NAME OF SPECIES: Celastrus orbiculata Thunb. (15)	
Synonyms: Celastrus articulatus Thunb. (18). Celastrus insularis Koidz.; Celastrus jeholensis Nakai; Celastrus lancifolius Nakai; Celastrus stephanotiifolius Makino; Celastrus strigulosus Nakai; Celastrus tatarinowii Rupr.; Celastrus versicolor Nakai (10)	
Common Name: Asian bittersweet, Asiatic bittersweet, Oriental bittersweet (15). Round-leaved bittersweet (16). climbing spindleberry (20).	
A. CURRENT STATUS AND DISTRIBUTION	
I. In Wisconsin?	1. YES ☒ NO ☐
	2. Abundance: 21 recorded occurrences in WI (15); however this species is under-reported. Some of these infestations are dense with bittersweet climbing into the canopy, girdling trees and having high stem density.
	3. Geographic Range: From 11 counties in WI, mostly from southern WI. Bayfield and Forest counties are the northern records. (15) (note discrepancy in maps below)
	4. Habitat Invaded: Gardens, Old home site, White oak-sugar maple, Shoreline, Disturbed woods, Pine Plantations (15). Disturbed Areas ☒ Undisturbed Areas ☐
	5. Historical Status and Rate of Spread in Wisconsin: The first recorded occurrence in WI is from 1927. However 18 of the 21 records date from 1995 to the present. (15)
	6. Proportion of potential range occupied: Probably in a very small part of potential range.
II. Invasive in Similar Climate Zones	1. YES ☒ NO ☐ Where (include trends): The plant has become widely established in the Eastern United States, occurring in 25 states (Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin) and the District of Columbia. It is also known in Canada from Ontario and Quebec. Based on its native range and habitat types, Oriental bittersweet can be expected to spread to additional areas in the United States and Canada(10)
III. Invasive in Similar Habitat Types	1. Upland ☒ Wetland ☒ Dune ☐ Prairie ☐ Aquatic ☐ Forest ☒ Grassland ☒ Bog ☐ Fen ☐ Swamp ☐ Marsh ☒ Lake ☐ Stream ☐ Other: Oriental bittersweet infests forest edges, woodlands, fields, hedgerows, coastal areas and salt marsh edges, particularly those suffering some form of land disturbance. While often found in more open, sunny sites, its tolerance for shade allows oriental bittersweet to invade forested areas. Oriental bittersweet is often associated with old home sites, from which it has escaped into surrounding natural areas. (1) It occurs in a variety of forest types, including undisturbed mesic and dry-mesic forest. It also is found in disturbed open areas such as roadsides. (2) It is variously described as occupying open woods and thickets, roadsides, fence-rows, and thickets, alluvial woods, roadsides and thickets. Upland meadows, thickets, young forests, and beaches

	are most vulnerable to Asian bittersweet invasion and dominance. (19)
IV. Habitat Effected	1. Soil types favored or tolerated: Tolerates pH range of 5 - 7.5 (17). Oriental bittersweet grows on forest, alluvial and floodplain, and glacial till soils. Soil textures include sand and silt. Soil pH is generally moderately to mildly acidic (pH 5.6-6.5). Nutrient content of soils with Oriental bittersweet varies widely. Oriental bittersweet is most common on mesic soils, and is apparently intolerant of saturated or droughty soils. Information on moisture regimes for Oriental bittersweet soils is sparse, and research is needed on moisture requirements for Oriental bittersweet. Oriental bittersweet was positively correlated with percent exposed mineral soil and sites with relatively less acidic soil pH, a combination of which was most common on logging roads and least common on undisturbed sites in the Pleasantville Valley Wildlife Sanctuary, Massachusetts. (20) Mature plants can girdle trees
	2. Conservation significance of threatened habitats: Currently known to be invading at least 14 national parks (1) Could interfere with the reproduction of a bird officially listed as a Threatened Species by the State of Connecticut, by spreading to nest areas or changing dune formation/erosion (4)
V. Native Habitat	1. List countries and native habitat types: Celastrus orbiculatus is native to temperate east Asia, including far eastern Russia, Mongolia, central and northern Japan, Korea, and China north of the Yangtze River. It inhabits lowland slopes or thickets at altitudes from 100m to 2200 m. (4) (18)
VI. Legal Classification	1. Listed by government entities? CT: invasive, banned; MA: prohibited; NH: prohibited invasive; NC: Class C noxious weed; VT: Class B noxious weed. (17)
	2. Illegal to sell? YES ☒ NO ☐ Notes: Connecticut; Massachusetts; New Hampshire; North Carolina, Vermont. However routinely available commercially. (17)
B. ESTABLISHMENT POTENTIAL AND LIFE HISTORY TRAITS	
I. Life History	1. Type of plant: Annual ☐ Biennial ☐ Monocarpic Perennial ☐ Herbaceous Perennial ☐ Vine ☒ Shrub ☐ Tree ☐
	2. Time to Maturity: seeds mature in fall (14)
	3. Length of Seed Viability: No specific info on seed bank length, however managers suggest 5 years of monitoring in a treated area to eradicate seedlings (4). Laboratory seed viability studies suggest that Oriental bittersweet seed does not remain viable for more than 1 growing season. Possibly because Oriental bittersweet is such a prolific seed producer, its seed bank is quickly replenished when seed sources remain on-site or nearby. (20).
	4. Methods of Reproduction: Asexual ☒ Sexual ☒ Notes: Oriental bittersweet reproduces prolifically by seed, which is readily dispersed to new areas by many species of birds. It also expands vegetatively through root suckering. (1) Oriental bittersweet is usually dioecious, but some individual plants are also occasionally polygamo-dioecious (both unisexual and

	perfect flowers), or monoecious variations (male & female on same vine). Mean germination rates for C. orbiculatus were 70% compared to 20 % for the native C. scandens. It will also root sucker prolifically, especially when the main vine is damaged. (4)
	5. Hybridization potential: Hybrid plants already exist between Oriental Bittersweet and American Bittersweet (1), however hybrids are not widely reported in the field, but this may be due to the difficulty in identifying bittersweet hybrids (20).
II. Climate	1. Climate restrictions: Oriental bittersweet appears to tolerate a wide range of climatic conditions (20).
	2. Effects of potential climate change:
III. Dispersal Potential	F. Pathways – Please check all that apply: Unintentional: Bird ☒ Animal ☒ Vehicles/Human ☒ Wind ☐ Water ☐ Other: Seeds are spread through the dumping of floral arrangements into waste areas. (3) Intentional: Ornamental ☒ Forage/Erosion control ☒ Medicine/Food: ☐ Other: Introduced into the U.S. in the 1860s as an ornamental plant, oriental bittersweet is still widely planted and maintained as an ornamental vine. (1) Also used for erosion control on roadsides. (3) It has been planted for "conservation" plantings for wildlife food and cover, and erosion control, both as itself or mistakenly for the native C. scandens. (4)
	2. Distinguishing characteristics that aid in its survival and/or inhibit its control: It is shade tolerant and seedlings may stay suppressed for some time before released by disturbance. (2) Produces fruits that are a brighter shade of red, and also produces more of them, so that birds are more likely to disperse the seeds. Seeds have a high rate of germination. Good at photosynthesizing, with the ability to absorb light from a wide range of the spectrum. (3) Easily adapts to a wide range of environments, making it highly competitive (8). Root suckering is a common occurrence and results in large clones or patches which often spread from one or a few original plants which originated as seedlings. Individual clones are difficult to kill. For example, one 5m x 5m clone treated with triclopyr in 1986 has produced 50+ sprouts each year since. The sprouts are hand-pulled but often break and resprout later. (4) Other invasion strategies include: wide-ranging seed dispersal by animal and human vectors; ability to germinate under a wide range of light conditions; ability to acclimate photosynthetic capacity and persist a wide range of light conditions; rapid growth after release; and ability to climb supports of varying sizes. (20)
IV. Ability to go Undetected	1. HIGH ☐ MEDIUM ☒ LOW ☐ Notes: It is shade tolerant and seedlings may stay suppressed for some time before released by disturbance (2). Produces bright red fruit (1) (2).

C. DAMAGE POTENTIAL	
I. Competitive Ability	1. Presence of Natural Enemies: Very few. Three fungal species (Microsphaera celastri, Uncinula sengokui, Amazonia celastri) infect plant and six anthropod species (Hypothenenmus eruditus, Plinachtus bicoloripes, Aphis clerodendri, Unaspis euonymi, Trioza celastrae, Yponomeuta sociatus) can cause damage to it. (9)
	2. Competition with native species: Oriental Bittersweet is displacing the native American Bittersweet through both competition and hybridization (1) (4). Spreads rapidly, invades mesic woods, and replaces spring ephemerals (2). Many of the rarest plants in the southeastern U.S. require a natural disturbance regimen of a certain quality and frequency. Because many of these processes have been altered some of these species are now relegated to roadway and utility corridors which provide exactly the sort of habitat most often invaded and dominated by C. orbiculatus. (4) A C. orbiculatus infestation in sand dunes adjacent to a Piping Plover nesting area on Long Island Sound may either spread into actual nesting areas or alter the dynamics of dune formation and erosion. In either case, they could interfere with the reproduction of a bird officially listed as a Threatened Species by the State of Connecticut. (19)
	3. Rate of Spread: -changes in relative dominance over time: -change in acreage over time: HIGH(1-3 yrs) ☐ MEDIUM (4-6 yrs) ☒ LOW (7-10 yrs) ☐ Notes: The exact date of Celastrus orbiculatus introduction to eastern North America is obscure, but appears to have been before 1879. By the early 1970's it was naturalized from central Maine through New England, New York, Ohio and west to Iowa, south to Louisiana and Georgia. It was considered weedy in all of New England and most of the Atlantic Coast States by 1971. (4) Based on its native range and habitat types, Oriental bittersweet can be expected to spread to additional areas in the United States and Canada. (10)
II. Environmental Effects	F. Alteration of ecosystem/community composition? YES ☒ NO ☐ Notes: "At Fern Rocks Nature Preserve in Jackson County, Illinois, it has covered the ground and vegetation, actually eliminating native ground-cover species in mesic and dry mesic woods. In the south, it climbs up to 60 feet in trees and reaches 4 inches in diameter." (2) Displaces the native American bittersweet (3). Oriental bittersweet can shade and restrict growth of native understory species, shrubs, tree seedlings, and some native vines (21). Oriental bittersweet canopies inhibit establishment of understory spring ephemerals. Because Oriental bittersweet alters forest structure, it probably favors thicket-dwelling animals at the expense of animals requiring more open habitats. (20) Tree and shrub stems are weakened and killed by the twining and climbing growth that twists around and eventually constricts solute flow (19).

	2. Alteration of ecosystem/community structure? YES ☒ NO ☐ Notes: There is a scarcity of other species under dense canopies of vine. Efficiently shades out many species. (4) Oriental bittersweet thickets are too densely shaded for most native herbaceous species to establish and grow. For example, Oriental bittersweet canopies inhibit establishment of understory spring ephemerals. (20)
	3. Alteration of ecosystem/community functions and processes? YES ☒ NO ☐ Notes: Oriental bittersweet is a vigorously growing vine that climbs over and smothers vegetation which may die from excessive shading or breakage (1). Trees with girdled stems and large amounts of vine biomass in their canopies are more susceptible to damage by wind, snow and ice storms. May affect sand dune formation and erosion in CT. (4) Oriental bittersweet competes with native vegetation for light, threatening native plant community diversity and modifying stand structure and plant succession. (20)
	4. Allelopathic properties? YES ☐ NO ☒ Notes:
D. SOCIO-ECONOMIC Effects	
I. Positive aspects of the species to the economy/society:	Notes: Still widely planted and maintained as an ornamental (1). It grows faster, has greater fecundity and greater tolerance to environmental heterogeneity than American Bittersweet and is, hence preferred by growers (10). Sometimes labeled mistakenly as "American Bittersweet". Previously used for soil erosion control on roadsides (3) Farmer in SW WI cultivates C. orbiculatus in very large quantities for sale as cut foliage. (13) C. orbiculatus can be used as an insect control agent (9). Bark and root are used in traditional Asian medicine (11). "Evidence of medicinal properties for rheumatoid arthritis and reversing cancer cell resistance to treatment drugs" (12). May aid in grape vine development (12). Enzymes in Oriental bittersweet leaves can clot milk. These leaf extracts may provide an alternative to calf rennet enzymes used in making cheese. (20)
II. Potential socio-economic effects of requiring controls: Positive: Negative:	Notes: Positive: Most plantings could easily be replaced with native bittersweet. Ecological and forestry impacts would be prevented. Negative: Homeowners and landowners with plantings or infestations would have to remove it. Large infestations are difficult to remove. Much of it was probably planted as mis-identified *C. scandens.* It is without question inferior as a landscape vine to the native *C. scandens.*(23)
III. Direct and indirect socio-economic effects of plant:	Notes: It is considered of particular concern to forestry programs in some parts of the southern United States due to the damage it can cause trees (19). Where it is present before harvest, Oriental bittersweet can rapidly overtake a site after tree harvest. After tree harvest or fire, Oriental bittersweet sprouts may outgrow and

	overtop competing sprouts of native trees and shrubs. Girdling and stem damage from Oriental bittersweet vines lowers the value of timber species infested with Oriental bittersweet. On the Pisgah National Forest, Oriental bittersweet has covered sapling-sized hardwood and eastern white pine (Pinus strobiformis) regeneration on small clearcuts. (20) Oriental bittersweet is an alternate host for Xylella fastidiosa. This bacterium is responsible for several crop diseases including Pierce's grapevine (Vitis spp.) disease, periwinkle (Vinca spp.) wilt, plum leaf scorch and phony peach (Prunus spp.) disease, and variegated chlorosis (affects several genera including oaks, elms, sycamores, citrus (Citrus spp.), and mulberries (Morus spp.). (20)
IV. Increased cost to sectors caused by the plant:	Notes: Without control, forest degradation may occur as well as possibly much greater costs in the long term of managing degraded forests (8). Mature plants can girdle trees. (22)
V. Effects on human health:	Notes: Fruits are toxic. (11) "Evidence of medicinal properties for rheumatoid arthritis and reversing cancer cell resistance to treatment drugs" (12)
VI. Potential socio-economic effects of restricting use: Positive: Negative:	Notes: John Zehrer, a farmer in Soldiers Grove, WI owns a cut-flower operation where bittersweet is his most abundant crop. He grows 40 acres of bittersweet and is the "largest bittersweet producer in the world". He would suffer a large loss of income unless given an exemption (13).
E. CONTROL AND PREVENTION	
I. Costs of Prevention (including education; please be as specific as possible):	Notes: Education for workers on eradication and public and private landowners. An effort would especially need to be made to make sure people can differentiate between American Bittersweet and Oriental Bittersweet. Eradication methods would include costs of labor, mechanical tools, chemicals, etc. (These are my interpretations according to the research I've conducted).
II. Responsiveness to prevention efforts:	Notes: It has been reported that even if you kill the root of the plant, it sometimes re-grows in the following years; possibly b/c of seed bank (4).
III. Effective Control tactics:	Mechanical ☒ Biological ☐ Chemical ☒ Times and uses: Light infestations of a few small plants can be controlled by cutting the vines and hand pulling the roots. Dense infestations can be treated by cutting the vines followed immediately by application of a glyphosate herbicide to the stumps. Merely cutting vines without removing or killing the roots will only stimulate vigorous re-growth. To ensure root kill, a late-season foliar application of herbicide may be necessary. (5) Winter applications may avoid harm to other plants and animals from chemicals. It is best to apply chemicals before spring ephemerals appear, in order to better eradicate the intended plant and avoid killing non-target ephemerals. Repeated application of herbicide will be necessary for full eradication. Plants can be replaced with native vegetation, such as American Bittersweet, Trumpet Honeysuckle, Trumpet Creeper, Passionflower Vine, Dutchman's Pipe, and native Wisteria (1), (2).
IV. Minimum Effort:	Notes: To fully eradicate both mechanical and chemical methods will be needed, as summarized above. Removal of plant by cutting

	and then by applying chemical treatment to ensure root kill (1), (4), (6).
V. Costs of Control:	Notes:
VI. Cost of prevention or control vs. Cost of allowing invasion to occur:	Notes: Education of nursery growers, retailers and the gardening public is needed to reduce the demand for and the dissemination of the vine and its fruit. (4)
VII. Non-Target Effects of Control:	Notes: Use of chemicals for eradication can result in the loss of other surrounding desired plants. Employing a combination of methods often yields the best results and may reduce potential impacts to native plants, animals and people (1).
VIII. Efficacy of monitoring:	Notes: Continued monitoring will be needed to avoid future infestations. Two weeks after the peak of fall leaves is a good time to check for infestations. By this time other native deciduous plants drop almost all of their leaves while C. orbiculatus leaves turn lemon- to golden-yellow making the plants easy to identify even at a distance or from a vehicle at moderate speeds. (4).
IX. Legal and landowner issues:	Notes: This plant is still grown and sold as an ornamental and is probably found in many gardens/yards, including extensive plantings on a 40 acre farm in SW WI (13).

F. REFERENCES USED:

☒ UW Herbarium
☐ WI DNR
☒ TNC
☒ Native Plant Conservation Alliance
☐ IPANE
☒ USDA Plants

Number	Reference
1	Swearingen, Jil M. Celastrus orbiculatus, Oriental Bittersweet. Plant Conservation Alliance's Alien Plant working Group Least Wanted. http://www.nps.gov/plants/alien/fact/ceor1.htm
2	Hutchison, Max. 1990. VEGETATION MANAGEMENT GUIDELINE Round-leaved bittersweet (Celastrus orbiculatus Thunb.). Illinois Natural History Survey–Vegetation Management Guideline– http://www.inhs.uiuc.edu/chf/outreach/VMG/rlbitter.html Vol. 1, No. 20.
3	University of Massachusetts-Boston–The Introduction of Non-native Plants into Massachusetts– http://efg.cs.umb.edu/conne/jennjim/celastrus.html
4	Dreyer, G.D. 1994. Element stewardship abstract: Celastrus orbiculata. The Nature Conservancy. Available at http://tncweeds.ucdavis.edu/esadocs/documnts/celaorb.pdf
5	Virginia Native Plant Society–Department of Conservation & Recreation http://www.dcr.virginia.gov/natural_heritage/documents/fsceor.pdf
6	Southeast Exotic Pest Plant Council. 1996. Invasive exotic pest plants in Tennessee. Research Committee of the Tennessee Exotic Pest Plant Council. Tennessee. http://www.se-eppc.org
7	Brooklyn Botanic Garden– http://nymf.bbg.org/profile_species_tech.asp?id=275
8	Global Invasive Species Database– http://www.issg.org/database/species/ecology.asp?si=156&fr=1&sts=
9	Hao Zheng, Yun Wu, Jianqing Ding, Denise Binion, Weidong F1 and Richard Reardon. 2004. Invasive Plants of Asian Origin Established in the US and Their Natural Enemies. USDA Forest Service - September 2004 - FHTET-2004-05. http://www.invasive.org/weeds/asian/celastrus.pdf
10	Ma, J. and G. Moore. 2003. Celastrus orbiculatus Thunb. Brooklyn Botanical Garden. Available at http://www.fs.fed.us/global/iitf/pdf/shrubs/Celastrus%20orbiculatus.pdf
11	Harvard University–Emergent Vegetation of the Urban Ecosystem– http://www.gsd.harvard.edu/loeb_library/information_systems/projects/E_vue/plants/celastrus_orbiculatus.htm

12	USDA Forest Service—Invasive Plants Field & Reference Guide: An Ecological Perspective of Plant Invaders of Forests and Woodlands–http://www.sref.info/publications/online_pubs/Members/Alana12/invasive-species-fiel%23D6D38.pdf
13	Star Valley Flowers Inc.. http://www.starvalleyflowers.com/story.html
14	Ellsworth, Joshua, Robin Harrington, and James Fownes. "Seedling Emergence, Growth, and allocation of Oriental Bittersweet: effects of seed input, seed bank, and forest floor litter". Journal of Forest Ecology and Management 190 (2004) p. 255-264. http://www.invasivespecies.net/database/species/reference_files/celorb/Ellsworth%20et%20al%202004.pdf
15	Wisconsin State Herbarium. 2007. WISFLORA: Wisconsin Vascular Plant Species (http://www.botany.wisc.edu/wisflora/). Dept. Botany, Univ. Wisconsin, Madison, WI 53706-1381 USA.
16	Czarapata, Elizabeth J. 2005. Invasive Plants of the Upper Midwest: An Illustrated Guide to their Identification and Control. The University of Wisconsin Press, Madison, WI.
17	USDA, NRCS. 2007. The PLANTS Database (http://plants.usda.gov (May 14, 2007). National Plant Data Center, Baton Rouge, LA 70874-4490 USA
18	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/cgi-bin/npgs/html/taxon.pl?9719 (14 May 2007)
19	NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 6.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: May 14, 2007).
20	Howard, Janet L. 2005. Celastrus orbiculatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, May 14].
21	Evans C. W., D. J. Moorhead, C. T. Bargeron and G. K. Douce. 2006. Invasive Plant Responses to Silvicultural Practices in the South. The University of Georgia, Bugwood Network. BW-2006-03 http://www.invasive.org/silvicsforinvasives.pdf
22	SAG meeting, 9-17-07
23	Ed Hasselkus, UW Emeritus Horticulture Professor. Comments on Invasive Plant Classification 2007.

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Reviewer(s) and date reviewed: Steve Richter, 7-12-07

Approved and Completed Date: Thomas Boos, 09-06-07

: Wireless - Mobility Documents. : 802.11 Association Status, 802.11 Deauth Reason codes. 802.11 Association Status, 802.11 Deauth Reason codes. Labels: Aironet Access Points.Â There is no blackbox test for this status code. 37. The request has been declined.Â NOT SUPPORTED. 21. Unsupported RSN information element version. NOT SUPPORTED. While better recording and reporting may partly explain some of the increase in events, much of it is due to a significant rise in the number of climate-related disasters.3 Between 2000 and 2019, there were 510,837 deaths and 3.9 billion people affected by 6,681 climate-related disasters. This compares with 3,656 climate-related events which accounted for 995,330 deaths (47% due to drought/ famine) and 3.2 billion affected in the period 1980-1999.Â Overall, the number of disaster events per year and the distribution of disaster sub-groups has remained relatively stable between the year 2000 and 2019, with an average of 367 recorded events per year (Figure 5). 1-25 26-75 76-200 +201. USA. However, Robertson is no sentimentalist. After devoting years of his life to the bears, he is under no (7) Ã–Ã–.. about their feelings for him. It is clear that their interest in him does not (8) Ã–Ã–.. beyond the food he brings.Â The proper method â€“ at least in the first phase of analysis â€“ is to proceed as do palaeontologists (who must study cave paintings without the aid of texts): by extrapolating from the images and the objects themselves a logic and a system based on various concrete factors such as the rate of occurrence of particular objects and motifs, their distribution and disposition. In short, one undertakes the internal structural analysis with which any study of an image or coloured object should begin. Participants under 16 or who had not completed the extended questionnaire were removed from the analysis.Â The first analysis examined differences in scores relative to people who were not ill for those who reported that they believed they had recovered from the COVID-19 illness. These were subdivided along an approximate severity scale into (i) those who did not have trouble breathing, (ii) those who had breathing problems but received no medical assistance, (iii) those who had breathing problems and received medical assistance at home, (iv) those who were taken to hospital but were not put on a ventilator and (v) those who were fitted with a ventilator. Quantifying species abundances is costly, especially when many species are involved. To overcome this problem, several studies have predicted local abundances (at the sample unit level) from species occurrence distribution models (SODMs), with differences in predictive performance among studies. Surprisingly, the ability of SODM to predict regional abundances of an entire area of interest has never been tested, despite the fact that it is an essential parameter for species conservation and management.Â AimThe way in which environmental conditions determine the distribution and abundance of species is a crucial topic in ecology, biogeography and conservation. It is especially important to understand the nature of this relationship regarding threatened species.