Taxon: Quercus ilex L. **Family:** Fagaceae

Common Name(s): evergreen oak
holly oak
holm oak

Synonym(s):

Assessor: Chuck Chimera **Status:** Assessor Approved **End Date:** 1 Sep 2017

WRA Score: 4.0 **Designation:** EVALUATE **Rating:** Evaluate

Keywords: Mediterranean Tree, Naturalized, Flammable, Mast-Seeding, Coppices

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y=-3, n=0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	(0-low; 1-intermediate; 2-high) (See Appendix 2)	Intermediate
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y=1, n=0	y
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	n
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n= question 205	y
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed		
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs		
402	Allelopathic		
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals	y=1, n=-1	n
405	Toxic to animals	y=1, n=0	n
406	Host for recognized pests and pathogens		
407	Causes allergies or is otherwise toxic to humans	y=1, n=0	n
408	Creates a fire hazard in natural ecosystems	y=1, n=0	y
409	Is a shade tolerant plant at some stage of its life cycle	y=1, n=0	y

Qsn #	Question	Answer Option	Answer
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y=1, n=0	y
411	Climbing or smothering growth habit	y=1, n=0	n
412	Forms dense thickets	y=1, n=0	y
501	Aquatic	y=5, n=0	n
502	Grass	y=1, n=0	n
503	Nitrogen fixing woody plant	y=1, n=0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y=1, n=0	n
601	Evidence of substantial reproductive failure in native habitat	y=1, n=0	n
602	Produces viable seed	y=1, n=-1	y
603	Hybridizes naturally	y=1, n=-1	y
604	Self-compatible or apomictic	y=1, n=-1	n
605	Requires specialist pollinators	y=-1, n=0	n
606	Reproduction by vegetative fragmentation	y=1, n=-1	y
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y=1, n=-1	n
702	Propagules dispersed intentionally by people	y=1, n=-1	y
703	Propagules likely to disperse as a produce contaminant	y=1, n=-1	n
704	Propagules adapted to wind dispersal	y=1, n=-1	n
705	Propagules water dispersed	y=1, n=-1	n
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)		
708	Propagules survive passage through the gut	y=1, n=-1	n
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)	y=1, n=-1	n
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y=1, n=-1	y
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	**Is the species highly domesticated?**	**n**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Not domesticated] "Q. ilex is one of the most important species in the Mediterranean area, where it is capable of growing both as a tree (representing 'climax' Mediterranean vegetation) and as a shrub in more degraded areas. It has a compact, dark green and rounded crown, with tough, long-lasting leaves. It can tolerate a wide range of soil types and both drought and frost. The wood is used for firewood and to produce good quality charcoal (called 'cannello' in Spain). The acorns of subsp. rotundifolia are also collected and fed to animals."

102	**Has the species become naturalized where grown?**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

103	**Does the species have weedy races?**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

201	**Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"**	**Intermediate**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The natural distribution of Q. ilex includes the Mediterranean basin, where it is more abundant in the west than in the eastern part, with a latitude range of 14° in the northern hemisphere. Among the two subspecies, Q. ilex subsp. rotundifolia occurs in Portugal, south and southeast Spain, and Morocco, wheras Q. ilex subsp. ilex occurs throughout the remaining area, which includes north Spain, France, Italy, Greece and Aegean islands, Corsica, Algeria and Turkey. It is sporadically found in Tunisia, Israel and the Balkans. Latitude between 30°N and 53°N"

202	**Quality of climate match data**	**High**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	

203	**Broad climate suitability (environmental versatility)**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Q. ilex usually grows from sea level up to 1000 m, but can be found as high as 2900 m (for example in the Atlas Mountains in Morocco). This species is resistant to adverse conditions, withstanding aridity, frost, shade and wind. Its thermal limit is a mean annual temperature of 10°C, but it can tolerate subzero temperatures and snowfalls, as long as crown branches are not heavily damaged. It benefits from a rainfall regime of 300-1500 mm per year, with the optimum being 800 mm, concentrated mainly in spring and autumn. Climatic amplitude (estimates) - Altitude range: 0 - 2900 m - Mean annual rainfall: 300 - 1500 mm - Rainfall regime: bimodal - Dry season duration: 0 - 2 months - Mean annual temperature: 10 - 20ºC - Mean maximum temperature of hottest month: 28 - 33ºC - Mean minimum temperature of coldest month: -3 - 8ºC - Absolute minimum temperature: > -23ºC"

Qsn #	Question	Answer
204	**Native or naturalized in regions with tropical or subtropical climates**	**n**
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 28 Aug 2017]	"Native: Africa Northern Africa: Algeria; Libya; Morocco; Tunisia Asia-Temperate Western Asia: Turkey Europe Southeastern Europe: Albania; Bosnia and Herzegovina; Croatia; Greece; Italy; Malta; Montenegro; Slovenia Southwestern Europe: France; Portugal; Spain"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	[No evidence] "Quercus ilex L. Fagaceae Synonym/s (n° of refs): Quercus ilex L. subsp. ballota (Desf.) Samp. (1) Total N° of Refs: 42 Global Risk Score: 12.96 Rating: Medium Habit: Tree Preferred Climate/s: Mediterranean, Tropical Origin: Africa, Europe, W Asia Major Pathway/s: Crop, Forestry, Herbal, Ornamental Dispersed by: Humans, Animals, Escapee References: United Kingdom-N-40, Global-N-108, Global-N-85, New Zealand- N-280, Australia-C-401, United Kingdom- N-314, Australia-E-380, United Kingdom- N-519, New Zealand-N-534, New Zealand- N-15, Australia-EN-310, Global-NI-714, United Kingdom-CN-812, United States of America-N-101, Australia-W-869, New Zealand-N-919, Australia-N-354, Portugal- N-1006, United Kingdom-N-1006, Portugal-N-1006, Europe-N-819, United Kingdom-W-1175, Belgium-U-1220, Australia-N-1450, Global-CD-1611, Greece-N-1803, Russia-N-1920, Australia- WD-1934, Switzerland-N-1990, South Africa-N-1991, Ukraine-U-2014, New Zealand-N-2048, Armenia-W-1977, Australia-W-1977, Belgium-W-1977, India-W-1977, Ireland-W-1977, South Africa-W-1977, Spain-W-1977, Switzerland-W-1977, United Kingdom-W- 1977."
	Wagner, W.L., Herbst, D.R.& Lorence, D.H. 2017. Flora of the Hawaiian Islands. Smithsonian Institution, Washington, D.C. http://botany.si.edu/. [Accessed 28 Aug 2017]	No evidence to date

205	**Does the species have a history of repeated introductions outside its natural range?**	**y**
	Source(s)	**Notes**
	Stace, C. 2010. New Flora of the British Isles. Third Edition. Cambridge University Press, Cambridge, UK	"Q. ilex L. - Evergreen Oak" ... "Intrd-natd; much planted for ornament throughout BI, for shelter in E En; self-sown in S & C En, Wa, S Ir and CI; Mediterranean and SW Europe."
	Skolmen, R.G. 1980. Plantings on the forest reserves of Hawaii: 1910–1960. Institute of Pacific Islands Forestry, Pacific Southwest Forest & Range Experiment Station, US Forest Service, Honolulu, HI	No forestry planting records in Hawaiian Islands
	Imada, C.T., Staples, G.W. & Herbst, D.R. 2005. Annotated Checklist of Cultivated Plants of Hawai'i. http://www2.bishopmuseum.org/HBS/botany/cultivatedplants/. [Accessed 28 Aug 2017]	No records of cultivation in Hawaiian Islands

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	Planted in Southern Russia, Switzerland, United Kingdom, Pakistan, Somalia,

301	Naturalized beyond native range	y
	Source(s)	**Notes**
	Peterken, G. F. (2001). Ecological effects of introduced tree species in Britain. Forest Ecology and Management, 141 (1), 31-42	"Many simply conform to the native range of form and physiognomy, but a few expand it (e.g. L. decidua and Quercus ilex, both of which are locally naturalised)." ... "In a few instances, vegetation types are developing which have no counterpart in native vegetation. For example, Q. ilex has developed small woods and scrubs mainly on coastal cliffs of southern Britain, forming broadleaved evergreen woodland."
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 28 Aug 2017]	"Naturalized: . natzd. elsewhere"
	Stace, C. 2010. New Flora of the British Isles. Third Edition. Cambridge University Press, Cambridge, UK	"Q. ilex L. - Evergreen Oak" ... "Intrd-natd; much planted for ornament throughout BI, for shelter in E En; self-sown in S & C En, Wa, S Ir and CI; Mediterranean and SW Europe."
	Sykes, W.R. (1982) Checklist of dicotyledons naturalised in New Zealand 15. Annonales, Berberidales, Cactales, Fagales, some Geraniales, Juglandales, Laurales, Rutales, Salicales, Sapindales, Tiliales, Nyctaginaceae, and Zygophyllaceae. New Zealand Journal of Botany, 20(4): 333-341	"Quercus ilex L. holm oak DISTRIBUTION: Rare escape from cultivation; Rangitoto I."

302	Garden/amenity/disturbance weed	
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Potentially. Included in weed citations, but evidence of impacts unspecified or unverified

303	Agricultural/forestry/horticultural weed	n
	Source(s)	**Notes**
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

304	Environmental weed	
	Source(s)	**Notes**
	Ison, J. 2011. Evergreen Oak, Quercus ilex. GB Non-native species secretariat. www.nonnativespecies.org	"Evergreen Oak is resistant to drought and sea spray and can come to dominate the sparse native vegetation on calcareous cliff tops."

Qsn #	Question	Answer
	Williamson, M. 2002. Alien plants in the British Isles. Pp. 91-122 in D. Pimentel (ed.). Biological Invasions: Economic and Environmental Costs of Alien Plant, Animal, and Microbe Species. CRC Press, Boca Raton, FL	"Quercus ilex, evergreen oak or holm oak, is a fine tree. “Introduced; much planted for ornament, and often for shelter in east England; self-sown in south and central England, Wales, south Ireland and the Channel Islands.”59 The Prus49 cost estimate of 7.54 = £1881 shows that herbicide would not usually be used to control this species. As a fine tree it brings many benefits, but it has costs, too: “This species is locally becoming a threat to native vegetation,”9 but then so are some native trees. The net cost is probably near zero, regardless of how these effects are valued."

305	Congeneric weed	y
	Source(s)	**Notes**
	Svenning, J. C., & Skov, F. (2007). Could the tree diversity pattern in Europe be generated by postglacial dispersal limitation?. Ecology Letters, 10(6), 453-460	"Quercus cerris is naturalized and invasive as far north-west of its native south-eastern European range as England (Peterken 1996)."
	Danielewicz, W., Kiciński, P., & Wiatrowska, B. (2016). Symptoms of the naturalisation of the Turkey oak (Quercus cerris L.) in Polish forests. Folia Forestalia Polonica, 58(3), 147-162	"Quercus cerrisis capable of a natural renewal in a woodland environment in Poland. In the light of the various definitions concerning the synanthropisation of the plant cover, it can be problematic to regard the Turkey oak as an invasive plant in forests. While it penetrates forest communities spontaneously and has a stable position in the undergrowth or even lower tree layers in them, those phytocoenoses greatly depart from the permanent natural communities in terms of structure and floristic composition. The dispersal of Q. cerris in them is similar to that of other oaks species, often renewing under the canopy of pine tree stands ... In many cases, this reflects the regeneration of forest communities in which native plants can be accompanied by alien species. If we assume, following Sukopp's (1962) conception, that a neophyte appearing in such 'unsaturated' phytocoenoses does not push out native species, and the proportion of the Turkey oak to the already present community components, according to Falinkski's (1968) criteria, can be called compensatory, at least for the time being, then classifying it as an invasive plant is disputable in terms of definitions emphasising the threat to biological diversity posed by such plants. However, if we were to use the criterion of the rate of dispersal of alien species - over a distance longer than 100 m in a period shorter than 50 years (Richardson et al. 2000), then Q. cerris would have the status of an invasive plant."
	National Trust. 2014. New Forest Northern Commons Invasive Species Removal. https://ehipc.files.wordpress.com/2013/02/ehi-turkey-oak-november-2014.pdf. [Accessed 28 Aug 2017]	"Turkey Oak – Quercus cerris • Introduced to Britain by Lucombe, Exeter 1735 • Aggressive coloniser of acid sandy soils • Displaces native vegetation • Harbours Knopper Gall wasp which lays eggs in English Oak acorns • Low value to nature conservation • Approx. 500 trees Rockford Common"

401	Produces spines, thorns or burrs	
	Source(s)	**Notes**

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "Q. ilex typically grows up to 20 m in height with a d.b.h of 80 cm, although it can grow up to 30 m, with a d.b.h. of over 2 m, and live for 1000 years or more. The plant has a straight stem with low branches and grey, tomentose tips; the bark is dark, greyish-brown, smooth when young and then splitting into small square plates; buds are small, rounded and tomentose. The roots are strong, divided into a deep taproot and a lateral root system which anchors the tree firmly to the substrate (Alexandrian, 1992). Foliage The leaves are simple, alternate, 3-7 cm long, thick, variable in form, but usually elliptic to ovate or ovate-lanceolate (smaller and more rounded in Q. ilex subsp. rotundifolia), base round to cuneate, either entire or more or less dentate, dark green and smooth on the upper surface, grey-tomentose beneath; persistent for 3-5 years on the tree. The petiole is 6-15 mm long with brown stipules."
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	[Young leaves may be spiny (i.e. "spinose")] "The margins are waved or sinuate, but they can be dentate or in some case spinose on young trees or sprouts"

402	Allelopathic	
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Q. ilex forms beautiful forests, composed of large, tall trees, with both protective and recreational functions. The litter acts as a soil improver."
	Bran, D., Lobreaux, O., Maistre, M., Perret, P., & Romane, F. (1990). Germination of Quercus ilex and Q. pubescens in a Q. ilex coppice. Plant Ecology, 87(1), 45-50	[Self-allelopathic. Effects on other species unknown] "Quercus ilex L. (holm oak) coppices, widespread around the Mediterranean basin, are probably the result of 5 000 years of prolonged human disturbance of the original Quercus pubescens Willd. (downy oak) forests. Since disturbance has almost ceased in recent years, a question arises as to the development of these coppices: will the Q. pubescens forests return, or will Q. ilex remain the dominant species? To investigate the phenomenon, we analyzed the first stages, i.e. germination of the two species in holm oak coppices. Our experiments show that both species germinated better in coppices than in clearings or clear-cuts. Moreover, Q. pubescens appears to be slightly favored above Q. ilex and it is suggested auto-allelopathy is involved, at least partially inhibiting the germination of Q. ilex."

403	Parasitic	n
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Q. ilex typically grows up to 20 m in height with a d.b.h of 80 cm, ..." [Fagaceae. No evidence]

404	Unpalatable to grazing animals	n
	Source(s)	**Notes**

Qsn #	Question	Answer
	Narjisse, H., Elhonsali, M. A., & Olsen, J. D. (1995). Effects of oak (Quercus ilex) tannins on digestion and nitrogen balance in sheep and goats. Small Ruminant Research, 18 (3), 201-206	"Results derived from this study indicate that Moroccan native goats are more suitable for grazing in oak woodland, especially during the season when alternative forage availability is scarce leading to a higher proportion of oak leaves in the botanical composition of diets ingested by grazing animals."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The acorns of subsp. rotundifolia are also collected and fed to animals."
	Ison, J. 2011. Evergreen Oak, Quercus ilex. GB Non-native species secretariat. www.nonnativespecies.org	"This species is generally resistant to herbivores, though the young stages may be browsed by ruminants. It is also affected by several leaf miners."

405	Toxic to animals	n
	Source(s)	**Notes**
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"(Stimulant, tonic.)" [No evidence]
	Narjisse, H., Elhonsali, M. A., & Olsen, J. D. (1995). Effects of oak (Quercus ilex) tannins on digestion and nitrogen balance in sheep and goats. Small Ruminant Research, 18 (3), 201-206	"Sheep and goats exhibited different levels of tolerance to the effects of tannins extracted from oak leaves (Quercus ilex) Feed intake, N balance, and rumen ammonia concentrations decreased by 8%, 159% and 50%, respectively, in sheep infused intraruminally with tannins (P <0.05). Similar measurements were not depressed (P> 0.05) in goats although mean rumen ammonia content was 39% less. In vivo DM digestibility was not significantly different for either sheep or goats. Averaged in vitro fermentation capacity was depressed 10% by tannin (8-12% concentration) in the rumen fluid from non-infused sheep given the same diet, but was improved by 9% for goats. Finally, tannin-infused goats lost in urine only 17% of the N ingested, while tannin-infused sheep excreted as much as 44%. The superiority of goats in dealing with tannin might result from the greater ability of their microbial population to degrade tannins, and/or their higher urea recycling and salivary secretion capabilities. Results derived from this study indicate that goats may be more suitable for grazing in oak woodland, especially during the season when alternative forage availability is scarce."

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"In Spain, under conditions of water stress, heavy damage to Q. ilex has been attributed to the fungal pathogen Phytophthora cinnamoni (Tuset et al., 1996) and cankers caused by Cryphonectria parasitica have also been reported. Phellinus erectus and Fomes fomentarius are responsible for wood decay, whereas Ganoderma spp. attack the roots. Q. ilex is reported to be resistant to honey fungus (Armillaria mellea). Apart from other common borers of oak trees, Q. ilex is particularly susceptible to Coraebus florentinus, a wood-eating beetle which can occur in large numbers after periods of drought. Another damaging boring beetle is Cerambyx cerdo (Soria et al., 1996), which attacks old or weak trees. Strong attacks of the kermesid Nidularia pulvinata, a cochineal insect, have been described in urban areas of Tuscany and south Italy (Viggiani, 1991). Defoliating Lepidopteran pests include Tortrix viridana, Malacosoma neustria, Lymantria dispar, Catocala nymphagoga and Ephestia nymphaea (Templado, 1990)."
	Kliejunas, J. T. (2010). Sudden oak death and Phytophthora ramorum: a summary of the literature. 2010 edition. Gen. Tech. Rep. PSW-GTR-234. USDA Forest Service, Pacific Southwest Research Station, Albany, CA	[Alternate host, but no native Quercus or Fagaceae in the Hawaiian Islands] "Phytophthora ramorum has been isolated from asymptomatic host tissue, including asymptomatic root tissue of infected tanoak seedlings (Parke and others 2006b); asymptomatic stems and roots of Rhododendron spp. (Bienapfl and others 2005); and leaves of Rhododendron “Cunningham’s White” and holm oak (Quercus ilex) being used as trap plants (Denman and others 2009)."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Quattrocchi, U. 2012. CRC World Dictionary of Medicinal and Poisonous Plants: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology. CRC Press, Boca Raton, FL	"(Stimulant, tonic.)" [No evidence]
	Victorian Resources Online. 2017. Holm oak (Quercus ilex). http://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/weeds_holm-oak. [Accessed 29 Aug 2017]	“Poisoning in children from chewing a few acorns need cause little worry before in the introduction the potato, acorns were a (starch-containing) food in times of emergency” (Pfander 1984).

408	Creates a fire hazard in natural ecosystems	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Frequent fires can degrade Q. ilex forest to low shrubs as the foliage is flammable all year round. Controlled fires should be undertaken with caution (Alexandrian, 1992)."

Qsn #	Question	Answer
	Roda, F., Retana, J., Gracia, C.A., Bellot, J. (Eds.).1999. Ecology of Mediterranean Evergreen Oak Forests: Ecological Studies, Vol. 137. Springer, Berlin.\	"Wildfires are an environmental threat to Mediterranean forests. Whereas Mediterranean pine forests are frequently devastated by fire, holm oak forests score lower in yearly burnt surfaces. For instance, in Catalonia the yearly burnt area relative to the area occupied by each species is double for Pinus halepensis than for Quercus ilex + Q. suber. It is well known that chemical composition and the production of volatile organic substances are related to flammability. Whereas most other oak species emit isoprene, holm oak, surprisingly, emits monoterpenes, with an emission rate that seems to be apparently higher than any other values reported in the literature for other plant species (Seufert et al. 1995). This behaviour differs from that of pines, which accumulate monoterpenes in the leaves, twigs or bark. The relevant aspect for fire behaviour is that no massive emission will occur from a holm oak canopy as a result of heating, making it less flammable than pine."

409	Is a shade tolerant plant at some stage of its life cycle	y
	Source(s)	**Notes**
	Roda, F., Retana, J., Gracia, C.A., Bellot, J. (Eds.).1999. Ecology of Mediterranean Evergreen Oak Forests: Ecological Studies, Vol. 137. Springer, Berlin.\	"Holm oak is a shade-tolerant tree, becoming dominant in late successional stages." ... "Germination is stimulated under reduced light levels and the associated increase in soil moisture that occurs at canopy closure (Bran et al. 1990). Survival is also better under closed canopies. There, the shade-tolerant holm oak seedlings can survive even decades without significant growth"
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	"It is a shade-tolerant species regenerating under the canopy cover, but it is also a vigorous root re sprouting species." ... "Holm oak is a slow-growing shade-tolerant tree and is able to dominate in late successional stages6. Its regeneration develops under the canopy, while in case of disturbances most of the regeneration comes vigorously from root re-sprouts6, 12."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Young plants tolerate reasonable levels of side shade." ... "- Tolerates drought; wind; shade"

Qsn #	Question	Answer
410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Q. ilex can grow on a great range of soil types, from littoral sandy soils to sandstone soils, limestone soils, volcanic soils (for example on Mt. Etna, Sicily), granite soils (Sardinia) and serpentine soils. It does not tolerate waterlogged soils or submerged roots, or overly compact or clayey soils. Its growth is slower or difficult on young or degraded soils. Away from the coast, in more continental climatic locations, it grows on south-facing calcareous soils. Its litter can improve the soil and under its crown microorganisms have suitable conditions to create a good, acid humus. Soil descriptors - Soil texture: light; medium - Soil drainage: free - Soil reaction: acid; neutral; alkaline - Soil types: calcareous soils; granite soils; limestone soils; sandstone soils; sandy soils; serpentine soils; volcanic soils"

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Q. ilex typically grows up to 20 m in height with a d.b.h of 80 cm, although it can grow up to 30 m, with a d.b.h. of over 2 m, and live for 1000 years or more. The plant has a straight stem with low branches and grey, tomentose tips; the bark is dark, greyish-brown, smooth when young and then splitting into small square plates; buds are small, rounded and tomentose. The roots are strong, divided into a deep taproot and a lateral root system which anchors the tree firmly to the substrate (Alexandrian, 1992)."

412	**Forms dense thickets**	**y**
	Source(s)	**Notes**
	Roda, F., Retana, J., Gracia, C.A., Bellot, J. (Eds.).1999. Ecology of Mediterranean Evergreen Oak Forests: Ecological Studies, Vol. 137. Springer, Berlin.\	"Holm oak is a hardwood tree that grows slowly, forming dense canopies." ... "Holm oak is a shade tolerant tree, becoming dominant in late successional stages."
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	"It can form pure or mixed stands in less optimal sites, often concentrating in the more favourable areas."

501	**Aquatic**	**n**
	Source(s)	**Notes**

Qsn #	Question	Answer
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	[Terrestrial] "Quercus ilex L., known as holm oak or evergreen oak, is a broadleaved tree or shrub, which can grow up to 25 m. It is characterised by coriaceous dark green leaves with a woolly lower side, and small acorns. It is native to the centralwestern Mediterranean basin, where it represents the dominating species in woodlands and maquis vegetation."

502	Grass	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 28 Aug 2017]	Family: Fagaceae Subfamily: Fagoideae

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	USDA, ARS, Germplasm Resources Information Network. 2017. National Plant Germplasm System [Online Database]. http://www.ars-grin.gov/npgs/index.html. [Accessed 28 Aug 2017]	Family: Fagaceae Subfamily: Fagoideae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	"The holm oak (Quercus ilex L.) is an broadleaved evergreen tree or shrub, which can grow up to 25 m and exceptionally 30 m with over 2 m of trunk diameter Its lifespan may reach more than 1 000 years."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	**Notes**
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	[No evidence of substantial reproductive failure] "The natural distribution of holm oak occurs principally in the central-western part of the Mediterranean basin, covering from Portugal and Morocco, to the Aegean Islands and western Turkey, expanding also northward up to northern Italy and France. It also occurs in a few localities in Anatolia on the coast of the Black Sea" ... "Mediterranean forests dominated by the holm oak have been strongly influenced by human activities during the last millennia by means of wood exploitation, species mixture modifications or substitution (e.g. Aleppo pine), livestock grazing and fires. All these disturbances have led to a degradation, and in many cases holm oak forests have been completely replaced by agriculture and urban settlements6, 30."

602	Produces viable seed	y

Qsn #	Question	Answer
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Q. ilex flowers after only 8 years and seed can be obtained every 2-3 years, some 60-70% of which will germinate."

603	Hybridizes naturally	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"In nature, hybridization with other oaks occurs, for example, Quercus x turneri (Q. ilex x Q. petraea), Quercus x audleyensis (Q. ilex x Q. robur), Quercus x morisii (Q. ilex x Q. suber) and Quercus x albescens (Q. ilex x Q. pubescens)."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Roda, F., Retana, J., Gracia, C.A., Bellot, J. (Eds.).1999. Ecology of Mediterranean Evergreen Oak Forests: Ecological Studies, Vol. 137. Springer, Berlin.\	"Flowering can last until late June, when acorn growth begins. Probably, holm oak has genetic auto incompatibility, and it shows large differences in flowering time between trees and between years; both factors favour gene combination within populations."
	Yacine, A., & Bouras, F. (1997). Self-and cross-pollination effects on pollen tube growth and seed set in holm oak Quercus ilex L (Fagaceae). Annales des Sciences Forestieres 54(5): 447-462	[Highly self-incompatible] "Patterns of the self-incompatibility system have been more often described for hermaphroditic, entomophilous and short-lived plant species. Quercus ilex is a long-lived, monoecious, anemophilous and highly self-incompatible species. We used pollination experiments to investigate phenotypic responses of the self-incompatibility system. Flowers from 14 individuals of the same stand were hand-pollinated with self-pollen, cross-pollen from a single donor and a mixture of the two types. We observed a slower pollen tube growth and no or nearly no seed production after self pollination. The more self-pollen tubes reach the style, the more flowers will stop their ovule development, resulting in a high flower abortion rate. In open pollination, pollen load is not a limiting factor, but incompatible pollen may reach stigma simultaneously or before compatible cross-pollen, which will induce an early abortion of flowers. When pollination is qualitatively and quantitatively effective, the regulation of seed production related to the resources availability acts by the late abortion of fruit."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Ison, J. 2011. Evergreen Oak, Quercus ilex. GB Non-native species secretariat. www.nonnativespecies.org	"Evergreen oak is monoecious and wind-pollinated. The female flowers give rise to acorns that ripen in their first year."
	Yacine, A., & Bouras, F. (1997). Self-and cross-pollination effects on pollen tube growth and seed set in holm oak Quercus ilex L (Fagaceae). Annales des Sciences Forestieres 54(5): 447-462	"Quercus ilex is a long-lived, monoecious, anemophilous and highly self-incompatible species."

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	[Adapted for wind pollination] "Q. ilex is monoecious plant, male flowers in greenish-white cylindrical aments or catkins, pendulous (short-stalked), with a tomentose perianth and six stamens. Female flowers are borne on erect spikes, with a white, tomentose stem bearing six to seven flowers. "

606	Reproduction by vegetative fragmentation	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"- Ability to sucker; self-prune; coppice"
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	"Holm oak is a slow-growing shade-tolerant tree and is able to dominate in late successional stages6. Its regeneration develops under the canopy, while in case of disturbances most of the regeneration comes vigorously from root re-sprouts6, 12."
	Soto, A., Lorenzo, Z., & Gil, L. (2007). Differences in fine-scale genetic structure and dispersal in Quercus ilex L. and Q. suber L.: consequences for regeneration of Mediterranean open woods. Heredity, 99(6), 601–607	"Q. ilex is also a more resilient species, with a better tolerance for direct insolation and with very effective asexual reproduction through stump and root shooting."

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The growth rate is slow and because of the deep taproots, transplanting from the nursery is difficult." ... "Q. ilex flowers after only 8 years and seed can be obtained every 2-3 years, some 60 70% of which will germinate."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The acorns are dark-brown, 1.5-3 cm long, long, narrow and tapering." [No evidence. No means of external attachment]

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"Like many other oak species, Q. ilex is used as an ornamental tree in gardens and parks, where it can reach a large size."

703	Propagules likely to disperse as a produce contaminant	n
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The acorns are dark-brown, 1.5-3 cm long, long, narrow and tapering." [No evidence. Unlikely given relatively large size of acorns]

704	Propagules adapted to wind dispersal	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The acorns are dark-brown, 1.5-3 cm long, long, narrow and tapering."

705	Propagules water dispersed	n
	Source(s)	**Notes**
	Gómez, J. M. (2004). Importance of microhabitat and acorn burial on Quercus ilex early recruitment: non-additive effects on multiple demographic processes. Plant Ecology, 172(2), 287-297	"Acorns are dispersed during autumn both abiotically by gravity and biotically mainly by the European jay Garrulus glandarius and to a lesser extent by the woodmouse Apodemus sylvaticus (Pulido 1999; Gómez et al. 2001; Gómez unpublished data). Gravity- dispersed acorns fall to the ground directly beneath the parent oak and remain in that location until being removed by rodents or covered by litter. Biotically dispersed acorns are usually transported far from adult oaks, and buried under shrubs or under other tree species (Gómez et al. 2001; Gómez unpublished data). However, woodmice act mainly as post-dispersal seed predators, since most acorns transported by these rodents are consumed, whether directly beneath the oaks or later in the caches (Sonesson 1994; Gómez et al. 2001). In the Iberian Peninsula, acorns are also consumed by several species of ungulates, notably the Wild boar Sus scrofa (Gómez et al. 2001)." [Water might move some seeds, but primarily dispersed by seed hoarding birds and rodents]

706	Propagules bird dispersed	y
	Source(s)	**Notes**
	Ison, J. 2011. Evergreen Oak, Quercus ilex. GB Non-native species secretariat. www.nonnativespecies.org	"In its native range, and presumably in GB, the main dispersal agent is the Jay."

Qsn #	Question	Answer
	Gómez, J. M. (2003). Spatial patterns in long-distance dispersal of Quercus ilex acorns by jays in a heterogeneous landscape. Ecography, 26(5), 573-584	"In this paper, I analyse the interaction between the holm-oak Quercus ilex, and one of its main dispersers, the European jay Garrulus glandarius, in an heterogeneous Mediterranean landscape. I quantify the spatial dispersal pattern of the seed shadow at two spatial scales, landscape (among patches) and microhabitat (within patches), by directly tracking the movement of seeds. Two main traits of the jay-mediated dispersal of holm-oak acorns across the landscape, the spatial pattern of dissemination and the distance from the source tree, are significantly and directly influenced by jay activity. Jays moved acorns nonrandomly, avoiding one main patch type of the study area to cache acorns, the shrubland-grasslands, and moving most of the acorns to pine stands, whether afforestation or open pinewoods. Within each patch type, jays had also a strong preference for caching acorns in some microhabitats, since 95% of the acorns dispersed by jays were cached beneath pines. The distance of holm-oak acorn dispersal was long in the study site, over 250 m, with some dispersals occurring up to 1 km from the source oaks. The shape of the dispersal kernel function fitted to the dispersal pattern produced by jays differed from those quantified for many other plant species. Jay-mediated dispersal had two components, one local and another produced by long-distance dispersal. Due to the heterogeneity of these Mediterranean environments, this difference in scale overlaps with a difference in habitat composition, short distances events resulting in dispersals within the same oak stands and long distance events resulting in dispersal outside of oak stands, usually to other vegetation units. Jay activity and movement pattern can have thus dramatic effects on both the local regeneration as well as the potential for regional spread of the holm-oak populations."

707	Propagules dispersed by other animals (externally)	
	Source(s)	**Notes**
	Gómez, J. M. (2003). Spatial patterns in long-distance dispersal of Quercus ilex acorns by jays in a heterogeneous landscape. Ecography, 26(5), 573-584	[In Hawaii, introduced rodents may serve as seed hoarders and potential dispersers, but the majority of seeds would likely be depredated] "Acorns of holm oaks are dispersed by only two organisms in the study site, jays and woodmice. Jays, however are presumably much more important as dispersers than are mice, which act mainly as seed predators (see also Bossema 1979, Lanner 1996, Wenny 2001)."

Qsn #	Question	Answer
708	**Propagules survive passage through the gut**	**n**
	Source(s)	**Notes**
	Gómez, J. M., & Hódar, J. A. (2008). Wild boars (Sus scrofa) affect the recruitment rate and spatial distribution of holm oak (Quercus ilex). Forest Ecology and Management, 256(6), 1384-1389	"Holm oak recruitment is limited by wild boar damage to acorns and seedlings. Wild boars consume a large proportion of the acorn crop (Gomez, 2004) and injure and kill many newly established and older seedlings (this study)."
	Gómez, J. M. (2003). Spatial patterns in long-distance dispersal of Quercus ilex acorns by jays in a heterogeneous landscape. Ecography, 26(5), 573-584	[Carried externally by jays and woodmice for consumption] "Acorns of holm oaks are dispersed by only two organisms in the study site, jays and woodmice. Jays, however are presumably much more important as dispersers than are mice, which act mainly as seed predators (see also Bossema 1979, Lanner 1996, Wenny 2001)."

801	**Prolific seed production (>1000/m2)**	
	Source(s)	**Notes**
	Roda, F., Retana, J., Gracia, C.A., Bellot, J. (Eds.).1999. Ecology of Mediterranean Evergreen Oak Forests: Ecological Studies, Vol. 137. Springer, Berlin.\	"High acorn production has been said to occur once every (2)4-6 years, but long series of systematic records are lacking."
	San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg	"Mature acorns fall in November- January with high productions every 4-6 years" [Densities unspecified]

802	**Evidence that a persistent propagule bank is formed (>1 yr)**	**n**
	Source(s)	**Notes**
	Roda, F., Retana, J., Gracia, C.A., Bellot, J. (Eds.).1999. Ecology of Mediterranean Evergreen Oak Forests: Ecological Studies, Vol. 137. Springer, Berlin.\	"As in other Quercus species, acorns remain viable for only a short time (1-2 months). The highest germination rates are obtained within 2 months after collecting the fruits."
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"The seed quickly loses viability if allowed to dry out and so is best stored in moist and cool conditions overwinter or sown in an outdoor seed bed when ripe." ... "Q. ilex seed is classified as recalcitrant and can be kept only until the following spring."

803	**Well controlled by herbicides**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	**Tolerates, or benefits from, mutilation, cultivation, or fire**	**y**
	Source(s)	**Notes**

Qsn #	Question	Answer
	CAB International, 2005. Forestry Compendium. CAB International, Wallingford, UK	"- Ability to sucker; self-prune; coppice" ... "This species is suitable for coppicing, so vegetative propagation is performed using stump plants, whereas stand establishment is usually by natural regeneration, wildings or direct sowing."

805	**Effective natural enemies present locally (e.g. introduced biocontrol agents)**	
	Source(s)	**Notes**
	WRA Specialist. 2017. Personal Communication	NA

Summary of Risk Traits:

High Risk / Undesirable Traits
• Elevation range exceeds 1000 m, demonstrating environmental versatility
• Naturalized in British Isles, escaped in New Zealand
• Possible negative environmental impacts in Britain
• Other Quercus species have become invasive
• Self-allelopathic (may affect other plants)
• Spinose leaves
• Alternative host of Phytophthora ramorum, pathogen causing sudden oak death
• Flammable. May increase fire risk
• Shade tolerant
• Tolerates many soil types
• Forms dense stands in native range
• Reproduces by seeds and root suckers
• Hybridizes with other Quercus species
• Seeds dispersed by seed hoarding birds, rodents & intentionally by people
• Potential for prolific seed production (mast seeder), but densities unspecified
• Able to coppice

Low Risk Traits
• Palatable to browsing animals
• Non-toxic
• Ornamental
• Self-incompatible
• Reaches maturity in 8+ years
• Recalcitrant seeds unlikely to form persistent seed bank

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Yes. Saplings establish in shade and trees form dense stands within native range
(B) Bird-dispersed?> Dispersed by seed hoarding birds (may not be effectively dispersed where such birds are absent)
(C) Life cycle <4 years? No. Reaches maturity in 8+ years
Outcome = Evaluate