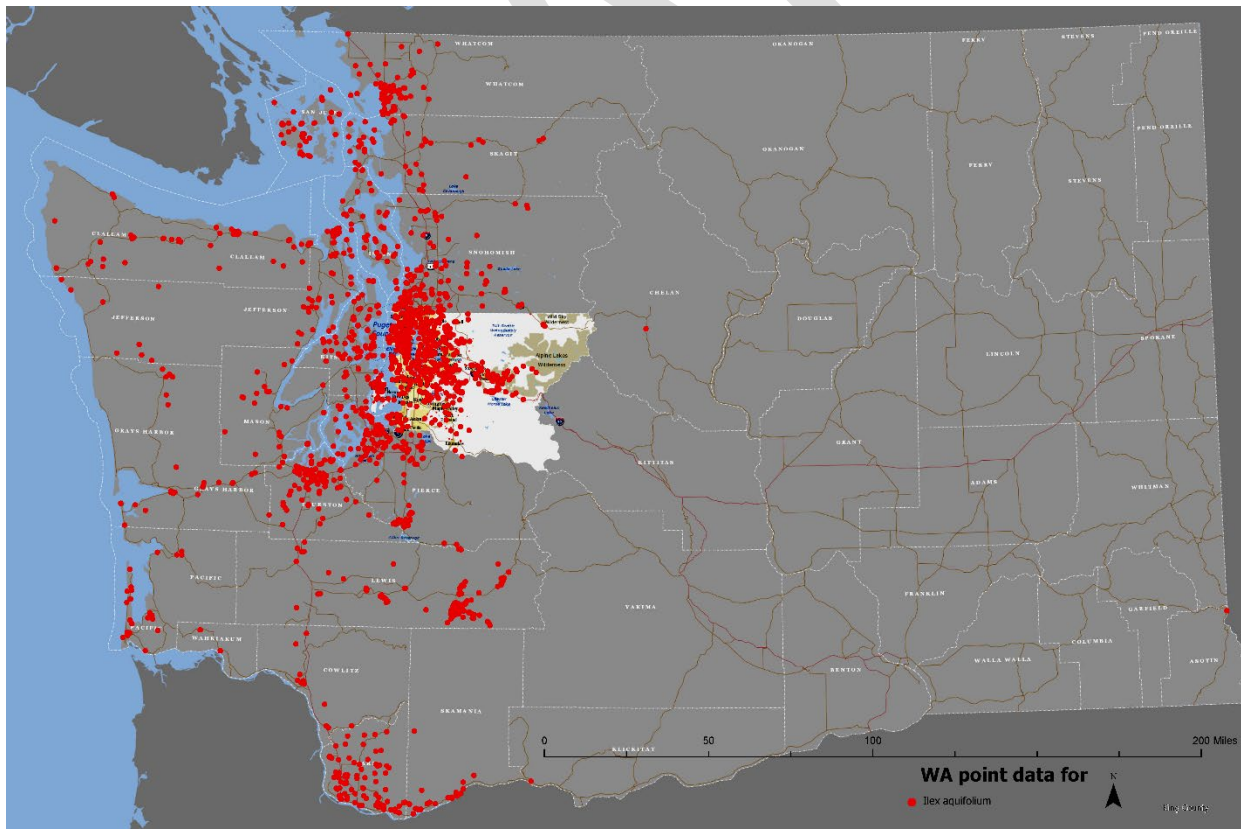
- I. aquifolium* has 187 herbarium records in Washington, Oregon, and British Columbia (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data). Zika (2010) provides a comprehensive history of *I. aquifolium* in the Pacific Northwest, from its first recorded introduction as an ornamental in 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). 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). Under the even the most conservative modeling from



Map of *I. aquifolium* expansion (orange) predictions, using the most conservative modeling from USGS and EDDMapS, generated on August 23, 2024.

the USGS and EDDMapS predict *I. aquifolium* will have a large expansion of range in the Pacific Northwest, given future climate predictions (EDDMapS, August 23rd, 2024, data).

- *I. crenata* has 4 herbarium records in the Pacific Northwest. All were found between 1999 and 2006. 1 was near Vancouver in British Columbia, and the other 3 were near urban areas of Snohomish and King Counties (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data). *I. crenata* is the only other *Ilex species*, besides *Ilex aquifolium*, to be listed in Flora of the Pacific Northwest, where it is only mentioned as a footnote due to a single occurrence, which was in Snohomish County in 2004, but is not acknowledged as a species present in the Pacific Northwest (Hitchcock & Cronquist, 2018).
- *I. opaca* has 1 herbarium record in the Pacific Northwest, Washington State, the same plant in 2005 and 2006, just outside of the Washington Park Arboretum (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).
- *Ilex x altaclerensis* has 2 records in the Pacific Northwest, both found just south of Vancouver, British Columbia, which were both seen in 2018 (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).
- *I. cornuta* has one herbarium record in the Pacific Northwest, which was collected in 2000 on the OSU campus in Corvallis, Oregon (DiscoverLife, August 23rd, 2024, data).
- *Ilex x attenuata* has no herbarium records in the Pacific Northwest, though 1 was found escaped in 1977 in Sacramento, California, and they are grown commercially in Western Washington



Burke Herbarium, EDDMapS, and iNaturalist *I. aquifolium* observation and specimen datapoints from 2022 combined by Tom Erler.

(Zika, 2010). *Ilex x attenuata* likely first hybridized in the wild in the 1920s, in Florida, where both parent species are native (NC State Extension).

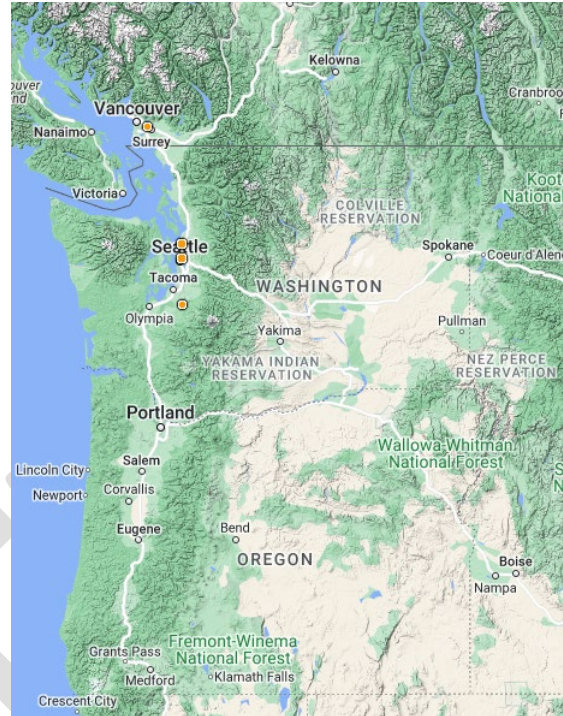
WASHINGTON:

- *I. aquifolium* is found in and around forests throughout Western Washington, and as far East as Klickitat County (Burke Herbarium). The Consortium of Pacific Northwest Herbaria has 114 herbarium records, while iNaturalist has 3,840 research grade observations in Washington (August 23rd, 2024, data).
- *I. crenata* has 3 in Washington, which were all collected between 1999 and 2006. The records are all in urban areas of King and Snohomish Counties (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).
- *I. opaca* has 1 herbarium record in Washington State, the same plant was found in 2005 and 2006, just outside of the Washington Park Arboretum (Consortium of Pacific Northwest Herbaria August 23rd, 2024, data).
- There are no observations or herbarium records of *Ilex x altaclerensis* in Washington, as of August 23rd, 2024.
- There are no observations or herbarium records of *I. cornuta* in Washington August 23rd, 2024.
- There are no observations or herbarium records of *Ilex x attenuata* in Washington as of August 23rd, 2024.

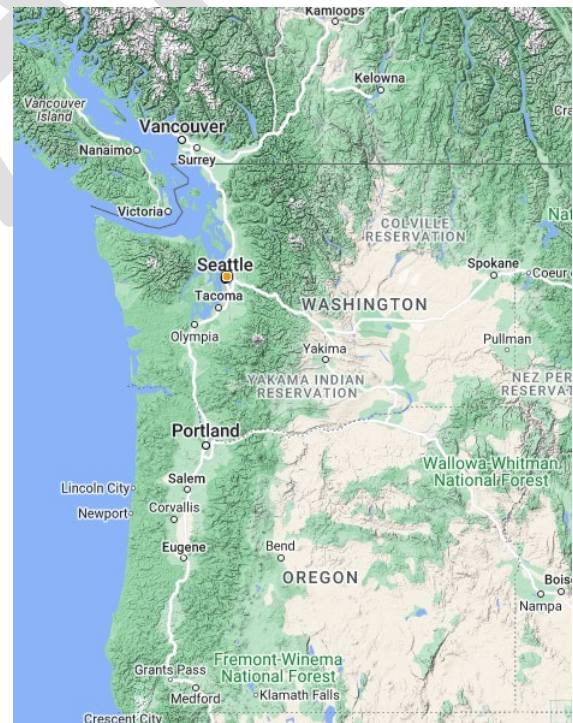
NEARBY TO WASHINGTON:

OREGON:

- *Ilex aquifolium* is known throughout Western Oregon, throughout and near forests, and there are 53 herbarium records (Consortium of Pacific Northwest Herbaria, August 23rd, 2024,



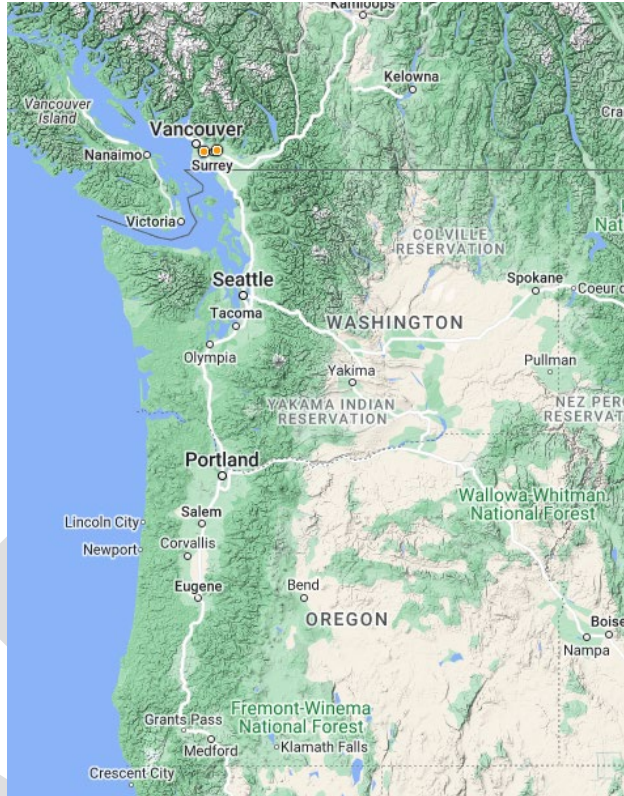
Map of the 4 records of *I. crenata* in the Pacific Northwest (above). From Consortium of Pacific Northwest Herbaria on August 23, 2024.



Map of the 1 record of *I. opaca* in the Pacific Northwest (above). Recorded only near Seattle, WA. From Consortium of Pacific Northwest Herbaria, on August 23, 2024.

data). iNaturalist has 1,554 research grade observations of *I. aquifolium* in Oregon (August 23rd, 2024, data).

- There are no observations or herbarium records of *I. crenata* in Oregon as of August 23rd, 2024.
- There are no observations or herbarium records of *I. opaca* in Oregon as of August 23rd, 2024.
- There are no observations or herbarium records of *Ilex x altaclerensis* in Oregon as of August 23rd, 2024.
- *cornuta* has 1 herbarium record in Oregon, collected from the Corvallis OSU campus in 2000 (DiscoverLife, August 23rd, 2024, data).
- There are no observations or herbarium records of *Ilex x attenuata* in Oregon as of August 23rd, 2024.



Map of the 2 records of *Ilex x altaclerensis* in the Pacific Northwest (above). All records near Vancouver, BC. From Consortium of Pacific Northwest Herbaria, on August 23, 2024.

IDAHO:

- *I. aquifolium* has no herbarium records in Idaho. There are few observations in the forested and low mountainous regions of Northern Idaho on iNaturalist, though none are research grade (August 23rd, 2024, data).
- There are no observations or herbarium records of *I. crenata* in Idaho, as of August 23rd, 2024.
- There are no observations or herbarium records of *I. opaca* in Idaho as of August 23rd, 2024.
- There are no observations or herbarium records of *Ilex x altaclerensis* in Idaho, as of August 23rd, 2024.
- There are no observations or herbarium records of *I. cornuta* in Idaho as of August 23rd, 2024.
- There are no observations or herbarium records of *Ilex x attenuata* as of August 23rd, 2024.

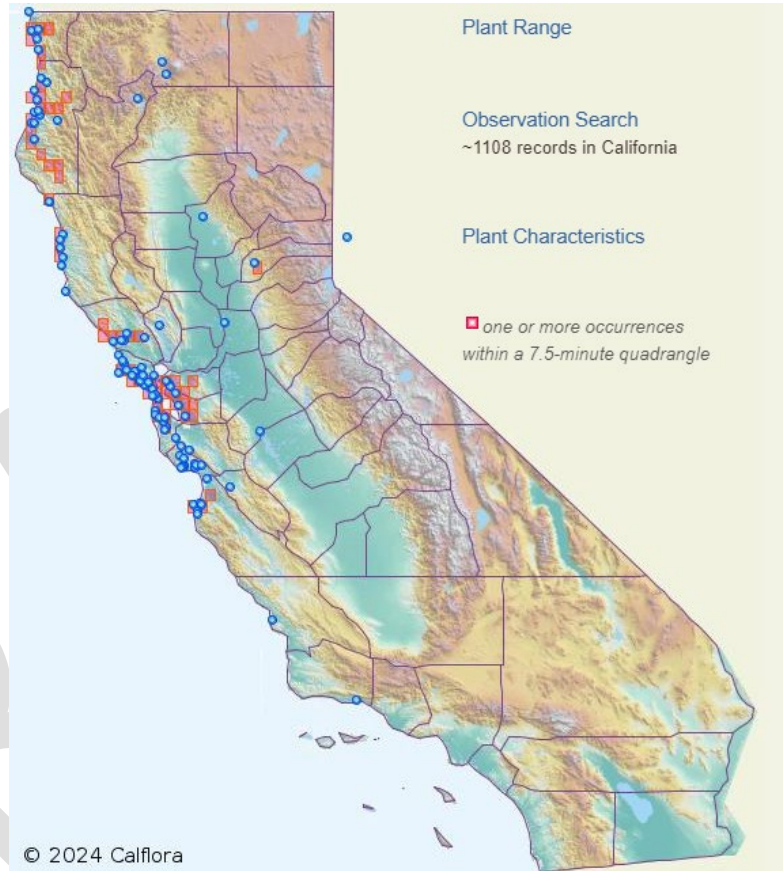
BRITISH COLUMBIA:

- *I. aquifolium* is found across southwestern British Columbia, especially around Vancouver Island and near the coast, all the way up into Alaska (EDDMapS, iNaturalist, Consortium of Pacific Northwest Herbaria). iNaturalist has 7,515 research grade observations, and the Consortium of Pacific Northwest Herbaria has 29 herbarium records (August 27th, 2024, data).
- *I. crenata* has one record in British Columbia, which was collected in 2018 from near Vancouver (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data). Likewise, there is one research grade observation on iNaturalist, also near Vancouver (August 23rd, 2024, data).

- There are no observations or herbarium records of *I. opaca* in British Columbia as of August 23rd, 2024.
- *Ilex x altaclerensis* has 2 records in British Columbia, just south of Vancouver, both of which were made in 2018 (Consortium of Pacific Northwest Herbaria, August 23rd, 2024, data).
- There are no herbarium records of *I. cornuta* in British Columbia as of August 23rd, 2024.
- There are no herbarium records of *Ilex x attenuata* in British Columbia as of August 23rd, 2024.

CALIFORNIA

- *I. aquifolium* occurs along the Western coast of California, all the way down to Mexico, and inland as far as Fresno, Sacramento, and Mt. Shasta (EDDMapS, iNaturalist). iNaturalist has 948 research grade observations, and Calflora has 1108 records throughout the state.
- There are no observations or herbarium records of *I. crenata* in California as of August 23rd, 2024.
- There are no observations or herbarium records of *I. opaca* in California as of August 23rd, 2024.
- There are no observations or herbarium records of *Ilex x altaclerensis* in California as of August 23rd, 2024.
- There are 6 records of *I. cornuta* in California, 5 of which are in Southern California, south of Big Sur, and one of was near Sacramento (Calflora, August 23rd, 2024, data). There are two research grade observations on iNaturalist (August 23rd, 2024, data).
- There is one record of *Ilex x attenuata* in California, which was collected near Sacramento in 1977 (Zika, 1010).



I. aquifolium records in Calflora on August 23, 2024.

LISTINGS:

The Washington State Noxious Weed Control Board has had *I. aquifolium* on the monitor list since 2012. WSU has *I. aquifolium* on their Invasive Forest Weeds list, in their extension forestry resources (Washington State University). The City of Portland has *I. aquifolium* listed as a Class C noxious weed since at least 2016 (Bureau of Planning and Sustainability, 2016). The Native Plant Society of Oregon

considers *I. aquifolium* invasive, with a moderate impact (Native Plant Society of Oregon, 2008). A few other municipalities around Washington and Oregon have added it to special weeds of concern lists, to facilitate control, though documentation is lacking in most, except for King County of Washington. Also considered invasive in Alaska (where it is in their “top 10 worst invasive species”), California (California Invasive Plants Council), Hawaii (Invasive Plant Atlas), Virginia (Arlington Virginia, 2013), and British Columbia (Invasive Species Council of BC). North Cascades, Redwood, and Yosemite National Parks, and Monocacy National Battlefield Park, all consider it invasive in their habitat plans (Invasive Plant Atlas). Has a legal listing as an invasive plant in Australia, New Zealand, and Chile (Invasive Plant Atlas). At the United States level, it is broadly considered an invasive species (Invasive Plant Atlas).

I. crenata is on New York’s invasive plant list, though not on a regulatory list there (New York State Invasive Species Tiers). In personal communication with Mitchell O’Neil, New York Natural Heritage Program’s invasive species biologist, he stated that *I. crenata* is not common and that it has been determined that *I. crenata* could pose a moderate threat (August 9th, 2024).

There are no known listings of *I. opaca*.

There are no known listings of *Ilex x altaclerensis*.

I. cornuta has been listed as an invasive species in Georgia (NC State Extension).

There are no known listings of *Ilex x attenuata*.

ECONOMIC AND ECOLOGICAL IMPORTANCE:

DETRIMENTAL:

Plants in the genus *Ilex* are adapted to spread by birds, which spread the seeds into highly suitable habitats for germination. This leads to successful conditions for holly species to spread to remote areas and quickly establish populations (Loizeau *et al.*, 2005). When conditions are met, *Ilex species* can become the major component of local plant communities (Yao *et al.*, 2020).

Sue Hunter, the president of the Holly Society of America,



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

stated in the Holly Society of America's journal (Volume 42. Number 1. 2024, pages 6 and 7), when talking on the concern she gets from the public about holly's invasiveness: "non-native *Ilex* species that performed well in the Pacific Northwest were and still are grown for the commercial cut-Holly trade at Christmastime. As a result, in specific geographical areas, *Ilex aquifolium* especially has become the horrendous menace that the Bradford Pear is to the East Coast." And as such "The Holly Society of America does not promote or advocate the use of any non-native species of *Ilex* to the detriment of any environment or ecosystem where the potential for invasiveness or harm to the natural environment exists." Because the Holly Society of America is continually striving to "focus on environmental awareness, sustainability, and current Horticultural events/issues. To be present, mindful, and aware are the attributes of a viable, growth-oriented organization."

I. aquifolium poses a threat to timber and forestry production, undeveloped or undisturbed forested areas, and forest edge habitats though 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).

In addition to this forestry research and data, there are many testimonies and letters from other small foresters and staff who manage government-owned forest who state that *I. aquifolium* is harmful to their forests or work (Adam Novick, small forester, testimony 2022; Andrea Watts; personal communication August 2024; Andrew Mathewson PhD, Washington Conservation Corps, proposal 2024; Bainbridge Island Cooperative Weed Management Area, testimony 2022; Brad Kriekhaus, US Forestry Service, personal communication, 2022; David Allen PhD, retired Olympic National Park botanist, testimony 2022; David Cass, Washington State Parks agency forester, personal communication August 2024; Dave Heimer, WDFW, testimony 2022; Cascade Land Conservancy, testimony 2010; Christopher Earle, retired forester, testimony 2022; Gretchen Mallari, Pierce County, testimony



I. aquifolium seedlings coming up in deep shade, with ivy.

2022; Janet Richards, small forester, proposal 2024; Julia Munger, Seattle Public Utilities, testimony 2022; Kathryn Hill, JBLM Fish & Wildlife Forest and Fire Ecologist, personal communication August 2024; Kelly Heintz, DNR testimony 2010; Ken Bevis, DNR stewardship biologist; Lewis County Noxious Weed Control Board, testimony 2022; Loutos, 2024; Kevin Zobrist, WSU Extension Forester, personal communication August 2024; Margaret Kreder, Mason Conservation District stewardship forester, personal communication August 2024; Nate Johnson, Washington State Parks, personal communication, August 2024; Steve Pedersen, WA tree farm inspector, personal communication August 2024; Todd Bates, Forestry Instructor at Grays Harbor College, personal communication August 2024; Tynan Ramm-Granberg, DNR, testimony 2022; Y. Robert Iwamoto, United States Forest Service, testimony 2010).

The Northwest Holly Growers Association (in a letter to the NWCB on July 27th, 2024) stated that an unnamed WSU Extension forester, the Washington Farm Bureau, and the Washington Farm Forestry Association do not see holly as a threat to forests or timberland. The board has received no testimony or data from these organizations or groups. Washington State Representative Ed Orcutt (in a letter to the NWCB on October 27th, 2022) and Skamania County Noxious Weed Control Board (in a letter to the NWCB on October 4th, 2022) made similar statements as the Holly Growers Association. The claims of holly not harming forest, growing in shade, being easy to control, and many other such statements in these letters, and other testimonies by holly growers (Four Bs Holly Farm, testimony 2010, & public comment 2024; Holly Hill Farm, testimony 2010; Holly Hill Orchards, testimony 2022; and Mill Creek Holly Farm, testimony 2010) are not backed up by the scientific research or data summarized in these written findings.

I. aquifolium 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



I. aquifolium saplings coming up in deep shade, nearby to the seedlings in the previous picture, on page 19.

can remain dormant in the soil for three years before germination (Watts, 2013).

I. aquifolium 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).

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

I. aquifolium berries are toxic to humans, horses, cats, and dogs, as they contain saponins, which cause vomiting, diarrhea, and depression. The amount of saponins is particularly toxic to children (NC State Extension; Smith, 2013).

It may be expensive and physically difficult to fully control adult and mature holly trees and shrubs without aggressive hand or mechanical means or without multiple proper herbicide treatments. At one site, just between 2007 and 2009 alone, Seattle Public Utilities spent almost \$90,000 to control holly (Loutos, 2024; Watts, 2013).

I. crenata poses a moderate flammability threat, and the consuming the berries can cause minor digestive system upset in humans, due to the presence of saponins (NC State Extension).

I. opaca has a high flammability rating. The berries are toxic to humans, horses, cats, and dogs, due to illicin, saponic glycosides, and triterpenoids (NC State Extension).

I. cornuta has a medium flammability rating. Berries are slightly toxic to humans, due to presence of saponins, which can cause vomiting, diarrhea, and other digestive tract symptoms. It is noted as being weedy (NC State Extension).



I. aquifolium growing tall enough to reach canopy vegetation. Photo by Thurston County Noxious Weed Control Board.

Ilex x attenuata berries are slightly toxic to humans, due to presence of saponins, which can cause vomiting, diarrhea, and other digestive tract symptoms (NC State Extension).

BENEFICIAL:

Historically, different species of *Ilex* have been used in medicines, dyes, beverages, and holly plantations have been used for timber, honey, and ornamental purposes (Yao *et al.*, 2021). Holly is commercially grown in for its foliage, used in wreaths and boughs – especially popular at Christmas time - and in floral arrangements. Because the Pacific Northwest climate is favorable to holly varieties, its cultivation as a crop is primarily limited to this area of the country. As of 1986, holly grown in this region has accounted for about 85% of the world’s commercially harvested foliage (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 to the state (Watts, 2013). Has been grown as a commercial agricultural crop for more than 90 years in the Pacific Northwest. Holly has been widely grown and planted in landscape settings, residential, cemeteries, churches and public buildings. Over the centuries holly has been considered to have spiritual meaning and a sign of good luck (Smith, 2013).



Ken Bajema’s holly farm in Skamania County.

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

I. crenata berries are a food source for birds, and the flowers provide pollen and nectar to bees (NC State Extension).

I. opaca are pollinated by many insects, and many birds will eat their berries (NC State Extension).

I. cornuta flowers are attractive to bees, and the fruits are attractive to birds (NC State Extension).

Ilex x attenuata flowers are attractive to pollinators, and the berries are attractive to birds (NC State Extension).

CONTROL:

MECHANICAL:

There is no research or data on mechanical or manual control of *I. crenata*, *I. opaca*, *Ilex x altaclerensis*, *I. cornuta*, *Ilex x attenuata*, though it is likely that the same methods that work on *I. aquifolium* (below) also work on other *Ilex* species, due to the similar growth types and taxonomy.



I. aquifolium trunk that was cut, with no herbicide applied, leading to dense resprouting below the cut.

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:

There is no research or data on cultural control of *I. aquifolium*, *I. crenata*, *Ilex x altaclerensis*, or *Ilex x attenuata*.

- Anecdotally, a Washington holly grower, Jim Rummel stated, at the Washington State Noxious Weed Control Board Meeting on July 18th, 2024, that flooding *I. aquifolium* with water for an extended period may kill trees. There is no data to back this method.
- *I. opaca* is fire-resistant, intense fire can still kill individuals (USDA).
- *I. cornuta* is prone to being killed by disturbance, including from winter storms in the first couple years (NC State Extension).

BIOLOGICAL:

There is no approved biological control agents for *I. aquifolium*, *I. crenata*, *I. opaca*, *Ilex x altaclerensis*, *I. cornuta*, or *Ilex x attenuata*.

A few species of fungus and insect can threaten *I. opaca* in their native range, in the SE United States (USDA).

CHEMICAL:

There is no research or data on chemical control of *I. crenata*, *I. opaca*, *Ilex x altaclerensis*, *I. cornuta*, *Ilex x attenuata*, though it is extremely likely that the same methods that work on *I. aquifolium* (below) also work on other *Ilex* species, due to the similar growth types and taxonomy.

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 without a sticking agent. 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.



EZ-ject lance being used on an unknown tree, photo from arborsystems.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). Non-native *Ilex species*, as proposed have negative impact on forests and forest health in multiple ways (as described in the Detrimental Economic And Ecological Importance section, pages 18-22), lowers species diversity (Stokes *et al.*, 2014; Stokes & Campbell, 2011), is difficult to control within one (or multiple) years (Loutos, 2024; Pacific Northwest Weed Management Handbook, 2019), and is harmful to many in the forestry industry, especially small-scale foresters and harmful to government-owned forests (Church, 2016; Loutos, 2024; Watts, 2013).

A Class C listing would not prohibit sale of any holly species in Washington, nor would it require removal, control, or eradication of any holly plant, by the state (RCW 17.10; WAC 16-750). Only the Washington



Dyed baby's breath, a class C noxious weed since 1988, being sold in Trader Joes in Olympia, in August 2024. Several farms in Washington sell Baby's Breath within, and out of Washington, including to international buyers. Just one example, of several plant species, which are on the Noxious Weed List, and continue to be sold.

State Department of Agriculture can stop sale of plants or plant parts within, into, or out of Washington, by adding plants to their own quarantine and prohibited plants list (WAC 16-752). At the May 10th, 2022, Noxious Weed Committee meeting, a holly grower expressed surprise at holly being on the monitor list since 2012, and stated he did not notice any change in buying habits in the 10 years following it being on the NWCB website. The currently proposed, modified listing, of *Ilex species* is intended to protect commercial holly growers and landscapers, by excluding holly found in managed landscapes or where commercially or agriculturally grown.

The purpose of the Washington State Noxious Weed List is to protect Washington's natural resources, including agriculture, horticulture, the environment, human health, and native species diversity by maintaining a regulatory law to remove, control, and educate on invasive and damaging invasive plants. Class C weeds are defined as any other nonnative plant species to Washington State, and not required for eradication, like Class As, or control, like class B Designates (WAC 16-750). Class C weeds are often widespread in Washington, or of special interest to the agricultural industry, such as small foresters. Class C weeds are allowed to be

enforced by a county, if the local county weed control board, deems it beneficial to that county, and other counties may choose to provide education or technical support on Class C weeds. The listing often helps municipalities, businesses, private landowners, agencies, and organizations add weight to grant funding proposals to conserve at-risk ecosystems or get permission to use herbicide in habitats that often have restrictions on chemical use, like wetlands and riparian areas (Loutos, 2024).

REFERENCES:

1. Agriculture Victoria, Invasiveness Assessment – Holly (*Ilex aquifolium*), retrieved on August 9, 2024, from https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/invasive_holly
2. Arlington Virginia (2013), Non-Native Invasive Plants of Arlington County Virginia. <https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/13/2013/11/invasive-1.pdf>
3. Bennett, J. R., Young, E. J., Giblin, D. E., Dunwiddie, P. W., & Arcese, P. (2011). Avian dispersal of exotic shrubs in an Archipelago. *Ecoscience*, 18(4), 369–374. <https://doi.org/10.2980/18-4-3423>
4. Berger, A. I. (2016). Soil Impacts Due to the Invasion of *Ilex aquifolium* (English Holly) into Second Growth Forests of the Pacific Northwest. *Metamorphosis*, 11. <https://metamorphosis.coplac.org/index.php/metamorphosis/article/view/36>
5. Bureau of Planning and Sustainability (2016), Portland Plant List. City of Portland, Oregon, Native Plant Society of Oregon. <https://www.portland.gov/bps/documents/portland-plant-list/download>
6. Burke Herbarium. (2024, July 26). *Ilex aquifolium*. Burke Herbarium Image Collection and Identification Key. <http://biology.burke.washington.edu/herbarium/imagecollection/taxon.php?Taxon=Ilex%20aquifolium>
7. Calflora. (2024). *Ilex cornuta*. Retrieved on August 14, 2024, from <https://www.calflora.org/app/taxon?crn=12576>
8. California Invasive Plant Council. Cal-IPC Inventory, <https://www.cal-ipc.org/plants/inventory/>
9. Carr, D. E. (1991). Sexual dimorphism and fruit production in a dioecious understory tree, *Ilex opaca* Ait. *Oecologia*, 85(3), 381–388. <https://doi.org/10.1007/BF00320614>
10. Church, E. d. (2016). Invasive English Holly (*Ilex aquifolium* L.) in Clear-Cut and Forest Units in a Western Washington Managed Forest. [Master Thesis, University of Washington]
11. Consortium of Pacific Northwest Herbaria (2024, July 30). *Ilex* search. <https://www.pnwherbaria.org/data/results.php?DisplayAs=WebPage&ExcludeCultivated=Y&GroupBy=ungrouped&SortBy=ScientificName&SearchAllHerbaria=Y&QueryCount=1&Genus1=Ilex&Species1=aquifolium&Zoom=4&Lat=55&Lng=-135&PolygonCount=0>
12. Cuenoud, P., Del Pero Martinez, M. A., Loizeau, P. A., Spichiger, R., Andrews, S., & Manen, J. F. (2000). Molecular phylogeny and biogeography of the genus *Ilex* L. (Aquifoliaceae). *Annals of Botany*, 85(1), 111–122. <https://doi.org/10.1006/anbo.1999.1003>
13. Darrow, K. “An Evergreen State of Mind: “The introduction of holly to Washington’s forests | Nature Notes”, The Port Townsend Leader (Online Newspaper), 29 December 2020, <https://www.ptleader.com/stories/an-evergreen-state-of-mind-the-introduction-of-holly-to-washingtons-forests-nature-notes,72976>.

14. Department of Natural Resources and Environment Tasmania, *Ilex aquifolium*, retrieved on August 9, 2024 from <https://nre.tas.gov.au/invasive-species/weeds/weeds-index/declared-weeds-index/holly>
15. Discover Life. (2022, August 30). *Ilex aquifolium*. Atlas of Living Things <https://www.discoverlife.org/mp/20q?search=Ilex+aquifolium>
16. EDDMapS. (2024, July 26, 2024). English Holly; *Ilex aquifolium*. Center for Invasive Species and Ecosystem Health. <https://www.eddmaps.org/distribution/usstate.cfm?sub=5744>
17. Eriksson, C., Månsson, P. E., Sjödin, K., & Schlyter, F. (2008). Antifeedants and feeding stimulants in bark extracts of ten woody non-host species of the pine weevil, *Hylobius abietis*. *Journal of Chemical Ecology*, 34(10), 1290–1297. <https://doi.org/10.1007/s10886-008-9525-0>
18. European and Mediterranean Plant Protection Organization (EPPO). "Datasheet: *Phytophthora ramorum*". November 2020. Web. Retrieved August 2022.
19. Flora of Australia, *Ilex aquifolium*, retrieved on August 9, 2024, from <https://profiles.ala.org.au/opus/foa/profile/Ilex%20aquifolium>
20. Forestrydistributing.com. 2022. Web store search: "EZ-ject". [online] Available at: <<https://www.forestrydistributing.com/filterSearch?q=eZ-ject>> [Accessed 16 August 2022].
21. Forrester, J. A., & Leopold, D. J. (2006). Extant and potential vegetation of an old-growth maritime *Ilex opaca* forest. *Plant Ecology*, 183(2), 349–359. <https://doi.org/10.1007/s11258-005-9045-8>
22. Guitián, J., & Bermejo, T. (2006). Dynamics of plant-frugivore interactions: a long-term perspective on holly-redwing relationships in northern Spain. *Acta Oecologica*, 30(2), 151–160. <https://doi.org/10.1016/j.actao.2006.02.009>
23. Hitchcock, C. L., & Cronquist, A. (2018). *Flora of the Pacific Northwest: An Illustrated Manual*.
24. Hunter, S. (2024). From the President. *Holly Society of America*, 42(1), 6-7.
25. iNaturalist. (2022, August 30). English Holly (understorey) (*Ilex aquifolium*). https://www.inaturalist.org/guide_taxa/375551
26. International Dendrology Society. *Ilex x altaclerensis*. Trees and Shrubs Online. Retrieved on August 14, 2024, from <https://www.treesandshrubsonline.org/articles/ilex/ilex-x-altaclerensis/>
27. Invasive Plant Atlas. (2022, August 30). English Holly, *Ilex aquifolium*. <https://www.invasiveplantatlas.org/subject.html?sub=5744>
28. Invasive Plant Council of BC. Invasive Plant English Holly *Ilex aquifolium*. Retrieved on August 23, 2024, from <https://bcinvasives.ca/invasives/english-holly/>
29. Iversen, J. 1944. Viscum, Hedera, and *Ilex* as climatic indicators. *Geol. For. Stockh. Forh.* 66:463-483.
30. Ives, S. A. (1923). Maturation and Germination of Seeds of *Ilex opaca*. Contributions from the Hull Botanical Laboratory, 76.
31. King County. King county wildfire risk reduction strategy. July 2022. <king-county-wildfire-strategy-report.pdf> (kingcounty.gov)
32. Loizeau, P.-A., Barriera, G., Manen, J.-F., & Broennimann, O. (2005). Towards an understanding of the distribution of *Ilex* L. (Aquifoliaceae) on a World-wide scale. *Biol. Skr*, 55, 501–520.
33. Loutos, Z. (2024). Proposal to add *Ilex aquifolium* to the Washington State Noxious Weed List.

34. Native Plant Society of Oregon (2008), Exotic Gardening and Landscaping Plants Invasive in Native Habitats of the Southern Willamette Valley. https://emerald.npsoregon.org/wp-content/uploads/2024/02/Invasive_Ornamentals.pdf
35. NC State Extension, *Ilex crenata*, retrieved on August 9, 2024, from <https://plants.ces.ncsu.edu/plants/ilex-crenata/>
36. New Zealand Plant Conservation Network, *Ilex aquifolium*, retrieved on August 9, 2024, from <https://www.nzpcn.org.nz/flora/species/ilex-aquifolium/>
37. New York State Invasive Species Tiers, retrieved on August 9, 2024, from <https://www.nynhp.org/invasives/species-tiers-table/>
38. Obeso, J. R., & Fernández-Calvo, I. C. (2003). Fruit removal, pyrene dispersal, post-dispersal predation and seedling establishment of a bird-dispersed tree. *Plant Ecology*, 165(2), 223–233. <https://doi.org/10.1023/A:1022241207296>
39. Pacific Northwest Weed Management Handbook. (2019). Holly, English (*Ilex aquifolium*). Peachey, E., Editor. Oregon State University. <https://pnwhandbooks.org/weed/problemweeds/holly-english-ilex-aquifolium>
40. Peterken, G. F., & Lloyd, P. S. (1967). *Ilex Aquifolium* L. *Encyclopedia of Environmetrics*, 55(3). <https://doi.org/10.1002/9780470057339.vab033.pub2>
41. Plants for a Future. *Ilex x altaclerensis*. Retrieved on August 14, 2024, from <https://pfaf.org/User/Plant.aspx?LatinName=Ilex+x+altaclerensis>
42. Rushforth, K. (1999). *Trees of Britain and Europe*. Collins ISBN 0-00-220013-9.
43. Sadhu, M.K. 1989. *Plant Propagation*. New Age International (P) Ltd., Publishers. New Delhi, India.
44. Salisbury, N. (2013). English Holly (*Ilex aquifolium*) Herbicide Treatment Study. Retrieved from earthcorps report http://www.earthcorps.org/ftp/ECScience/Projects/Holly_Research/Holly_Treatment_Study_Report_2013.pdf
45. Skou, A. M. T., Toneatto, F., & Kollmann, J. (2012). Are plant populations in expanding ranges made up of escaped cultivars? The case of *Ilex aquifolium* in Denmark. *Plant Ecology*, 213(7), 1131–1144. <https://doi.org/10.1007/s11258-012-0071-z>
46. Smith, A. “How Washington Nearly Became the Holly State: The Story of Holly in Seward Park”, *Douglasia Journal* (retrieved online), Winter 2013, https://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Slideshows/Smith_How_Washington_nearly_became_the_holly_state_DouglasiaWinter2013.pdf.
47. Stokes, D. L., & Campbell, C. (2011). English Holly Removal and Research in St. Edward State Park: Control of English Holly for Science and Native Biodiversity. Scientific Research Permit #110101: retrieved from St. Edward State Park.
48. Stokes, D. L., Church, E. D., Cronkwright, D. M., & Lopez, S. (2014). Pictures of an Invasion: English Holly (*Ilex aquifolium*) in a semi-natural Pacific Northwest Forest.
49. Stokes, D. L., & Williams, A. “English Holly (*Ilex aquifolium*) Control and Eradication”. Slideshow PDF, 2014, [https://your.kingcounty.gov/dnrp/library/water-and-](https://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Slideshows/Smith_How_Washington_nearly_became_the_holly_state_DouglasiaWinter2013.pdf)

- land/weeds/Slideshows/Williams_and_Stokes_2014_English_Holly_Ilex_aquifolium_Control_and_Eradication.pdf.
50. Stokes, D. L., Lopez, S., & Thiel, K. (2017). Cherry laurel (*Prunus laurocerasus*) and Portuguese laurel (*Prunus lusitanica*) Invasion in Saint Edward State Park.
 51. Supnick, M. (1983). On the Function of Leaf Spines in *Ilex opaca*. *Bulletin of the Torrey Botanical Club*, 110(2), 228. <https://doi.org/10.2307/2996348>
 52. The Spruce (2024, July 22) 18 types of Holly Plants, retrieved on August 9, 2024 from <https://www.thespruce.com/eighteen-species-holly-trees-and-shrubs-3269647>
 53. Ticknor, R.L. 1986. Overview of commercial production of cut English holly (*Ilex aquifolium*) in the Pacific Northwest. *Ornamentals Northwest Newsletter* 10: 12-15.
 54. USDA. *Ilex opaca* American Holly. Retrieved on August 14, 2024, from https://www.srs.fs.usda.gov/pubs/misc/ag_654/volume_2/ilex/opaca.htm
 55. Washington State Noxious Weed Control Board (2010). *Written Findings of the Washington State Noxious Weed Control Board, Ilex Aquifolium*.
 56. Washington State University. *Invasive Forest Weeds Resources*. Extension Forestry. Retrieved on August 27th, 2024, from <https://forestry.wsu.edu/weeds/#holly>
 57. Watts, A. L. "English Holly: Garden and Wildlife Favorite or Invasive Foe?", *Pacific Horticulture* (Online Magazine), 3 October 2012, <https://www.pacifichorticulture.org/articles/english-holly/>.
 58. Watts, A. L. (2013). *An Examination of Stand Attributes and the Presence of English holly in a Pacific Northwest Forest, Grays Harbor County, Wash.* [Master Thesis, University of Washington]
 59. Weedbusters, *Holly*, retrieved on August 9, 2024, from <https://weedbusters.org.nz/what-are-weeds/weed-list/holly/>
 60. Yadrick, M. "Life and Death of English Holly in Seattle's Forested Parklands". Slideshow PDF, 2014, https://your.kingcounty.gov/dnrp/library/water-and-land/weeds/Slideshows/GSP_2014_Life_and_Death_of_English_Holly_in_Seattle%E2%80%99s_Forested_Parklands.pdf.
 61. Yao, X., Song, Y., Yang, J. B., Tan, Y. H., & Corlett, R. T. (2021). Phylogeny and biogeography of the hollies (*Ilex* L., Aquifoliaceae). *Journal of Systematics and Evolution*, 59(1), 73–82. <https://doi.org/10.1111/jse.12567>
 62. Yao, X., Zhang, F., & Corlett, R. T. (2022). Utilization of the Hollies (*Ilex* L. spp.): A Review. *Forests*, 13(1), 1–12. <https://doi.org/10.3390/f13010094>
 63. Zika, P. F. (2010). Invasive Hollies (*Ilex*, Aquifoliaceae) and Their Dispersers in the Pacific Northwest. *Madrono*, 57(1).