Taxon: Ilex rotunda **Family:** Aquifoliaceae

Common Name(s): Kurogane holly
kurogane mochi
round leaf holly

Synonym(s): Ilex koshunensis Yamamoto
Ilex microcarpa Lindley &
Ilex rotunda var. microcarpa (Lindley
Ilex sasakii Yamamoto
Ilex unicanaliculata

Assessor: No Assessor **Status:** Assessor Approved **End Date:** 23 Jul 2014

WRA Score: 2.0 **Designation:** EVALUATE **Rating:** Evaluate

Keywords: Dioecious Tree, Temperate, Tropical, Bird-dispersed, Resprouts

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)	High
202	Quality of climate match data	(0-low; 1-intermediate; 2-high) (See Appendix 2)	High
203	Broad climate suitability (environmental versatility)		
204	Native or naturalized in regions with tropical or subtropical climates	y=1, n=0	y
205	Does the species have a history of repeated introductions outside its natural range?	y=-2, ?=-1, n=0	n
301	Naturalized beyond native range		
302	Garden/amenity/disturbance weed		
303	Agricultural/forestry/horticultural weed	n=0, y = 2*multiplier (see Appendix 2)	n
304	Environmental weed	n=0, y = 2*multiplier (see Appendix 2)	n
305	Congeneric weed	n=0, y = 1*multiplier (see Appendix 2)	y
401	Produces spines, thorns or burrs	y=1, n=0	n
402	Allelopathic	y=1, n=0	n
403	Parasitic	y=1, n=0	n
404	Unpalatable to grazing animals		
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

Qsn #	Question	Answer Option	Answer
408	Creates a fire hazard in natural ecosystems	y=1, n=0	n
409	Is a shade tolerant plant at some stage of its life cycle		
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	n
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		
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	n
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		
706	Propagules bird dispersed	y=1, n=-1	y
707	Propagules dispersed by other animals (externally)	y=1, n=-1	n
708	Propagules survive passage through the gut	y=1, n=-1	y
801	Prolific seed production (>1000/m2)		
802	Evidence that a persistent propagule bank is formed (>1 yr)		
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**
	Hu, S.-Y. 1949. The genus Ilex in China. Journal of the Arnold Arboretum 30: 348-387	[No evidence] "Ilex rotunda was first described from Japan and stated to be an entirely glabrous plant. This typical form has been collected from a few coastal provinces in China and Indo-China. In China the plant becomes a tree and develops a trunk up to 30 cm. in diameter. The white fragrant flowers appear in April, and the red fruit lasts until February or March of the following year."

102	Has the species become naturalized where grown?	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	NA

103	Does the species have weedy races?	
	Source(s)	**Notes**
	WRA Specialist. 2014. 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"	High
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 23 Jul 2014]	"Native: ASIA-TEMPERATE China: China - Guangdong, Guangxi, Hunan, Zhejiang Eastern Asia: Japan - Honshu, Kyushu, Ryukyu Islands, Shikoku; Korea; Taiwan ASIA-TROPICAL Indo-China: Vietnam"

202	Quality of climate match data	High
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed]	

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

Qsn #	Question	Answer
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	"Ilex lohfauensis is abundant only at high altitude, while all other Ilex species, including the commonest species, I. pubescens, are abundant only at low altitude (< 500 m), except for I. rotunda which is absent below 300 m and can be found up to 800 m above sea level." ... "Table 2.1 Altitudinal range of Ilex species in Hong Kong." ... "I. rotunda - Altitudinal range (m) = 300-800" ... "Table 2.2 Distribution of the 14 Hong Kong Ilex species in the world (Appendix 1.1)." ... "I. rotunda alt. 400-1200 m, montane evergreen broad-leaf forests, forest margins, streamside"
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	"USDA hardiness zone : 6-9"
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Possibly exhibits environmental versatility. Elevation range may exceed 1000 m, but core range extends ca. 700 m] ":Evergreen broad-leaved forests, forest margins on mountain slopes; 40–1100(–1700) m."

204	Native or naturalized in regions with tropical or subtropical climates	y
	Source(s)	**Notes**
	USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/. [Accessed 23 Jul 2014]	"Native: ASIA-TEMPERATE China: China - Guangdong, Guangxi, Hunan, Zhejiang Eastern Asia: Japan - Honshu, Kyushu, Ryukyu Islands, Shikoku; Korea; Taiwan ASIA-TROPICAL Indo-China: Vietnam"

205	Does the species have a history of repeated introductions outside its natural range?	n
	Source(s)	**Notes**
	Dirr, M.A. 2011. Dirr's encyclopedia of trees and shrubs. Timber Press, Portland, OR	"A rare species in cultivation, but based on my observation, one of the more heat tolerant hollies."
	Nelson, G., Earle, C.J. & Spellenberg, R. 2014. Trees of Eastern North America. Princeton University Press, Princeton, NJ	"Range. Introduced; native to Japan and Korea; reported in Ga."

301	Naturalized beyond native range	
	Source(s)	**Notes**
	Dave's Garden. 2014. "PlantFiles: Round Leaf Holly, Kurogane Holly - Ilex rotunda. http://davesgarden.com/guides/pf/go/149931/. [Accessed 23 Jul 2014]	"Native to Eastern China, Japan and Korea, apparently natualizing in Georgia, USA."
	Nelson, G., Earle, C.J. & Spellenberg, R. 2014. Trees of Eastern North America. Princeton University Press, Princeton, NJ	[Possibly naturalizing. Status unverified] "Range. Introduced; native to Japan and Korea; reported in Ga."

Qsn #	Question	Answer
302	**Garden/amenity/disturbance weed**	
	Source(s)	**Notes**
	Yoshioka, T. 2005. Preliminary Weed Risk Assessment of Landscaping Plants, Landscape Research Japan 68(4): 296-300	Ilex rotunda listed as an Invasive Indigenous plant taxon, but no details of adverse impacts are provided

303	**Agricultural/forestry/horticultural weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

304	**Environmental weed**	**n**
	Source(s)	**Notes**
	Randall, R.P. 2012. A Global Compendium of Weeds. 2nd Edition. Department of Agriculture and Food, Western Australia	No evidence

305	**Congeneric weed**	**y**
	Source(s)	**Notes**
	King County. 2014. Noxious weeds - King County, Washington. English holly - Ilex aquifolium. http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/weed-identification/english-holly.aspx. [Accessed 21 Jul 2014]	"English holly is on the monitor list of the Washington State Noxious Weed Control Board (external link). However, in King County, English holly is classified as a Weed of Concern and its control is recommended in natural areas that are being restored to native vegetation and in protected forest lands." ... "English holly is carried by birds into forests where it can form dense thickets that dominate the tall shrub layer and suppress germination and growth of native tree and shrub species."
	Zika, P. F. 2010. Invasive Hollies (Ilex, Aquifoliaceae) and Their Dispersers in the Pacific Northwest. Madroño, 57(1): 1-10	"Naturalized Ilex aquifolium L. (English holly) was first collected in the Pacific Northwest in 1953, based on herbarium records. Field surveys showed it is now commonly naturalized from northwestern California to coastal British Columbia. Ilex crenata Thunb. and I. opaca Aiton were also found growing outside of cultivation, but rarely." ... "Only Ilex aquifolium was abundant enough to represent a conservation concern in the Pacific Northwest; the other hollies were documented as escapes at just one location each." ... "In the Pacific Northwest I found Ilex aquifolium was thoroughly naturalized at low elevations west of the Cascade Range (Fig. 2). I found it reproducing outside of cultivation at hundreds of locations, including forests of all age classes"

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

Qsn #	Question	Answer
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[No evidence] "Shrubs or trees, evergreen, to 20 m tall; trunk to 1 m d.b.h.; bark gray to gray-black. Young branchlets longitudinally angular, glabrous, rarely puberulent; older branchlets terete, straight, rough, longitudinally fissured, with slightly raised obovate or deltoid leaf scars, lenticels inconspicuous; terminal buds conical, small. Stipules subulate-lanceolate, 1–1.5 mm, caducous; petiole 8–18 mm, glabrous, rarely slightly puberulent, narrowly sulcate adaxially; leaf blade ovate, obovate, or elliptic, 4–9 × 1.8–4 cm, thinly leathery or papery, both surfaces glabrous, midvein impressed adaxially, lateral veins 6–9 pairs, evident on both surfaces, anastomosing near margin, reticulate veins obscure, base obtuse or cuneate, margin entire, slightly recurved, apex shortly acuminate."

402	Allelopathic	n
	Source(s)	**Notes**
	Morita, S., Ito, M., & Harada, J. 2005. Screening of an allelopathic potential in arbor species. Weed Biology and Management, 5(1): 26-30	"Table 1 showed that many plant leaves exhibited inhibitory or stimulatory effects on the growth of lettuce seedlings, as demonstrated by the sandwich method. These results seemed to be associated with biologically active substances." [Ilex rotunda stimulates, and does not inhibit, lettuce seedlings in laboratory settings]

403	Parasitic	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[No evidence] "Shrubs or trees, evergreen, to 20 m tall"

404	Unpalatable to grazing animals	
	Source(s)	**Notes**
	Agetsuma, N., Agetsuma-Yanagihara, Y., & Takafumi, H. 2011. Food habits of Japanese deer in an evergreen forest: Litter-feeding deer. Mammalian Biology-Zeitschrift für Säugetierkunde, 76(2): 201 207	"Appendix Identified food species and part of Japanese sika deer in a warm temperate broad leaved forest" [For Ilex rotunda, deer only reported to consume fallen leaves, and not living plant parts. Possibly unpalatable]
	Tsujino, R., & Yumoto, T. 2004. Effects of sika deer on tree seedlings in a warm temperate forest on Yakushima Island, Japan. Ecological Research, 19(3): 291-300	[One sapling of Ilex rotunda was not browsed by deer, suggesting the species may be unpalatable. However, the sample size is too small to make a definitive conclusion] "Table 3 No. individuals (height ≥ 30 cm, d.b.h. < 1 cm) in the study plot (2500 m2) and ratios of deer preference of each species (= no. herbivored individuals over total no. species)"

Qsn #	Question	Answer
405	**Toxic to animals**	**n**
	Source(s)	**Notes**
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	[No evidence for Ilex rotunda, although other members of the genus are reported to be toxic]

406	Host for recognized pests and pathogens	
	Source(s)	**Notes**
	OnlinePlantGuide.com. 2014. Ilex rotunda 'Lord' /Lord Holly. http://www.onlineplantguide.com/Plant-Details/1208/. [Accessed 23 Jul 2014]	[Unknown] "Susceptible to insects and diseases: Yes" ... " It is almost pest free."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	**Notes**
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	"Although no specific reports of toxicity have been seen for this species, the fruits of at least some members of this genus contain saponins and are slightly toxic. They can cause vomiting, diarrhea and stupor if eaten in quantity[274]."
	Wagstaff, D.J. 2008. International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence for Ilex rotunda, but other members of the genus reportedly toxic

408	Creates a fire hazard in natural ecosystems	n
	Source(s)	**Notes**
	Li, X., Wu, Z., Chen, H., Lu, Y., Hu, X., Xue, K., & Wu, Z. 2002. The selection of forest-fire resistant species in urban forestry in Pearl river delta. Journal of Tropical and Subtropical Botany, 11(4), 316 318	[No evidence, and reported to be fire resistant] "Species with moisture content ≥40%, crude fat ≤20‰ and crude ash≥5% are considered to be fire resistant species, viz, Ilex rotunda,..."

Qsn #	Question	Answer
409	**Is a shade tolerant plant at some stage of its life cycle**	
	Source(s)	**Notes**
	Dave's Garden. 2014. "PlantFiles: Round Leaf Holly, Kurogane Holly - Ilex rotunda. http://davesgarden.com/guides/pf/go/149931/. [Accessed 23 Jul 2014]	"Sun Exposure: Sun to Partial Shade Light Shade Partial to Full Shade Full Shade"
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	[I. rotunda a pioneer species. Suggests low shade tolerance] "Ilex cinerea, I. graciliflora, I. hanceana, I. memecylifolia, I. pubescens and I. viridis may have occupied similar sites, since all show some degree of shade tolerance but are rare or absent under a tall closed canopy. In contrast, the pioneer characteristics of I. asprella, I. lohfauensis and I. rotunda suggest that they must have been much less common in the primeval landscape."
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	[Moderately shade tolerant] "It can grow in semi-shade (light woodland) or no shade."

410	**Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)**	**y**
	Source(s)	**Notes**
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	"Succeeds in most soils so long as they are not water-logged[200]. "

411	**Climbing or smothering growth habit**	**n**
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Shrubs or trees, evergreen, to 20 m tall; trunk to 1 m d.b.h.; bark gray to gray-black."

Qsn #	Question	Answer
412	**Forms dense thickets**	**n**
	Source(s)	**Notes**
	Ishii, H. T., & Iwasaki, A. 2008. Ecological restoration of a fragmented urban shrine forest in southeastern Hyogo Prefecture, Japan: Initial effects of the removal of invasive Trachycarpus fortunei. Urban Ecosystems, 11(3), 309-316.	[I. rotunda found at a density of 7.6 trees/ha. A common, but not thicket-forming component in the study forest] "The vegetation of the forest was dominated by evergreen broadleaved trees (Table 1). C. camphora dominated the canopy contributing 66.3% of the total basal area density. Other dominant evergreen species included (in order of basal area density) Ilex rotunda Thunb., Quercus glauca Thunb., Camelia japonica L. and Cinnamomum japonicum Sieb." ... "Table 1 Tree species composition of the shrine forest of Nishinomiya Shrine in southeastern Hyogo Prefecture, Japan" ... "Ilex rotunda - Tree density (trees ha–1) = 212 (7.6)]
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	[Other Ilex species reported to occur in thickets, but no evidence for I. rotunda] "montane evergreen broad-leaf forests, forest margins, streamside"

501	Aquatic	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Evergreen broad-leaved forests, forest margins on mountain slopes; 400–1100(–1700) m. Anhui (Sixian), Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu, Jiangxi, Taiwan, Yunnan, Zhejiang [Japan, Korea, Vietnam]."

502	Grass	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Shrubs or trees" [Aquifoliaceae]

503	Nitrogen fixing woody plant	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	Aquifoliaceae

504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Shrubs or trees, evergreen, to 20 m tall; trunk to 1 m d.b.h.; bark gray to gray-black."

Qsn #	Question	Answer
601	**Evidence of substantial reproductive failure in native habitat**	**n**
	Source(s)	**Notes**
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	[No evidence] "since I. rotunda produces the highest amount of fruits per plant, fruit removal is high in terms of absolute number"
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	No evidence

602	**Produces viable seed**	**y**
	Source(s)	**Notes**
	Tezuka, T., Yokoyama, H., Tanaka, H., Shiozaki, S., & Oda, M. 2013. Factors Affecting Seed Germination of Ilex latifolia and I. rotunda. HortScience, 48(3): 352-356	"Germination was not observed in I. rotunda, even when embryos were cold-stratified. Because cold stratification might induce embryo development in I. rotunda, it deserves further investigation in combination with other treatments to obtain seedlings from seeds or embryos."
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	"Seed - best sown as soon as it is ripe in the autumn in a cold frame. It can take 18 months to germinate. Stored seed generally requires two winters and a summer before it will germinate and should be sown as soon as possible in a cold frame. Scarification, followed by a warm stratification and then a cold stratification may speed up the germination time[78, 80]."
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	"The four relatively uncommon species, I. cinerea, I. ficoidea, I. graciliflora and I. rotunda, perform well at the pollination and seed dispersal stage, as shown by their high Apis visitation rates, and relatively high fruit set and fruit removal rates (since I. rotunda produces the highest amount of fruits per plant, fruit removal is high in terms of absolute number)."

603	**Hybridizes naturally**	
	Source(s)	**Notes**

Qsn #	Question	Answer
	Manen, J. F., Barriera, G., Loizeau, P. A., & Naciri, Y. 2010. The history of extant Ilex species (Aquifoliaceae): Evidence of hybridization within a Miocene radiation. Molecular Phylogenetics and Evolution, 57(3): 961-977	[Possibly Yes] "The history and diversification of the genus Ilex (Aquifoliaceae), based on 108 different species (116 specimens), are inferred from the analysis of two nuclear (ITS and nepGS) and three plastid (rbcL, trnL-F and atpB-rbcL) sequences. Nuclear and plastid trees are highly incongruent and the nuclear tree is more compatible with current taxonomic classifications than the plastid one. The most recent common ancestor (MRCA) of extant species is dated from the Miocene, although the Ilex stem lineage can be traced back to the late Cretaceous, according to fossil records. This suggests extensive lineage extinctions between the Cretaceous and Miocene and may also explain the difficulties encountered in defining the relationships between Ilex and its closest relatives. The MRCA ancestral area was identified as being in the North Hemisphere (North America and/or East Asia). Several bidirectional North America/East Asia and North America/South America dispersal events are proposed to explain observed geographic and phylogenetic patterns. Hybridization and introgression events between distantly related lineages are also inferred, indicating weak reproductive barriers between species in Ilex."

604	Self-compatible or apomictic	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Plants dioecious"
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	"The flowers are dioecious (individual flowers are either male or female, but only one sex is to be found on any one plant so both male and female plants must be grown if seed is required) and are pollinated by Bees.The plant is not self-fertile."

605	Requires specialist pollinators	n
	Source(s)	**Notes**
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	"Pollen-collecting A. cerana transfer pollen from the front legs to the corbiculae on the hind legs." ... "Most A. cerana on I. cinerea and I. rotunda male plants were nectar-collecting bees." ... "The four relatively uncommon species, I. cinerea, I. ficoidea, I. graciliflora and I. rotunda, perform well at the pollination and seed dispersal stage, as shown by their high Apis visitation rates, and relatively high fruit set and fruit removal rates (since I. rotunda produces the highest amount of fruits per plant, fruit removal is high in terms of absolute number)."
	Akratanakul, P. (ed.). 1986. Beekeeping in Asia. FAO Agricultural Services Bulletin 68/4. FAO, Rome, Italy	"Table 2/1. Some Important Asian Bee Forage Plants" [Includes Ilex rotunda]

606	Reproduction by vegetative fragmentation	n

Qsn #	Question	Answer
	Source(s)	**Notes**
	Green Legacy Hiroshima. 2011. Kurogane holly (Ilex rotunda). http://www.unitar.org/hiroshima/sites/unitar.org.hiroshima/files/GLH%202011%20Tree%20Kurogane%20Holly_1.pdf. [Accessed 23 Jul 2014]	[No evidence of vegetative spread] "Propagation: Planting seeds or grafting"

607	Minimum generative time (years)	>3
	Source(s)	**Notes**
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	"However, these species do not flower profusely until they attain > 3 m high, although I. cinerea and I. rotunda occasionally produce a few flowers at shorter height, so they cannot reproduce in habitats with frequent fires or other disturbances." ... "Table 6.1 Comparisons among the fifteen Ilex species in Hong Kong, in the rank order of their commonness, using characters examined in this thesis." [Ilex rotunda reported to have a minimum reproductive height of 1.6 m for female, fruiting trees]
	Gilman, E.F. 1997. Trees for urban and suburban landscapes. Delmar Publishers, Albany, NY	[As a slow to moderate growing tree, presumably >3 years to reproductive maturity] "Growth Rate: slow to moderate; moderate life span."

701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Unlikely. Adapted for bird dispersal. Fruits & seeds lack means of external attachment] "Fruit red, subglobose, rarely ellipsoid, 4–6 mm in diam.; persistent calyx explanate, ca. 3 mm in diam., shallow lobes deltoid, not ciliate; persistent stigma thickly discoid, convex, shallowly 5- or 6-lobed; pyrenes 5–7, ellipsoidal, ca. 5 mm, ca. 2.5 mm in diam., abaxially 3-striate and 2-sulcate, rarely 2-striate and 1-sulcate, laterally smooth, endocarp subwoody."

702	Propagules dispersed intentionally by people	y
	Source(s)	**Notes**
	Gilman, E.F. 1997. Trees for urban and suburban landscapes. Delmar Publishers, Albany, NY	[Ornamental and shade tree] "It has not been used extensively in zones 9 and 10, so it is not well known there, but past experience in zone 8B shows that this can be a very nice shade tree useful for many landscapes."

Qsn #	Question	Answer
703	**Propagules likely to disperse as a produce contaminant**	**n**
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Unlikely. Slow-growing ornamental & shade tree not grown with commercial crops] "Fruit red, subglobose, rarely ellipsoid, 4–6 mm in diam.; persistent calyx explanate, ca. 3 mm in diam., shallow lobes deltoid, not ciliate; persistent stigma thickly discoid, convex, shallowly 5- or 6-lobed; pyrenes 5–7, ellipsoidal, ca. 5 mm, ca. 2.5 mm in diam., abaxially 3-striate and 2-sulcate, rarely 2-striate and 1-sulcate, laterally smooth, endocarp subwoody."

704	**Propagules adapted to wind dispersal**	**n**
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Fruit red, subglobose, rarely ellipsoid, 4–6 mm in diam.; persistent calyx explanate, ca. 3 mm in diam., shallow lobes deltoid, not ciliate; persistent stigma thickly discoid, convex, shallowly 5- or 6-lobed"

705	**Propagules water dispersed**	
	Source(s)	**Notes**
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	[Fleshy-fruits adapted for vertebrate dispersal, but distribution along streams suggests water may also aid in seed dispersal] "Some populations of I. cinerea, I. ficoidea, I. graciliflora, I. kwangtungensis and I. rotunda are found near or along streams."

706	**Propagules bird dispersed**	**y**
	Source(s)	**Notes**
	Levey, D. J., & Sargent, S. 2000. A simple method for tracking vertebrate-dispersed seeds. Ecology, 81(1), 267-274	"Each of the seven waxwings was fed four fruits of Ilex rotunda, a species they commonly consume in Florida (D. Levey, personal observation). Fecal samples were collected for 2 h, well beyond the mean retention time of waxwings feeding on fruit (Holthuijzen and Adkisson 1984, Levey and Grajal 1991, Levey and Martı´nez del Rio 1999,Witmer 1998)."
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	"Fruit red, subglobose, rarely ellipsoid, 4–6 mm in diam.; persistent calyx explanate, ca. 3 mm in diam., shallow lobes deltoid, not ciliate; persistent stigma thickly discoid, convex, shallowly 5- or 6-lobed; pyrenes 5–7, ellipsoidal, ca. 5 mm, ca. 2.5 mm in diam., abaxially 3-striate and 2-sulcate, rarely 2-striate and 1-sulcate, laterally smooth, endocarp subwoody"
	Corlett, R. T. 1998. Frugivory and seed dispersal by birds in Hong Kong shrubland. Forktail: 23-28	"Table 2. The number of bird species recorded consuming the major bird-fruits in the shrub land at KARC, based on faecal analysis and direct observations." [flex pubescens/1. rotunda - Bird species (number) = 10]

Qsn #	Question	Answer
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	"Two individuals of Scaly thrush (Zoothera dauma) were seen defending planted I. rotunda at the Peak by attacking other birds, although they sometimes allowed other birds to feed on the fruits. No defending behavior were observed by birds on other plants." ... "Most of the Hong Kong hollies produce large, synchronous crops of small, low quality, chemically defended fruits that are eaten by birds and, in some species, including I. pubescens, I. rotunda and I. viridis, can persist for several months after ripening."

707	Propagules dispersed by other animals (externally)	n
	Source(s)	**Notes**
	Wu, Z.Y., Raven,P.H. & Hong, D.Y. (eds.). 2008. Flora of China. Vol. 11 (Oxalidaceae through Aceraceae). Science Press & Missouri Botanical Garden Press, Beijing & St. Louis	[Unlikely, Adapted for frugivory & internal dispersal] "Fruit red, subglobose, rarely ellipsoid, 4–6 mm in diam.; persistent calyx explanate, ca. 3 mm in diam., shallow lobes deltoid, not ciliate; persistent stigma thickly discoid, convex, shallowly 5- or 6-lobed; pyrenes 5–7, ellipsoidal, ca. 5 mm, ca. 2.5 mm in diam., abaxially 3-striate and 2-sulcate, rarely 2-striate and 1-sulcate, laterally smooth, endocarp subwoody."

708	Propagules survive passage through the gut	y
	Source(s)	**Notes**
	Levey, D. J., & Sargent, S. 2000. A simple method for tracking vertebrate-dispersed seeds. Ecology, 81(1), 267-274	"Each of the seven waxwings was fed four fruits of Ilex rotunda, a species they commonly consume in Florida (D. Levey, personal observation). Fecal samples were collected for 2 h, well beyond the mean retention time of waxwings feeding on fruit (Holthuijzen and Adkisson 1984, Levey and Grajal 1991, Levey and Martı´nez del Rio 1999,Witmer 1998)."

801	Prolific seed production (>1000/m2)	
	Source(s)	**Notes**
	Au, Y.Y.A. 2006. Patterns of seed deposition in the upland landscape of Hong Kong. PhD Dissertation. University of Hong Kong, Hong Kong	"Table 4.4 The three most abundant taxa of the seed rain into the eight sets of traps" ... "Ilex rotunda - Seed rain (m-2 year-1) = 237.0"
	WRA Specialist. 2014. Personal Communication	Unknown

802	Evidence that a persistent propagule bank is formed (>1 yr)	
	Source(s)	**Notes**
	Au, Y.Y.A. 2006. Patterns of seed deposition in the upland landscape of Hong Kong. PhD Dissertation. University of Hong Kong, Hong Kong	"Similarly 94-100% Ilex pubescens and I. rotunda seeds remained intact after 3, 6, 9 and 12 months of burial and 0-74% germinated within 12 months."

Qsn #	Question	Answer
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	[Ilex species can form a short persistent seed bank] "The seeds of Ilex are individually enclosed by a woody endocarp. A pyrene is the endocarp and enclosed seed, and a seed contains endosperm and an embryo." ... "The immature embryo and the thick endocarp result in dormancy (Ives, 1923, Hu 1975, Naka and Yoda 1984, Baskin and Baskin 2001, Shelton and Cain 2002) and a short-persistent seed bank (Arrieta and Suárez, 2004)."
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	[Suggests a persistent seed bank could form] "Seed - best sown as soon as it is ripe in the autumn in a cold frame. It can take 18 months to germinate. Stored seed generally requires two winters and a summer before it will germinate and should be sown as soon as possible in a cold frame. Scarification, followed by a warm stratification and then a cold stratification may speed up the germination time[78, 80]."
	Green Legacy Hiroshima. 2011. Kurogane holly (Ilex rotunda). http://www.unitar.org/hiroshima/sites/unitar.org.hiroshima/files/GLH%202011%20Tree%20Kurogane%20Holly_1.pdf. [Accessed 23 Jul 2014]	[Suggests a persistent seed bank may not form if seed dry out] "Seed picking period: Dried seeds will not germinate."

803	Well controlled by herbicides	
	Source(s)	**Notes**
	DiTomaso, J.M./Kyser, G.B. et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California, Davis, CA	[Possibly. Herbicides including 2,4-D, Glyphosate, Imazapyr, Picloram, Tebuthiuron, & Triclopyr listed as providing excellent control for the invasive holly Ilex aquifolium']

804	Tolerates, or benefits from, mutilation, cultivation, or fire	y
	Source(s)	**Notes**
	Tsang, Che-wah, A. 2005. The ecology of Ilex species in Hong Kong. PhD Dissertation. The University of Hong Kong, Hong Kong	"Five individuals of I. asprella, I. hanceana, I. pubescens and I. viridis in Pokfulam and twenty planted individuals of I. asprella and I. rotunda in the greenhouse were cut to ground level to check for their resprouting ability." ... "All the plants of I. asprella, I. hanceana, I. pubescens, I. rotunda and I. viridis that were cut to ground level could resprout within three months."
	Plants for a Future. 2014. Ilex rotunda. http://www.pfaf.org/user/Plant.aspx?LatinName=Ilex+rotunda. [Accessed 23 Jul 2014]	"Plants are very tolerant of pruning and can be cut right back into old wood if required[188]. "

805	Effective natural enemies present locally (e.g. introduced biocontrol agents)	
	Source(s)	**Notes**
	WRA Specialist. 2014. Personal Communication	Unknown

Summary of Risk Traits:

High Risk / Undesirable Traits
• Grows in temperate and tropical climates
• Possibly naturalizing in Georgia (confirmation needed)
• Listed as a native weed in Japan (but no specific impacts described)
• Other Ilex species have become invasive
• Possibly unpalatable to animals
• Tolerates many soil types
• Seeds dispersed by birds & intentionally by people
• May form a persistent seed bank
• Able to resprout after cutting to ground level

Low Risk Traits
• Unarmed (no spines, thorns or burrs)
• Ornamental
• Dioecious trees (and therefore not self-fertile)
• Not reported to spread vegetatively
• Slow growth rate and long time to maturity

Second Screening Results for Tree/tree-like shrubs

(A) Shade tolerant or known to form dense stands?> Unknown. Possibly shade tolerant, but not reported to form dense stands
(B) Bird-dispersed?> Dispersed by birds
(C) Life cycle < 4 years? No
Outcome = Evaluate